PROPERTY BEYOND FLATLAND

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INTRODUCTION

Although the world of property is wonderfully complex, property theory invites diverse perspectives, and the word "property" itself is elusively protean, there is one respect in which the field of property is neither complex, nor diverse, nor protean. Property suffers from a bad case of "dichotom-itis," and like private law generally, it is stuck in what, to borrow a term, I will call "Flatland."[1] In this Essay I want to help us escape from Flatland.

To do so, our field needs to incorporate modern notions of complex systems much more thoroughly than it now does. One theme I see in property theory and increasingly in property practice is an excessive reductionism. Let me emphasize the "excessive": the problem is not reductionism per se.[2] As limited beings, we are not capable of dealing with all of life's complexity all of the time.[3] And yet too

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1. I am referring to the satirical novella of that name. EDWIN A. ABBOTT, FLATLAND: A ROMANCE OF MANY DIMENSIONS (2005) (1884). I also acknowledge Carol Rose's use of the term "Propertyland," which she contrasts to "Contractland," and other territories. Also, as some of my former students know, "Flatland" is the lightly fictionalized version of my hometown of Chicago, which, particularly through its Flubs baseball team, makes regular appearances on my final exams.

2. Thus, I need not assume strong anti-reduction which holds that reduction is not possible in principle. *See* P.W. Anderson, *More Is Different: Broken Symmetry and the Nature of the Hierarchical Structure of Science*, 177 SCIENCE 393 (1972).

3. *See, e.g.*, ALEXIS DE TOCQUEVILLE, DEMOCRACY IN AMERICA 402 (J .P. Mayer & Max Lerner eds., George Lawrence trans., Harper & Row 1966) (1835) (In contrast to the divine point of view that can take account of all particulars, "[g]eneral ideas do not bear witness to the power of human intelligence but rather to its inadequacy . . . . General ideas have this excellent quality, that they permit human minds to pass judgment quickly on a great number of things; but the conceptions they convey are always incomplete, and what is gained in extent is always lost in exactitude."); Albert Kocourek, *Formal Relation Between Law and Discretion*, 9 ILL. L. REV. 225, 238 (1914) ("While the combinations of situations, persons, things, and facts are beyond computation, yet these computations are not such that they cannot be

much reductionism or reductionism of the wrong kind can be seriously limiting.

The way to overcome this misplaced reductionism is to get beyond the dichotomies in property theorizing. And for that we need a better handle on the role complexity plays in property institutions, as they are embedded in real life.

By complexity, I do not mean complicatedness. Intricacy, elaboration, and the like are not complexity. Rather, complexity stems from the interactions of the elements of a system. If a system is a collection of interconnected elements, a complex system is one in which the elements are not only numerous enough but interconnected enough that properties of the system cannot be traced to the individual elements or their additive effect.[4] Instead, the action is in the interactions, and system properties can be emergent.

And here is where the idea of Flatland is inspiring and a little daunting. The characters in the two-dimensional world found the introduction of three-dimensional beings into their world very strange, and, seen in two dimensions, they were strange indeed.[5] Stepping outside a world of *n* dimensions and into one of *n +1* or more dimensions is disorienting. At least in property theory, we have the advantage of legal systems of other times and places with which we can compare our own. Further, in the spirit of Legal Realism, we have the complexity of the real world and nonlegal institutions as sources of comparison and inspiration (not, as we will see, simple mirroring), which can be our starting point for looking more deeply into our property system. To begin with, we can ask why in the face of complexity of the problems they confront, our legal system in general and property law in particular should not adopt the methods of dealing with complexity in these other aspects of life. Life in all its fullness requires no less, and as limited creatures, we can meet this challenge in characteristically limited ways. This Essay is about those.

To be sure, something going under the banner of "complexity" has often been invoked in property theory and in private law more

managed by the aid of legal science. The same multiplicity is found in the domain of nature, but yet the external sciences are able to bring order out of chaos.").

4. MELANIE MITCHELL, COMPLEXITY: A GUIDED TOUR (2011); HERBERT A. SIMON, THE SCIENCES OF THE ARTIFICIAL (2d ed. 1981); Ludwig von Bertalanffy, *An Outline of General System Theory*, 1 BRIT. J. PHIL. SCI. 134 (1950).

5. The narrator in *Flatland*, A Square, was even an old-fashioned lawyer.

generally. And, as we will see, Legal Realism has made great efforts at dealing with complexity, in the course of which notions of complexity have been adopted that are not entirely on point or even consistent with each other. I will draw on complex systems theory to bring out the role that interactions—those between attributes of resources, between resources, between aspects of the law, between law and society and so on—play in property institutions and how we can build our understanding of property law and institutions around this complexity.

Essential to what follows is to recognize that complexity falls along a spectrum (not a dichotomy) and that it matters greatly where, along that spectrum, the complexity of property law and institutions falls. The spectrum is defined by the nature and extent of the interconnections of the elements of a system. If the elements are not connected at all—they are a heap, as it were—then we have simplicity. Change in an element does not affect other elements, and each element contributes additively to the fitness of the entire collection. A literal bundle of sticks would be a good example. At the opposite extreme is disorganized, maximal complexity (even, in special cases, chaos), in which elements of a system are densely and intensively interconnected. Change in one element can have many and large effects on other elements and drastic effects on the performance of the system. In between is what Warren Weaver called organized complexity, in which elements are connected but not maximally, and the density of connections may not be uniform throughout the system.[6] Instead they may cluster, and in some systems may form distinct clusters that are connected much more intensely inside than outside to the rest of the system. Such systems are "nearly decomposable" (because the components are, unlike in simplicity, not totally unconnected[7]), and in such situations complexity can be managed through modularity: internally complex components can be linked through more sparse and stylized interfaces.[8] A car is a modular system (brakes and windshield wipers are not interconnected, and the drive

6. Warren Weaver, *Science and Complexity*, 36 AM. SCIENTIST 536 (1948).

7. SIMON, *supra* note 4, at 195–98.

8. *See, e.g.*, 1 CARLISS Y. BALDWIN & KIM B. CLARK, DESIGN RULES: THE POWER OF MODULARITY (2000); Richard N. Langlois, *Modularity in Technology and Organization*, 49 J. ECON. BEHAV. & ORG. 19 (2002).

train is connected in specific ways to, e.g., the wheels), as are most computer hardware and software.[9] There is an active debate about how modular the mind and human language competence are.[10] The more that elements are interconnected, whether organized in modules or not, the more we may expect system properties to be difficult to trace to individual components. Such system-level properties are emergent.[11] Thus, the hardness of a diamond or the wetness of water are not properties of carbon atoms or water molecules.

Because social and cognitive systems are complex—they fall somewhere along the spectrum of complexity well away from simplicity—we lose something, including the possibility of emergence, when we assume away those connections. The legal system as a whole, or property law itself, may exhibit properties that cannot be traced to a particular "legal rule."[12] Property law might be efficient or fair even though one rule or especially an invocation of a rule (a suit in trespass) might not be efficient or fair.[13]

To capture this kind of complexity requires more structure and a less homogeneous law than we often are led to expect. For one thing, property theory sports a lot of dichotomous thinking, which we need to overcome. I will explore a number of these dichotomies, the final one of which is that between theory and practice. Current theorizing is not just divorced from practice.[14] It is a kind of practice itself, substituting theoretical constructs for the reality they are supposed to be serving. This is deeply ironic given that the orientation in Legal Realism was to stress the "facts of the situation" and to fashion concepts to be closer to particulars. At the same time, under the influence of flattened property law, practice itself is not everything it could be.

I think something similar is true of property law, when current theory at its most reductionist is confronted with the complexity of

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9. BALDWIN & CLARK, *supra* note 8, at 149–217.

10. *See, e.g.*, H. Clark Barrett & Robert Kurzban, *Modularity in Cognition: Framing the Debate*, 113 PSYCH. REV. 628 (2006) (reviewing the modularity of mind debate); JERROLD M. SADOCK, THE MODULAR ARCHITECTURE OF GRAMMAR (2012) (presenting theory of natural language based on nonhomogeneous modules connected by meta interfaces).

11. For a strong statement, see Anderson, *supra* note 2.

12. Andrew S. Gold & Henry E. Smith, *Sizing Up Private Law*, 70 U. TORONTO L.J. 489 (2020).

13. Henry E. Smith, Property as a Complex System (draft June 2021) (on file with author).

14. *See, e.g.*, Harry T. Edwards, *The Growing Disjunction Between Legal Education and the Legal Profession* 91 MICH. L. REV. 34 (1992).

the world. An engagement with practice in that world is the way out of Flatland.

This Essay begins in Part I by setting out the partial view of complexity in property theory and how it expresses itself in a variety of dichotomies that systematically fall short in capturing the reality of property. Part II then turns to the kinds of system that might characterize property and how an understanding of organized complexity avoids the traps commonly thought to be inherent in "systems" in law. Turning to property on the ground (and in the air!), Part III shows how theories of property incorporating organized complexity point to solutions to a variety of problems, including aerial trespass, nuisance, and the clustering of rights. I conclude with some thoughts on the role of property theory in the world of property.

I. MISLEADING DICHOTOMIES IN PROPERTY THEORY

In property theory as currently practiced, dichotomies and reductionism abound. All stem from a lack of appreciation of complexity in its full sense. The problem is often identified with the so-called bundle-of-rights or bundle-of-sticks picture of property.[15] However, I think the problem extends far beyond the bundle picture, and the bundle picture itself is more a remediable symptom of a deeper problem—of complexity.

As with "property," the term "complexity" is certainly used a great deal in connection with property. Moreover, it was concerns about "complexity" that led the Realists to embrace the bundle picture.[16] "Complexity" also supplied an important motivation for the American Law Institute to initiate its Restatement projects.[17] When these

15. *See, e.g.*, J.E. Penner, *The "Bundle of Rights" Picture of Property*, 43 UCLA L. REV. 711 (1996); Henry E. Smith, *Property as the Law of Things*, 125 HARV. L. REV. 1691 (2012). *See generally* Symposium, *Property: A Bundle of Rights?,* 8(3) ECON J. WATCH (Sept. 2011), https://econjwatch.org/issues/volume-8-issue-3-september-2011?ref=issue-archive.

16. *See, e.g.*, THURMAN W. ARNOLD, THE FOLKLORE OF CAPITALISM 114–16 (1937); JAMES E. HERGET, AMERICAN JURISPRUDENCE, 1870–1970: A HISTORY 146–47 (1990); G. EDWARD WHITE, *The Evolution of Reasoned Elaboration: Jurisprudential Criticism and Social Change, in* PATTERNS OF AMERICAN LEGAL THOUGHT 136, 139 (Quid Pro Books 2010) (1978); *see also* RICHARD A. POSNER, REFLECTIONS ON JUDGING (2013) (arguing from complexity against formalism and for a new judicial realism).

17. REPORT OF THE COMMITTEE ON THE ESTABLISHMENT OF A PERMANENT ORGANIZATION FOR THE IMPROVEMENT OF THE LAW PROPOSING THE ESTABLISHMENT OF AN AMERICAN LAW

consequential movements got their start in the 1920s and 1930s, our understanding of complexity was intuitive but incomplete—sometimes even flat. What was meant in those days by "complex" was often more like complicated, having many pieces. Lawyers and commentators worried about the burgeoning wave of case law, and the law itself consisted of many rules. While complicatedness is a problem, it is a different one from true complexity. Further, the world itself was becoming more complex—new activities and industries were coming to the fore and social conflicts were coming to a head—and although this was closer in spirit to true complexity, many made the assumption that if the law were to meet each of these new challenges, it would need more complex rules.[18]

The true complexity problem required something more, and there were inklings at the time for a different take on complexity. In particular, the controversy in biology between vitalists and mechanists led Ludwig von Bertalanffy to develop his general systems theory, one of the first versions of modern complex systems theory.[19] Systems theory allows all the system properties to be grounded in elements of the system and their interactions, without having to hold true or even be identified with particular local collections of elements. Later Herbert Simon (well known to behavioral economists) developed the notion of complex system across fields. Simon was concerned with design (the artificial) across engineering, medicine, business, architecture, art, psychology, linguistics, and economics, among many areas, and he found nearly decomposable systems and a role for modularity in economic systems, business firms, computer programs, and even watches (a famous illustration). In doing so, he made the intriguing observation that complex systems theory makes it possible to be an "in-principle reductionist" and a "pragmatic holist."[20] These days complex systems theory (alternatively known as complex adaptive systems and complexity science) is an active field (it certainly promises a

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INSTITUTE 12 (Feb. 23, 1923), *reprinted in* THE AMERICAN LAW INSTITUTE 50TH ANNIVERSARY (2d ed. 1973); *see* Henry E. Smith, *Restating the Architecture of Property*, *in* 10 MODERN STUDIES IN PROPERTY LAW 19 (Sinéad Agnew & Ben McFarlane eds., 2018).

18. *See infra* notes 31 and 94–99 and accompanying text.

19. *See* Bertalanffy, *supra* note 4; *see also* LUDWIG VON BERTALANFFY, GENERAL SYSTEM THEORY: FOUNDATIONS, DEVELOPMENT, APPLICATIONS (1969).

20. SIMON, *supra* note 4, at 195.

great deal!),[21] and there is increasing interest in seeing private law, including property law, in terms of complexity.[22]

The upshot is that even a conceptual "reduction" of more abstract notions to their "atomic" parts does not tell us which concepts we should use in our workaday use of the legal system. Notions like corporation or thing or possession (and so on) can still be useful, including in legal reasoning—as long as that reasoning is pragmatic and defeasible rather than rigidly deductive.[23] And from a practical point of view, concepts and rules of a middle-level abstractness are likely to be especially useful.[24] At the poles of extreme abstraction and extreme concreteness, concepts leave actors in extreme epistemic uncertainty. Super abstract concepts give little information at all,

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21. In addition to the sources cited in note 4 *supra*, *see, e.g.*, NINO BOCCARA, MODELING COMPLEX SYSTEMS (2d ed. 2010); STEFAN THURNER ET AL., INTRODUCTION TO THE THEORY OF COMPLEX SYSTEMS (2018); *see also* GERALD M. WEINBERG, A GENERAL INTRODUCTION TO SYSTEMS THINKING (2011).

22. *See, e.g.*, Lynda L. Butler, *The Importance of Viewing Property as a System*, 58 SAN DIEGO L. REV. 73 (2021); David Harper, *Property Rights as a Complex Adaptive System: How Entrepreneurship Transforms Intellectual Property Structures*, 24 J. EVOLUTIONARY ECON. 335 (2014); Jessica A. Shoemaker, *Complexity's Shadow: American Indian Property, Sovereignty, and the Future*, 115 MICH. L. REV. 487 (2017); Henry E. Smith, *Systems Theory: Emergent Private Law*, *in* THE OXFORD HANDBOOK OF THE NEW PRIVATE LAW 139 (Andrew Gold et al. eds., 2020); Alan Calnan, *Torts as Systems*, 28 S. CAL. INTERDISC. L.J. 301 (2019); Spencer Williams, *Contracts as Systems*, 45 DEL. J. CORP. L. 219 (2021); Joshua C. Teitelbaum, *Computational Complexity and Tort Deterrence* (Geo. Univ. L. Ctr., Working Paper No. 3480709, 2021), https://ssrn.com/abstract=3480709. *See generally* Simon Deakin, *Legal Evolution: Integrating Economic and Systemic Approaches*, 7 REV. L. & ECON. 659 (2011); Eric Kades, *The Laws of Complexity and the Complexity of Laws: The Implications of Computational Complexity Theory for the Law*, 49 RUTGERS L. REV. 403 (1997); Daria Roithmayr, *Evolutionary Dynamics and Method, in* ENCYCLOPEDIA OF LAW AND ECONOMICS (Gerrit De Geest ed., 2d ed. 2012); J.B. Ruhl, *Law's Complexity: A Primer*, 24 GA. ST. L. REV. 885 (2008).

23. *See, e.g.*, Simon Deakin, *Juridical Ontology: The Evolution of Legal Form*, 40 HIST. SOC. RES. 170 (2015) (presenting system of defeasible concepts as able to coevolve with social and economic context); Kocourek, *supra* note 3, at 238 (presenting "legal science" as a method for managing "combinations of situations, persons, things, and facts" where these are not directly computable); F.H. Lawson, *The Creative Use of Legal Concepts*, 32 N.Y.U. L. REV. 909 (1957) (arguing for practical use of semi-abstract concepts that can be designed for convenience, especially for non-litigation uses of law); Henry E. Smith, *On the Economy of Concepts in Property*, 160 U. PA. L. REV. 2097 (2012). *See generally* J.A. SCOTT KELSO & DAVID A. ENGSTRØM, THE COMPLEMENTARY NATURE (2006) (showing how complementarity rises from systems resolving internal contradictions).

24. Mario J. Rizzo, *Abstract Rules for Complex Systems*, EUR. J. L. & ECON., Mar. 2021 at 6; Douglas Glen Whitman, *The Rules of Abstraction*, 22 REV. AUSTRIAN ECON. 21 (2009); *cf.* ROBERT P. MERGES, JUSTIFYING INTELLECTUAL PROPERTY (2011) (arguing for mid-level principles in intellectual property).

and very concrete concepts mimicking the complexity of life are uncertain in application and costly to process.

Property theory as currently practiced is suspicious of concepts of even middling abstractness. Before turning to how such concepts work better than is commonly thought, let me diagnose how property theory, by leaving complexity out of the picture, flattens the law into a series of distorting dichotomies.

1. The Bundle of Rights. Although I do not see the bundle as a huge obstacle to progress in theorizing about property (at least not as big an obstacle as I used to think), it is a symptom of how complexity has been read out of private law theory. There are different versions of the bundle picture, and it is sometimes hard to know which we are dealing with.

The bundle picture is so useful, seductive, and ultimately limiting because it is a kind of reductionism. Notions like property or ownership can be broken into smaller pieces, and the properties of the whole are reduced to the sum of the properties of these parts. One version is the Hohfeldian system of jural relations (right-duty, privilege-no right, power-liability, immunity-disability) and opposites across pairs of relations (right-no right, privilege-duty, power-disability, immunity-liability), which can capture what is going on in any legal situation—especially in terms of who can prevail legally against whom in a putative lawsuit.[25] This has an appealing bottom-line or "brass tacks" flavor, and the Legal Realists always wanted to keep close to the facts. The flip side is that more aggregate notions like ownership and property were downplayed or derided as "transcendental nonsense."[26] Legal concepts should be narrow and shallow and keep close to the facts.[27] While the Realists were motivated in part by their hope that

25. Wesley Newcomb Hohfeld, *Some Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 23 YALE L.J. 16 (1913), *reprinted in* WESLEY NEWCOMB HOHFELD, FUNDAMENTAL LEGAL CONCEPTIONS AS APPLIED IN JUDICIAL REASONING AND OTHER LEGAL ESSAYS 23–64 (Walter Wheeler Cook ed., 1923).

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

27. Smith, *supra* note 23, at 2102–06. For a moderate statement of the Realist position, see Karl N. Llewellyn, *A Realistic Jurisprudence—The Next Step*, 30 COLUM. L. REV. 431, 438–51 (1930) (distinguishing between abstract legal verbalisms and concrete empirical facts). For a classic post-Realist statement, see Thomas C. Grey, *The Disintegration of Property*, *in* NOMOS XXII: PROPERTY 69 (J. Roland Pennock & John W. Chapman eds., 1980). For a

this picture would dethrone classical liberal notions of property and deprivilege traditional baselines, the bundle picture is not ultimately tied to any particular ideology.[28] While reducing property to a pile of sticks allows engineering to work stick by stick in isolation, libertarians and classical liberals have flipped the script: if each stick is property, then it might get protection against government takings.[29] Each stick is its own "denominator," and the government would be on the hook for compensation much of the time. Something isn't right here.

As I have argued elsewhere, what the bundle picture leaves out—flattens out—is an essential kind of complexity—organized (or structured) complexity to be exact.[30] Realism made a major effort to accommodate complexity, and complexity was a major reason cited for the inadequacy of prior law and the need for a different style of judging and legal scholarship. Nuisance would be a primary example.[31]

However, the role of complexity was, well, complex, and Realism's treatment of it was not terribly consistent. Thus, on the one hand, the world was taken as irreducibly complex, implying a high degree of unorganized complexity. The solution, however, was to assume that the law in general and the bundle in particular, needed to reflect that complexity stick by stick and rule by rule—without much internal structure, or complexity, itself. Often assuming away such internal connections, the picture of private law (especially the common law) that emerges is quite simple, in a way: a system with little internal structure or interaction among its parts. Notions like

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modern defense of this moderate realist approach, see Hanoch Dagan, *Doctrinal Categories, Legal Realism, and the Rule of Law*, 163 U. PA. L. REV. 1889 (2015).

28. Grey, *supra* note 27, at 81 (noting that the legal realists "were on the whole supporters of the regulatory and welfare state, and in the writings that develop the bundle-of-rights conception, a purpose to remove the sanctity that had traditionally attached to the rights of property can often be discerned").

29. *See, e.g.*, Richard A. Epstein, *Bundle-of-Rights Theory as a Bulwark Against Statist Conceptions of Private Property*, 8(3) ECON J. WATCH 223 (Sept. 2011).

30. Smith, *supra* note 22; Henry E. Smith, *Complexity and the Cathedral: Making Law and Economics More Calabresian*, 48 EUR. J. L. & ECON. 43 (2019).

31. RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 121 (2004) ("The essential premise of much environmental law is . . . that the physical characteristics of the ecosystem generate spatial and temporal spillovers that require restrictions on the private use of natural resources far beyond those contemplated by centuries-old common law tort rules."); *see also* Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 DUKE L.J. 1, 9–36.

"reasonableness" or even "in accordance with policy" can reflect complexity but themselves are simple. That is, the law's own contribution is to let the complexity of the world take its course, and the law itself can be stated very briefly (and so, in that sense, simply).

The problem here is twofold, both theoretical and practical. As a matter of understanding, much of the structure of law and everyday cognition was simply assumed, in a way that traditional grammarians would assume the categories of Latin when analyzing non-Indo-European languages.[32] Once we endogenize categories—in property theory that would be things, bundles, and legal concepts—we get a more explanatory theory. At the practical level, an attention to what kind of complexity we're dealing with (and when) is crucial for picking the rights tools. The conventional bundle picture assumes that problems can be addressed in separate fashion—which is sometimes true. For very advanced problems that can be taken in isolation without ripple effects (i.e., they are on a separable margin), it is highly fruitful to regard entitlements in a disaggregated way. Because attention is focused more on such problems, the conventional bundle seems more generalizable than it really is. We may forget that property law and institutions are quite multipurpose, applying all the way from the sandbox and the parking lot to our dealings with everyday objects, like costs and watches, to residential leases and sophisticated real estate deals.[33]

If the problems facing property law show complexity with some organization, we might expect a different kind of reflection. The law itself might show structure to its own complexity, and the law might be a device for managing the complexity of the world through this very structure. That is, the very organization of the world into legal things that can be possessed and owned, and the definition of lumpy packages of legal relations (sometimes called "property") over them will, in a sense I will explore, serve to manage the complexity of the interactions among resource attributes and actors. Likewise, a set of interlocking legal concepts (like possession) can respond flexibly but at lower complexity cost than a more free-form or highly articulated

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32. *See, e.g.*, WILLIAM CROFT, SYNTACTIC CATEGORIES AND GRAMMATICAL RELATIONS: THE COGNITIVE ORGANIZATION OF INFORMATION (1990).

33. Thomas W. Merrill & Henry E. Smith, *What Happened to Property in Law and Economics?*, 111 YALE L.J. 357, 398 (2002).

style of law. Systems rest on interrelationships—between resource attributes, legal relations, legal concepts, and the like—and on the architectural approach we need to ask about their relationships. Again, this need not mean any necessary or deductive relationship. It might be complementarity or any other influence on the value of one relation from the presence or absence of another.

The conventional bundle picture is only part of the story. First of all, we need to be clear on what we are doing when we analyze property into bundles. Hohfeld was engaged in conceptual analysis, and defenders of the bundle are on solid ground when they claim that as a conceptual matter one can think of each stick separately.[34] The problem is that in practice, conceptual separateness is treated the same as practical distinctness and independence.[35] To get from conceptual separateness to practical independence we have to assume away the actual contingent, empirical interdependencies among the sticks we have identified.[36]

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34. Shane Nicholas Glackin, *Back to Bundles: Deflating Property Rights, Again*, 20 LEGAL THEORY 1 (2014).

35. Thomas Ross argues that the bundle-of-sticks metaphor itself implies strong separability:

> Although both the Hohfeldian abstraction and the pre-metaphor property law [property as thing ownership] recognized the separation of particular property interests, the metaphorical conception [bundle of sticks], when examined, emphasizes that separation. Within both the Hohfeldian abstraction and the metaphorical conception, my legally recognized right, for example, to lease my home is distinguishable from my other rights. But within the metaphorical conception if the state changes or takes away this particular right, all other rights are presumptively left intact and unaffected. To take one stick out of the bundle leaves the remaining sticks undisturbed. The metaphor not only makes analysis by disaggregation seem natural and right; it also suggests the separability of those disaggregated interests in a way not suggested by the Hohfeldian abstraction. Once you embrace the metaphor, it becomes hard to imagine how the taking of one interest could affect the interests remaining.

Thomas Ross, *Metaphor and Paradox*, 23 GA. L. REV. 1053, 1061–62 (1989); *see also, e.g.*, CAROL M. ROSE, PROPERTY AND PERSUASION: ESSAYS ON THE HISTORY, THEORY, AND RHETORIC OF OWNERSHIP 280 (1994) (arguing that the bundle-of-sticks metaphor implies that rights making up ownership are separable and "all more or less alike" and that seeing ownership rights as more like "[t]oys in a toy chest"would be truer to how they are "interconnected and interdependent," perhaps in the service of "some larger general purpose"); Jane B. Baron, *The Contested Commitments of Property*, 61 HASTINGS L.J. 917, 967 (2010) ("In the sense of being an agglomeration of separable powers, property can be said to be a 'bundle of rights.'"); Anna di Robilant, *Property: A Bundle of Sticks or a Tree*, 66 VAND. L. REV. 869, 877–89 (2013) (setting out separability as element of the bundle theory of property); *see generally* Grey, *supra* note 27 (arguing for disaggregation of property bundle based in part on separability).

36. Whatever those are: individuation is a related challenge.

The nature and extent of such connections determine the type of complexity and hence the version of the bundle of rights. Various versions of the bundle picture correspond to types of complexity. If the sticks in the bundle are totally unconnected, the effects of the bundle are the additive sum of the effects of the sticks and optimizing each stick never makes the bundle less fit (efficient, fair, autonomy promoting) overall. This corresponds to simplicity. At the other extreme, each stick might be tightly connected (for example, by affecting the value greatly) of every other stick. If so, any change can lead to wild swings in the value of the bundle, which are very hard to predict. In between we might have some degree of connection in the bundle, and, importantly, greater internal connections within the bundle than between elements in the bundle and those outside. Thus, the bundle of rights includes rights of lateral support and rights and privileges for use of adjacent watercourses, because support and uses of water are highly complementary to what owners would do with land. (What "land" is can be endogenized in this way.[37]) In other words, the system overall is one of what Warren Weaver dubbed "organized complexity,"[38] with a pattern of partial decomposability.[39]

A modular structure emerges, which can be modeled using networks.[40] And the legal system can shape the interface between modules further (e.g., by ruling out unvaluable potential connections that could lead to costly complexity). Lee Alston and Bernardo Mueller capture this range of bundle pictures by using Stuart Kauffman's famous *N-K* model of biological evolution (*N* genes and *K* epistatic connections in the sense that the effect of a mutation in a gene depends on other genes).[41] They show how these different degrees of

37. For an early and sophisticated attempt, see Stuart S. Ball, *The Jural Nature of Land*, 23 ILL. L. REV. 45 (1928).

38. Weaver, *supra* note 6.

39. SIMON, *supra* note 4, at 209–17; *see also* Herbert A. Simon, *The Architecture of Complexity*, 106 PROC. AM. PHIL. SOC'Y 467, 477 (1962).

40. Ted Sichelman & Henry E. Smith, Modeling Legal Modularity (draft 2017) (on file with author); *see also* MATTHEW O. JACKSON, SOCIAL AND ECONOMIC NETWORKS 443–57 (2008); M. E. J. Newman & M. Girvan, *Finding and Evaluating Community Structure in Networks*, 69 PHYSICAL REV. E 026113 (2004).

41. STUART KAUFFMAN, AT HOME IN THE UNIVERSE: THE SEARCH FOR THE LAWS OF SELF-ORGANIZATION AND COMPLEXITY 170–76 (1995); Lee Alston & Bernardo Mueller, *Towards a More Evolutionary Theory of Property Rights*, 100 IOWA L. REV. 2255, 2262–63, 2265–68 (2015); *see also* James E. Krier, *Evolutionary Theory and the Origin of Property Rights,* 95 CORNELL L. REV. 139 (2009).

interconnection and hence complexity lead to different expectations about the evolution of property bundles. The unconnected-stick bundle, the simple one, has a fitness landscape that is like a smooth mountain with one overall optimum reachable by any path. The maximally connected bundle (or world) has a random-looking landscape: any change can lead to wild peaks and valleys, and the global maximum may not be reachable through small changes. By contrast, the fitness landscape corresponding to the bundle showing organized complexity is jagged, with several somewhat predictable maxima, and with some improvements outside the reach of incremental changes.

This middle-range organized complexity promises to be the most realistic. Alston and Mueller see my architectural approach as being an instance of this middle picture, and it nicely captures some of the stakes in the debate over the bundle. They give the example of the statutory right to roam in England, which was generally considered an unambiguous improvement (with one note of caution).[42] Consistent with a picture based on organized complexity, recent empirical work suggests that the statute did negatively affect land prices—which is not to say that this cost stemming from epistatic connections was not worth incurring.[43] Again, these connections are empirical and a matter of degree.

The picture here is endogenous, not exogenous. That is, the bundle endogenously responds to exogenous factors. We can thus explain the contours of bundles and things and how they respond to external change. Much of what can be owned is determined by purpose (land and tools yes, air normally no) and feasibility (land and everyday objects yes, distant astronomical objects no, *ad coelum* notwithstanding). Importantly, morality shapes what is eligible for property: wedding rings and other familiar property for personhood emphatically yes

42. Alston & Mueller, *supra* note 41, at 2267–68 (quoting Henry E. Smith, *Property Is Not Just a Bundle of Rights*, 8 ECON J. WATCH. 279, 286 (2011)) ("'[A]dding or subtracting a stick to the bundle affects the rest of the sticks. In principle the bundle theory could take this into account, but it typically does not. Instead, the metaphor of the bundle of sticks is used to imply precisely the opposite. In a bundle of sticks the sticks do not interact; you can add or subtract them at will, and still you will have a bundle with roughly the same properties. Not so with property: giving the right-to-roam stick to a neighbor or to the public affects the value of the remaining property, including "sticks" like the ability to grow plants, to eat dinner in peace, etc.'").

43. *See* Jonathan Klick & Gideon Parchomovsky, *The Value of the Right to Exclude: An Empirical Assessment*, 165 U. PA. L. REV. 917 (2017).

and slavery emphatically no.[44] What is definitely not true is that everything that could be a thing can be owned. Complexity considerations will make some possible things infeasible and shape which version of other things and bundles we see. On the margins, internal "epistatic" connections help determine the contours of bundles and affect the course of change.

In a sense, we need to adopt the spirit of Yoram Barzel's theory of property (and his related earlier work on taxation) to investigate how "quality changes" can occur.[45] Thus, for example a per unit tax on light bulbs or cigarettes can lead to inefficiently durable light bulbs or long cigarettes. And an ad valorem tax on cars can cause sound systems to be sold separately. The problem is that a tax can have an effect on the underlying things subject to taxation, because actors will want to alter the nominal thing to minimize the tax. We need to allow for the possibility of adjustment through the law and through actors' responses to the law, both in terms of things and bundles of rights.

The same is true of property law: legal rules can shape the "things" and the "bundles of rights" over them both directly and indirectly. While it is often convenient to assume that the objects of the legal system or taxation are given or constant, this can foreclose important kinds of description and explanation. It is not realistic.

Here, too, we need to get beyond an important reductionist dichotomy. Things and bundles are assumed to be either totally rigid or totally plastic, and sometimes things are assumed to be fixed and bundles plastic. It is sometimes assumed that allowing for fluidity at the margins or for some resources means that somehow fluidity reigns everywhere.[46] Property is more complex.

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44. *See* Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957 (1982). Slavery is immoral whether or not one believes in Lockean fashion that we own ourselves or that property only refers to objects separable from the self.

45. YORAM BARZEL, ECONOMIC ANALYSIS OF PROPERTY RIGHTS (2d ed. 1997); Yoram Barzel, An *Alternative Approach to the Analysis of Taxation*, 84 J. POL. ECON. 1177 (1976); Henry E. Smith, *Ambiguous Quality Changes from Taxes and Legal Rules*, 67 U. CHI. L. REV. 647 (2000).

46. *See, e.g.*, Katrina M. Wyman, *The New Essentialism in Property*, 9 J. LEGAL ANALYSIS 183 (2017) (arguing from edge cases that thinghood in the architectural theory has no stability and is as protean as the bundle of rights). In a similar way, the usefulness of the bundle theory at the margin does not make it a theory of property as a whole, nor does it preclude that the bundle might have a relatively stable core. For analyses assuming a homogeneity in the bundle in this sense, *see, e.g.*, Jane B. Baron, *Rescuing the Bundle-of-Rights Metaphor in Property Law*, 82 U. CIN. L. REV. 57 (2013); Stephen R. Munzer, *A Bundle Theorist Holds On to His Collection of Sticks*, 8 ECON. J. WATCH 265 (2011). Some theorists make the assumption that both things and bundles are totally disaggregating. *See* Grey, *supra* note 27.

2. System in Property and Private Law. The prevalent allergy to system in law reflects another flattening dichotomy. System in law is assumed to be fully deductive or nothing.[47] Because the former is obviously inadequate and even undesirable, we seem to be forced into anti-system. This doesn't follow (deductively or otherwise!). In keeping with complex systems theory, the real question is whether the parts of property law and its institutions interlock in interesting ways—and these ways need not be deductive.[48]

Basic notions of possession can be taken as emblematic of the vagaries of system in property law. Starting with Savigny, possession was taken as a central test for system in law and the use of Roman law as such a system.[49] This notion of system became more deductive and ambitious over time. Even Savigny's approach can be faulted for not being policy oriented,[50] and the Realists and their successors zeroed in on possession as a classic instance of overtheorizing. They went so far as to claim that there is no unitary notion of possession at all in the law but rather a series of context-specific notions for trespass, conversion, and adverse possession, all varying by resource, and so on.[51]

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47. *See, e.g.*, GRANT GILMORE, THE AGES OF AMERICAN LAW 42 (1977) (claiming that in supposed Langdellian formalism, "the law is a closed, logical system. Judges do not make law: they merely declare the law which, in some Platonic sense, exists. The judicial function has nothing to do with the adaptation of rules of law to changing conditions; it is restricted to the discovery of what the true rules of law are and indeed always have been."); Roscoe Pound, *Mechanical Jurisprudence*, 8 COLUM. L. REV. 605, 606 (1908) ("[T]he effect of a scientific legal system upon the courts and upon the legal system is more subtle and far-reaching. The effect of all system is apt to be petrifaction of the subject systematized."). On the vast array of varieties of formalism and the incorrectness of this picture, see Paul B. Miller, *The New Formalism in Private Law*, 66 AM. J. JURISPR. (forthcoming 2021), https://ssrn.com/abstract=3908595.

48. *See, e.g.*, Gerald Postema, *Law's System: The Necessity of System in Common Law*, 2014 NEW ZEALAND L. REV. 69 (2014) (arguing that non-deductive type of system is compatible with common law reasoning); Jeremy Waldron, *"Transcendental Nonsense" and System in the Law*, 100 COLUM. L. REV. 16, 25 (2000) (discerning in law "a form of interconnectedness (flagged by a corresponding technical vocabulary) that we might refer to not just as coherence but as doctrinal systematicity—the way that, in specific areas of law . . . rules of different kinds fit together in a structured and articulated whole as part of a system").

49. FRIEDRICH CARL VON SAVIGNY, VON SAVIGNY'S TREATISE ON POSSESSION; OR THE JUS POSSESSIONS OF THE CIVIL LAW (Sir Erskine Perry trans., London, R. Sweet, 6th ed. 1848).

50. Richard A. Posner, *Savigny, Holmes, and the Law and Economics of Possession*, 86 VA. L. REV. 535 (2000).

51. *See* Joseph W. Bingham, *The Nature and Importance of Legal Possession*, 13 MICH. L. REV. 535 (1915); Burke Shartel, *Meanings of Possession*, 16 MINN. L. REV. 611 (1932).

These criticisms of extreme notions of deductive system are well taken, but they can be mistakenly extended to kinds of system that can prove their worth. The law should not try as a matter of book learning to capture the nature of possessory control for each resource in the world, which is more a matter of social fact upon which the law draws. Moreover, we can avoid abstractions like "constructive possession," if we recognize (as did Albert Kocourek) that possession concepts can be useful if we allow them to specialize.[52] If "possession" is a matter close to facts in the world,[53] and we make many legal rights turn on the "right to possess," we can capture the law in a looser but still somewhat systematic way. Moreover, some such structure reflects the path of legal development, with possession and rights to possess layered on top of each other as a matter first of custom and then of law.[54] At the same time, as Carol Rose has shown, possession is directed at an audience of sometimes socially close and at other times socially distant potential duty bearers.[55] Such communication must be modulated in terms of its degree of formalism (versus contextualism).[56]

3. Formalism and Standardization as Categorical or Along a Spectrum. System is often associated with formalism, because a deductive system operates in a fashion relatively free from context. (We define what is in the system and what is not.) Supposedly, formalists see law as an autonomous discipline and law as hermetically sealed from politics—and perhaps some do. As Paul Miller has shown, "formalism" has come to mean many things ranging from the ridiculous (a matter of caricature) to the highly nuanced.[57] Here is not the place to explore all these notions of formalism, but I do want to point out how we can avoid needlessly dichotomizing formalism and contextualism, and thereby can open ourselves to true complexity.

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52. ALBERT KOCOUREK, JURAL RELATIONS 364–71 (2d ed. 1928). For a compatible approach to civil law, see Yun-chien Chang, *The Economy of Concept and Possession*, *in* LAW AND ECONOMICS OF POSSESSION 103 (Yun-chien Chang ed., 2015).

53. EUGEN EHRLICH, FUNDAMENTAL PRINCIPLES OF THE SOCIOLOGY OF LAW 379–80 (W. Moll trans., 1936) (1913) (providing an account of possession as resting on social facts).

54. Henry E. Smith, *The Elements of Possession*, *in* LAW AND ECONOMICS OF POSSESSION 65 (Yun-chien Chang ed., 2015).

55. Carol M. Rose, *Possession as the Origin of Property*, 52 U. CHI. L. REV. 73, 78 (1985).

56. Henry E. Smith, *The Language of Property: Form, Context, and Audience*, 55 STAN. L. REV. 1105, 1115–25 (2003).

57. Miller, *supra* note 47.

Formalism is not—as it is often taken to be—all or nothing. It is often assumed that law is either totally deductive and autonomous or it cannot be formal at all. Intractable complexity might point away from formalism (but which way would it point?). Perhaps as in early conceptions of the environment, everything is connected to everything else and context always matters, which would preclude the use of shortcut or system of any kind.[58] Clearly context matters a great deal and interconnections are important, in the environment and in law.[59] The question is how to manage the challenge, and a degree of formalism can sometimes be a part of the solution rather than always the problem.

Although formalism takes many forms, it is surprisingly possible to give general characterizations of formalism. Francis Heylighen defines formalism as relative invariance to context.[60] This definition can be used in language (computer languages versus human language, formal versus informal speech), scientific theories, and mathematical notation (published proofs versus everyday work). Most interesting for our purposes is the role of formality in communicating with socially distant audiences who cannot be presumed to bring as much background knowledge or common norms to the communication. In rem versus in personam can be seen as an important example.[61]

If we take complexity seriously, we should treat formalism as being a matter of degree—a matter of when, how much, and why. Within the law, we should not expect the same degree of formalism everywhere. When it comes to the most impersonal contexts, where an in rem right is being asserted against people generally ("against the world"), requiring duty bearers to process a lot of contextual information is not realistic.[62] Famously, James Penner argued for the importance of in rem rights and the formal (not substantive) centrality of

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58. ALDO LEOPOLD, A SAND COUNTY ALMANAC 239–40 (1949); JOHN MUIR, MY FIRST SUMMER IN THE SIERRA 211 (1911); Steven J. Eagle, *The Common Law and the Environment*, 58 CASE W. RSRV. L. REV. 583, 594–95 (2008) (discussing the views of Aldo Leopold and John Muir).

59. Henry E. Smith, *The Ecology of the Common Law*, 9 BRIGHAM-KANNER PROP. RTS. J. 153 (2020).

60. Francis Heylighen, *Advantages and Limitations of Formal Expression*, 4 FOUND. SCI. 25, 26–28, 49–53 (1999); *see also* Smith, *supra* note 56, at 1148–57.

61. Smith, *supra* note 56, at 1139–67.

62. Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The* Numerus Clausus *Principle*, 110 YALE L.J. 1, 55 (2000); Henry E. Smith, *Toward an Economic Theory of Property in Information*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 104 (Kenneth Ayotte & Henry E. Smith eds., 2011).

the right to exclude in property through the example of a parking lot: duty bearers need to know not to take or meddle with cars, but they need not know anything about the owner, the owner's plans, whether the car is borrowed from the user's sister-in-law, etc.[63] By contrast to such in rem relations, where people are contracting between themselves, we can expect and allow a lot more (but not unlimited) idiosyncrasy, and it makes more sense to take context into account. And between these poles (if that's what they are), we get a lot of variation. As Merrill and I have shown, there are many property institutions that fall in between.[64] Here the duty bearers and other potentially interested parties are numerous but definite or non-numerous but indefinite, making the audience of intermediate social distance. And in these "intermediate" situations, we find intermediate degrees of standardization.[65] And within such intermediate institutions, like landlord-tenant, bailments, security interests, and trusts, we find an intermediate degree of formalism with standardization of the more in rem aspects and more tailoring and use of context in the more in personam aspects.[66] Boilerplate in contract law falls between the in rem and in personam, and it exhibits a semi-formal modular structure.[67]

Indeed, this differential formalism based on varieties of audience is very general.[68] It occurs within human language, and even in realms we might not expect it. For example, within the world of mathematical communication, which is sometimes taken to be totally formal, degrees of formalism are crucial to the course of mathematical understanding itself.[69]

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63. J.E. PENNER, THE IDEA OF PROPERTY IN LAW 75–76 (1997).

64. Thomas W. Merrill & Henry E. Smith, *The Property/Contract Interface*, 101 COLUM. L. REV. 773 (2001) [hereinafter Merrill & Smith, *The Property/Contract Interface*].

65. *Id.*

66. *Id.* at 809–51.

67. Henry E. Smith, *Modularity in Contracts: Boilerplate and Information Flow*, 104 MICH. L. REV. 1175, 1180 (2006); Cathy Hwang, *Unbundled Bargains: Multi-Agreement Dealmaking in Complex Mergers and Acquisitions*, 164 U. PA. L. REV. 1403, 1420 (2016); *see also* Erik F. Gerding, *Contract as Pattern Language*, 88 WASH. L. REV. 1323 (2013). This is not to say that such contractual provisions are totally modular or that modularization comes without cost. *See, e.g.*, Matthew Jennejohn, *The Architecture of Contract Innovation*, 59 B.C. L. REV. 71 (2018); Tal Kastner, *Systemic Risk of Contract* (June 17, 2021), B.Y.U. L. REV. (forthcoming), https://ssrn.com/abstract=3869216.

68. Smith, *supra* note 56, at 1125–67.

69. William P. Thurston, *Proof and Progress in Mathematics*, 30 BULL. AM. MATH. SOC'Y 161 (1994).

Formalism sometimes manifests as standardization, and among areas of private law, property is more standardized than most. Which is not to say that it is always standardized or that the degree of standardization is constant over time and place. Tom Merrill and I offered a theory of standardization in property, known by the civil-law term "*numerus clausus*," based on the benefits and costs of information implicated by in rem versus in personam rights.[70] As mentioned earlier, in rem audiences (of duty bearers and potential acquirers) are more distant than those involved in corresponding in personam scenarios. Moreover, someone creating an in rem right does not necessarily face all the information costs thrown off by a new form: an idiosyncratic form may cause everyone else to be on the lookout for unwanted features along a variety of margins and to fear surprises along unknown ones.[71] Title records can help, but it is an empirical question how much and when.[72] And it is noteworthy that systems of registration often have a stricter, not a looser, *numerus clausus*. If, as some have argued, notice really cured all—any detail in the land records provides sufficient opportunity for notice—then we would expect freedom of creation should reign, and registration, which gives the best notice, would allow more idiosyncrasies.[73] Instead, if anything, we find the opposite, and it is not hard to guess why: if the registrar must make a pronouncement on title, the registrar stands in for the "in rem" public and will not want to incur high information costs evaluating idiosyncratic interests.[74] (Interestingly, when New Zealand tried to automate its Torrens registration system, it had to standardize even further.[75]) Consistently with complexity economics, information is a way of framing a substantive problem: in rem rights are nonconsensual, and we

70. Merrill & Smith, *supra* note 62.

71. *Id.* at 32.

72. Henry E. Smith, *Standardization in Property Law*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 148, 165–67 (Kenneth Ayotte & Henry E. Smith eds., 2011).

73. For an argument to this effect, see Richard A. Epstein, *Notice and Freedom of Contract in the Law of Servitudes*, 55 S. CAL. L. REV. 1353 (1982); *see also* Alfred F. Conard, *Easement Novelties*, 30 CAL. L. REV. 125, 131–33 (1942) (arguing that novel easements should be enforceable as long as there is notice).

74. Benito Arruñada, *Property Enforcement as Organized Consent*, 19 J.L. ECON. & ORG. 401, 416–20 (2003).

75. Benito Arruñada, *Leaky Title Syndrome?*, 2010 N.Z. L.J. 115 (April 2010).

should hesitate in imposing on in rem audiences who do not agree to be bound by idiosyncratic duties.[76]

Standardization varies over time in a complex way, but often not in the way sometimes portrayed. It is said that some countries have the opposite of the *numerus clausus*, a "*numerus apertus*" or open set of property rights—free customization. This turns out to be somewhere between overblown and false: such systems, including those of Norway, South Africa, and Spain, in practice are more standardized than they are in theory.[77] On the other hand, in more close-knit groups we can expect much less standardization, as we find with customary regimes.[78] Indeed, the question of how much a society-wide, more impersonal legal system should recognize community custom is perhaps the most controversial aspect of the *numerus clausus*.[79]

At the level of law, it is possible to be a functionally oriented partial formalist.[80] That is, the pattern of when formalism is (and is not) desirable can be grounded in functional considerations (not usually associated with strong forms of formalism). In personam and in rem would be but one example. Thus, external perspectives like functionalism need not read the concepts important to internal perspectives entirely out of the law: concepts like possession can be justified by their function in a system, a function that is not merely given. By the same token, internal perspectives theorize from the perspective of system participants and are often grounded in local kinds of morality like corrective justice. These internal perspectives

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76. *See, e.g.*, Nestor M. Davidson, *Standardization and Pluralism in Property Law*, 61 VAND. L. REV. 1597 (2008); Avihay Dorfman, *Property and Collective Undertaking: The Principle of* Numerus Clausus, 61 U. TORONTO L.J. 467 (2011); Joseph William Singer, *Democratic Estates: Property Law in a Free and Democratic Society*, 94 CORNELL L. REV. 1009 (2009).

77. Yun-chien Chang & Henry E. Smith, *Convergence and Divergence in Systems of Property Law: Theoretical and Empirical Analyses*, 92 S. CAL. L. REV. 785, 798 & nn.36–38 (2019) (discussing and citing sources for Norway, South Africa, and Spain).

78. *See* Henry E. Smith, *Community and Custom in Property*, 10 THEORETICAL INQUIRIES L. 5 (2009). For this reason and because modularity is endogenous in the architectural theory, I do not see this as a "modernist" project or geared exclusively to modern property systems. *Cf.* Carol M. Rose, *Modularity, Modernist Property, and the Modern Architecture of Property*, 10 BRIGHAM-KANNER PROP. RTS. J. 69 (2021) (detecting a modernist theme in the architectural theory). Perhaps the baroque would be a better architectural and cultural analogy?

79. *See* Henry E. Smith & Yun-chien Chang, *The* Numerus Clausus *Principle, Property Customs, and the Emergence of New Property Forms*, 100 IOWA L. REV. 2275 (2015).

80. Smith, *supra* note 22, at 158; ("Applying systems theory to private law . . . allows us to take seriously some of the structures of private law for functional reasons."); *see also* Wyman, *supra* note 46, at 206 (discussing functionally motivated formalism or functional formalism).

should be open to functional considerations—to the way that the functioning of concepts in society helps shape legal concepts. Thus, both external and internal perspectives can converge to some degree on a more varied picture of formalism.[81]

4. Information Costs. Related to system and formalism is the notion of information costs. While not the sole or even the main focus of property law, information costs are a source of potential flattening in property they if they are not handled properly. They also shape property law in characteristic ways.

Information costs are a broad category. They include much more than the verification costs a party incurs in order to evaluate whether rights are valid.[82] Measurement costs of all kinds are information costs, including the costs of figuring out the contours of rights and their various implications.[83] Highly interactive rights—where the interactions can have consequences but are not that valuable overall—present a complexity problem. The emerging field of complexity economics sees many of the benefits and costs of economic activity in terms of information, a trend consistent with developments in the natural sciences.[84]

Complexity gives rise to information costs. Complexity causes uncertainty which can be measured in terms of entropy.[85] That is, complexity carries a lot of information both in the sense that it would require a long description and that it has a lot of surprise value. From a practical standpoint these aspects of complexity give rise to costs: the resources for dealing with complexity or the losses incurred because of it can be classed as information costs. And different modes of delineation are differentially costly. Just as we reserve a signal

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81. On how complexity considerations point toward a partial convergence of external and internal perspectives, see Gold & Smith, *supra* note 12.

82. If we focus only on verification costs to the exclusion of other information costs, the problem of standardization in property looks much narrower than it actually is. *See* Henry Hansmann & Reinier Kraakman, *Property, Contract, and Verification: The* Numerus Clausus *Problem and the Divisibility of Rights*, 31 J. LEGAL STUD. S373, S416 (2002).

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

84. *See, e.g.*, CÉSAR HIDALGO, WHY INFORMATION GROWS: THE EVOLUTION OF ORDER FROM ATOMS TO ECONOMIES (2015); HANDBOOK OF RESEARCH ON COMPLEXITY (J. Barkeley Rosser, Jr. ed., 2009).

85. Ted M. Sichelman, *Quantifying Legal Entropy* (forthcoming 2021), *in* THE PHYSICS OF THE LAW: LEGAL SYSTEMS THROUGH THE PRISM OF COMPLEXITY SCIENCE.

like a light being on or a siren going off for the less probable state (higher entropy in an informational sense), so we use the least cost delineation for the "default" set of rights, such as the fees simple or full ownership. This does not make them more important. It just means that we can make property law serve our purposes at lower cost. For all these reasons, formalism—a matter of degree—can be seen as a response to information costs, and in my previous work I have explored some of these implications.

It should be said that despite my architectural approach sometimes being called (included by me) an "information cost" theory, I have never claimed that the be-all-and-end-all or even the main purpose of property is to lower information costs. The model is a benefit-cost model (and even here I do not adopt such a model as any kind of philosophical utilitarian).[86] The point is to handle complexity: to make it serve our purposes—and for present purposes I take these purposes to be plural—without causing excessive problems, however those are cast. Part of the point of emphasizing information costs is that until recently they were often assumed away, to the detriment of explanatory power. This is not unrelated to the bundle picture and the reflexive dismissal of formalism of all kinds. It is true that some of property's characteristic devices are shaped by the cost of in rem rights—costs incurred in achieving the benefits—and that this causes property to be different in interesting ways from contract.

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86. Smith, *supra* note 15, at 1725 ("I am not arguing for utilitarian foundations in a philosophical sense. If explanations based on information costs, complexity, and the nearly decomposable system of social interactions dovetail with moral theories, it is quite likely not an accident. This convergence is a consequence of complexity. As Herbert Simon pointed out, complexity can lead us to be "in-principle" reductionists and "practical" holists."); Henry E. Smith, *Mind the Gap: The Indirect Relation Between Ends and Means in American Property Law*, 94 CORNELL L. REV. 959, 974 (2009) ("Undoubtedly, one can find convinced utilitarians and consequentialists, but I suspect for many, including myself, utilitarianism is a method of communication more than anything else."); *see also* Thomas W. Merrill & Henry E Smith, *The Morality of Property*, 48 WM. & MARY L. REV. 1849, 1850–51 (2007) ("But it seems highly unlikely that such a morality will be captured by many forms of utilitarianism. Pragmatism is too uncertain, and case-specific cost-benefit analysis too demanding and error-prone, to supply the kind of robust and widely accepted moral understanding needed to sustain a system of property."); Thomas W. Merrill & Henry E. Smith, *The Architecture of Property*, *in* RESEARCH HANDBOOK ON PRIVATE LAW THEORIES 134, 136 (Hanoch Dagan & Benjamin Zipursky eds., 2020) ("We do not claim that these purposes can be reduced to a single metric (such as utility), although we do think that the kind of quasi-utilitarianism of law and economics can serve as a provisional lingua franca or integrating tool of analysis (analogously to the way cost-benefit analysis serves a role in the regulatory context).") (footnote omitted).

Indeed, one may even say that these characteristic devices, including a large role for exclusion in modern property systems, are an "essential role" of property law in the sense of Henry Hansmann and Reinier Kraakman's work on organizations: these devices in property law do something that could not feasibly be replicated by contract.[87] Nevertheless, information costs are but part of the picture.

As with complexity, the problem of information costs and resultant partial formalism is far from limited to property. Similar patterns of "audience design" are reflected in natural language, with more formal "high delineation cost" speech used for socially distant audiences and more informal implicit communication for those closer in social context.[88] Closely related to this is how custom tends to be partially formalized and simplified if it is taken up into the law and applied beyond its community of origin.[89] Even in an enterprise that has a clear-cut deductive image like mathematics the very same patterns of communication can be seen.[90]

The need to achieve property's purposes at reasonable cost helps explain why the trust works the way it does and why it is such an important legal innovation. Because the trustee has legal title, for most purposes third parties can interact with the property in the usual way. The trustee is subject to equitable duties (prominently loyalty and prudence, but also accounting, information, etc.) to the beneficiary.[91] These can be very intense and context-specific because they are mainly of relevance to these two parties. The one exception is that if the trustee transfers to a third party who does not give value (no reliance) or knows that the transfer is in breach of trust, then the third party will be treated as a constructive trustee with a duty to convey to the appropriate party.[92] The beneficial interest is

87. *See* Henry Hansmann & Reinier Kraakman, *The Essential Role of Organizational Law*, 110 YALE L.J. 387, 390 (2000) (arguing that asset-partitioning is not achievable by contract, making it the "essential role" of organizational law); Brian Angelo Lee & Henry E. Smith, *The Nature of Coasean Property*, 59 INT'L REV. ECON. 145 (2012).

88. Smith, *supra* note 56, at 1133–39.

89. Smith, *supra* note 78.

90. Thurston, *supra* note 69.

91. *See, e.g.*, Ben McFarlane & Robert Stevens, *The Nature of Equitable Property*, 4 J. EQUITY 1, 1 (2010); J.E. Penner, *An Untheory of the Law of Trusts, or Some Notes Towards Understanding the Structure of Trusts Law Doctrine*, 63 CURRENT LEGAL PROBS. 653, 665–66 (2010); Robert H. Sitkoff, *An Agency Costs Theory of Trust Law*, 89 CORNELL L. REV. 621 (2004).

92. RESTATEMENT (THIRD) OF RESTITUTION AND UNJUST ENRICHMENT § 55 (AM. L. INST. 2011).

therefore "in personam plus." The arrangement achieves much of the benefit of property for the beneficiary in a way that facilitates expert management and the like, but does not present large information costs for third parties.

The trust exemplifies how attention to complexity and information costs can help us to see that the law achieves its purposes, here quite important and sometimes idiosyncratic purposes, through specialized structures. The traditional debates about whether trusts are contract or property miss how it is a unique hybrid that makes it possible to achieve many of the benefits of property (and more) using mechanisms that in a sense hardly go beyond contract.[93] The trust is quite special, and its uniqueness is easy to miss if we are looking for flattened law. Trusts help us break out of Flatland.

5. Purpose in Property Beyond the Mirror Principle. The flip side of this more complete picture of where information costs come from and why they (but not they alone) matter is the question of purpose in property law. Conventionally, property theory gets straight to the purpose by expecting each component, including each stick in the bundle and each "rule" of property law to reflect some purpose directly.[94] Systems need not work this way.[95] This expectation that property law's purposes are close to the surface has deep roots in Legal Realism and beyond. In characteristically pithy fashion, Oliver Wendell Holmes proclaimed that "a body of law is more rational and

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93. *Compare* F.W. MAITLAND, EQUITY: A COURSE OF LECTURES 29 (A.H. Chaytor & W.J. Whittaker eds., 1936) ("[T]he Chancellor begins to enforce a personal right . . . which in truth is a contractual right, a right created by a promise."); John H. Langbein, *The Contractarian Basis of the Law of Trusts*, 105 YALE L.J. 625, 627, 669 (1995) (acknowledging that "[t]rust is a hybrid of contract and property," but maintaining that at bottom "[t]rusts are contracts") *with* Austin Wakeman Scott, *The Nature of the Rights of the* Cestui Que *Trust*, 17 COLUM. L. REV. 269, 289 (1917) ("[T]he rights of the *cestui que trust* . . . are treated like property rights rather than like obligations."); Henry Hansmann & Ugo Mattei, *The Functions of Trust Law: A Comparative Legal and Economic Anal*ysis, 73 N.Y.U. L. REV. 434, 454–59 (1998) (arguing for a property-based account of trusts); *see also* Merrill & Smith, *The Property/Contract Interface*, *supra* note 64, at 843–49 (analyzing trust as an institution between in rem and in personam); Yun-chien Chang & Henry E. Smith, *An Economic Analysis of Civil Versus Common Law Property*, 88 NOTRE DAME L. REV. 1, 13 (2012) (discussing trusts in context of styles of legal systems).

94. *See, e.g.*, Smith, *supra* note 86.

95. *See* GERALD M. WEINBERG & DANIELA WEINBERG, ON THE DESIGN OF STABLE SYSTEMS 299 (1979) ("[P]eople persist in the fallacy that mechanisms and variables are in one-to-one-correspondence.").

more civilized when every rule it contains is referred articulately and definitely to an end which it subserves, and when the grounds for desiring that end are stated or are ready to be stated in words."[96] And the external and functional perspective advocated by the Realists and their successors usually involved this rule-by-rule approach. Much of law and economics, especially in its first generation, canvassed the rules of the common law for efficiency.[97] And this kind of reductionism is furthered by the reductionism of the bundle of rights: drawing on Coase (who adopted it for different purposes), law and economics employs the separability of the sticks and the consequent ease of optimization to make it more straightforward to evaluate and reshape the property bundle by the metric of efficiency.[98]

Just as we should neither assume that sticks are always easily separable in practice, likewise we should be open to the idea that rules or other constituents of the law and legal institutions might work synergistically. Law is not just a heap of rules. Such a heap would leave out the whole problem of complexity: sticks and rules might be connected—might work together, might work at cross-purposes, etc.

Thus, when we come at it from the end of purpose—of ends, if you will—we should not necessarily expect that a purpose will be achieved directly by some single component of the legal system, whether it be a stick in the bundle or a "rule" of law. Yes, this sometimes happens, as where we might consider the implied warranty of habitability in isolation. The implied warranty of habitability is embedded in the lease and in landlord-tenant law more generally, but it is more separable from the bundle than would be the notion of possession or the right to repel gross physical invasions under the law of trespass. Transacting behavior, such as in landlord-tenant and real property

96. Oliver Wendell Holmes, Jr., *The Path of the Law*, 10 HARV. L. REV. 457, 469 (1897).

97. This is what led Arthur Leff in his review of the first edition of Richard Posner's *Economic Analysis of Law* to identify Posner's book as a picaresque novel in which "the eponymous hero sets out into a world of complexity and brings to bear on successive segments of it the power of his own particular personal vision." Arthur Allen Leff, *Economic Analysis of Law: Some Realism About Nominalism*, 60 VA. L. REV. 451, 451 (1974). One theme of Leff's review is the problem of complexity and how Posner's method, like any nominalism, assumes it away. *See, e.g.*, the section entitled "Avoiding Complexity." *Id.* at 469–77.

98. On Coase's adoption of the bundle of rights and its pervasiveness in law and economics, see Merrill & Smith, *supra* note 33; Thomas W. Merrill & Henry E. Smith, *Making Coasean Property More Coasean*, 54 J.L. & ECON. S77 (2011).

sales, is easier to regulate under antidiscrimination law than invocations of trespass at the proverbial dinner party. And, it should be remembered, the intertwining of a "stick" is not a reason to avoid touching it: the purpose or policy can be important enough to overcome the attendant complications. Thus, however integral to their conception of ownership racially restrictive covenants were to those who employed them, such covenants should not be enforced and should be banned.[99] Again, the what and the how of property's purposes are two sides of the coin.

And stepping back to a comparative perspective, we see the residue of these kinds of considerations of system and purpose. Having just said that all else is not equal at the micro level—we need to compare purposes and means for achieving them—in the large we should expect aspects of the law in its initial or earlier states to be stickier if they are more integrated or interconnected with the rest of the system of property law.[100] Yun-Chien Chang and I find evidence suggestive of a pattern of convergence and divergence in property law across systems that reflects the architecture of the law. Aspects of the law that serve functions relatively directly—"structural aspects"—can be expected to converge if they respond to similar conditions. More tellingly, those aspects of the law that are characteristic of a legal regime but could easily be otherwise—the stylistic aspects of law—will, if they start out from different initial states, tend to persist if they are more interconnected.[101] Thus, doctrines relating to management of property, which are more intertwined with other aspects of the law and property institutions in an ongoing relationship, tend to diverge more across jurisdictions than the rules for judicial partition, which are more discrete (ending the relationship).[102]

Much of the flattening of property law shows up as a series of dichotomies revolving in one way or another around the bundle picture, system, formalism, information costs, and purposes. Each seems to be an all-or-nothing choice. These dichotomies seem to be built into property law and theory because we have downplayed or

99. *See* RICHARD R.W. BROOKS & CAROL M. ROSE, SAVING THE NEIGHBORHOOD: RACIALLY RESTRICTIVE COVENANTS, LAW, AND SOCIAL NORMS (2013).

100. Henry E. Smith, *The Persistence of System in Property Law*, 163 U. PA. L. REV. 2055 (2015).

101. Chang & Smith, *supra* note 77, at 804–08.

102. *Id.*

overlooked the web of interconnections that lends property—and the world—its organized complexity.

II. VARIETIES OF SYSTEM IN PROPERTY LAW

If the world in which property law is embedded is complex, it is to be expected that property law and institutions would be shaped by that complexity. And, as we have seen, complexity comes in different kinds. Those aspects of the world relevant to property law could be simple or chaotic—or far more likely they could feature Weaver's organized complexity.[103] Resource attributes, their values, actors' activities with respect to them, and so on, are connected but not completely, and the pattern of connections exhibits some clustering (attributes into "things" more or less, and legal relations into legal interests). And if the kind of complexity we're talking about is organized complexity, we might expect property to show a response to that kind of complexity and exhibit a kind of organized complexity itself. The world in general and property institutions in particular are complex systems in which organized complexity plays a large role.

Consistently with organized complexity, when it comes to property law, the system is not purely deductive, but it is structured.[104] Interactions that are dense but not maximal and that show some clustering cause the system of property law to be neither simple nor chaotic, but rather to exhibit Weaver's organized complexity.[105] System is a matter of degree, including in how much it facilitates or impedes dynamic change. Arms or gliding structures evolve into wings but not eyes. And as we have seen, relatively detached features of property law like partition evolve more readily than more connected facets like management doctrines.[106] We can ensure that needed change happens more effectively by paying attention to complexity—by having a more realistic and less nominalist view of what's going on.

To start with, we need to drop the assumption that property must be homogeneous, and thus flat in that sense. Sticks may cover all manner of content, but their role according to the conventional

103. *See* Weaver, *supra* note 6.

104. This idea of system as being a way to overcome complexity and not necessarily through deduction has deep roots, going back to Leibniz. *See* Smith, *supra* note 13.

105. *See* Weaver, *supra* note 6.

106. *See supra* notes 101–02 and accompanying text.

bundle picture is much of a muchness. Such a picture of fully independent sticks and additive rules portrays property as more homogeneous than it is. Also, to assume that there must be one optimal degree of formalism for all of property law (or all of law) is to make the same mistake. Once we confront our theories with the complex reality, it becomes clearer how we can do better.

Let me now briefly survey certain aspects of the system of property law that show nontrivial structure—that are anything but flat.

1. Exclusion Versus Governance. Let's start with the question of how property rights are delineated. These strategies can be placed along a spectrum according to how much they focus in on specific uses.[107] An exclusion strategy employs rough proxies that are relatively easy to monitor (e.g., boundary crossings) but that are under- and especially over-inclusive when it comes to regulating use.[108] By giving possessors and owners the power to control access, they can protect a wide range of uses that need not be spelled out or justified to a court (and harm need not be measured to get an injunction), but given positive transaction costs, this power also prevents access by those who would not do any harm.[109] By contrast, governance involves proxies closely tied to use, as in an easement (a right to use) and the more fine-grained aspects of nuisance, covenants and zoning. As this last list indicates, governance can be supplied by various institutions, including contract, tort, zoning, and the like. And if we include self-help, social norms, and even "vibes,"[110] some of which

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

108. And so are formal in Heylighen's sense. *See* Heylighen, *supra* note 60, at 49–53.

109. Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1327–28 (1993). For theories that emphasize the right to exclude, which is one way to implement an exclusion strategy, *see, e.g.*, J.W. HARRIS, PROPERTY AND JUSTICE 30–32 (1996); J.E. PENNER, PROPERTY RIGHTS: A RE-EXAMINATION 139–56 (2020); PENNER, *supra* note 63, at 68–74; Shyamkrishna Balganesh, *Demystifying the* Right *to Exclude: Of Property, Inviolability, and Automatic Injunctions*, 31 HARV. J.L. & PUB. POL'Y 593 (2008); Eric R. Claeys, *Exclusion and Exclusivity in* Gridlock, 53 ARIZ. L. REV. 9, 17–28 (2011) (book review); Thomas W. Merrill, *Property and the Right to Exclude*, 77 NEB. L. REV. 730, 731 (1998); Thomas W. Merrill, *Property and the Right to Exclude II*, 3 BRIGHAM-KANNER PROP. RTS. CONF. J. 1 (2014); *see also* Henry E. Smith, *The Thing about Exclusion*, 3 BRIGHAM-KANNER PROP. RTS. CONF. J. 95 (2014) (distinguishing the right to exclude from exclusion strategies).

110. Such vibes are especially likely to be problematic if they are designed to get around legal prohibitions on or social disapproval of discrimination. In addition to exclusionary vibes,

can be violent or immoral, exclusion strategies are not tied to any one institutional source. Exclusion and governance are strategies, or legal technologies, that fall along a spectrum defined by the degree to which they zero in on specific uses.

Different resources call for different combinations of exclusion and governance at different times. It is often thought that the Demseztian evolution of property rights with increased value of and pressure on a resource is one toward greater reliance on exclusion (and Demsetz's article can be read that way), but depending on the costs and benefits an increase in use governance can be the best response to new or increased externalities.[111] Thus, the "Demseztian" evolution of property rights might take the form of increased governance,[112] as it did in many historic grazing commons, with the addition and strengthening of "stinting" rules among common grazers.[113]

Moreover, some resources call for a greater reliance on governance, and governance is especially important when it comes to what I call "fluid" property.[114] In an analog to physical fluids, which deform continuously under shearing stress and flow in characteristic ways, some resources are correspondingly hard to "bound." These include water, radio spectrum, and the subject matter of intellectual property. For these resources, particularly where uses are not only hard

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Strahilevitz identifies "exclusionary amenities" as well. Lior Jacob Strahilevitz, *Information Asymmetries and the Rights to Exclude*, 104 MICH. L. REV. 1835, 1861–98 (2006); *see also* LIOR J. STRAHILEVITZ, INFORMATION AND EXCLUSION (2011). Self-help can easily get out of hand, as can informal enforcement of social norms. *See, e.g.*, Carol M. Rose, *Introduction: Property and Language, or, the Ghost of the Fifth Panel*, 18 YALE J.L. & HUMANS. 1, 13–15 (2006) (discussing violent and symbolically violent efforts at exclusion in settings ranging from lobster gangs to neighborhoods with racially restrictive covenants). Different devices can work together, sometimes for bad ends. *See* BROOKS & ROSE, *supra* note 99, at 187–210 (discussing signaling function of racially restrictive covenants).

111. Smith, *supra* note 107, at S453–56, S464, S483; *see also* Rose, *supra* note 31, at 9–12, 19–21 (setting out theory of management strategies for common resources use including "RIGHTWAY").

112. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967); Terry L. Anderson & P.J. Hill, *The Evolution of Property Rights: A Study of the American West*, 18 J.L. & ECON. 163, 170 (1975) (proposing model for degree of property rights activity); *see also* Smith, *supra* note 107, at S468–78 (arguing that increased property rights might take the form of more governance).

113. *See* ELINOR OSTROM, GOVERNING THE COMMONS 61–69 (1990); Karen J. Friedman, *Fencing, Herding, and Tethering in Denmark, from Open-Field Agriculture to Enclosure*, 58 AGRIC. HIST. 584, 591–92 (1984).

114. Henry E. Smith, *Semicommons in Fluid Resources*, 20 MARQ. INTELL. PROP. L. REV. 195 (2016).

to disentangle but also hard to treat as a group and for which multiple access is valuable, we see the expected heavy reliance on governance relative to exclusion.[115]

Governance also shades off into more complex forms of property we can call "entity property." Another way to put this is that property is the law of partial separation, sometimes into modules.[116] Just as things are partially separated from their context and packages of rights over them are partially separated from other relations, there can be separation within packages of rights in quite sophisticated ways. As we will see in the next Subsection, property regimes (private, common, and public) can be mixed into hybrids, and we can also see even within private property forms of property that separate out clusters of functions. In "entity property" we have separation of possession and management (common interest communities and, in a functional sense, leases) and separation of beneficial interests from management (trusts, corporations and other business organizations), with much internal governance.[117]

We should also expect exclusion and governance to work in tandem. Focusing in on certain uses through governance can increase the effectiveness of exclusion strategies. Governance of uses works better when exclusion takes care of many obvious problems based on limiting access to the resource. Without such specialization, a homogeneous strategy would always be entangled in "intermediate" cases. An extreme version would be a universal balancing test for every trespass.[118]

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115. Henry E. Smith, *Governing Intellectual Property*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW: VOLUME 1: THEORY 47 (Ben Depoorter et al. eds., 2019). In this respect patent law is more property-like than copyright and many other areas of intellectual property. By covering generic use it comes closer to an exclusion regime, which may find its explanation in the difficulty of specifying the set of uses in advance and the importance of commercialization and thus rights transfers. *See* Henry E. Smith, *Intellectual Property as Property: Delineating Entitlements in Information*, 116 YALE L.J. 1742, 1799–1819 (2007).

116. Henry E. Smith, *The Economics of Property Law*, *in* THE OXFORD HANDBOOK OF LAW AND ECONOMICS, VOLUME 2: PRIVATE AND COMMERCIAL LAW 148 (Francesco Parisi ed., 2017) (analyzing property law as involving partial separation of various kinds).

117. *See* THOMAS W. MERRILL & HENRY E. SMITH, PROPERTY: PRINCIPLES & POLICIES 641–799 (3d ed. 2017) (chapter on "Entity Property"); THOMAS W. MERRILL & HENRY E. SMITH, OXFORD INTRODUCTIONS TO U.S. LAW: PROPERTY 123–58 (2010) (chapter on "Governing Property").

118. For a proposal somewhat in this direction, see Ben Depoorter, *Fair Trespass*, 111 COLUM. L. REV. 1090 (2011).

2. Hybrids of Private, Common, and Public Property. Property is not all of a piece. We need to distinguish private, common, and public property, and different resources are best held in different ways at different times.[119] This goes beyond the shift from one mode to another (eminent domain as private to public, enclosure movement as common to private), but also includes mixing elements of private, common, and public ownership with respect to the same resource. Different attributes or even different uses of the same resource might fall under different regimes.

Complexity is inevitable where two regimes come together.[120] Even what we think of as the tragedy of the commons only has its tragic tendency because common property abuts private property.[121] If fish taken from a common pond were still common property (assuming that could be enforced in the face of efforts at concealment), then there would be no incentive to overfish.[122] Likewise, if the whole pond were under single ownership there is no such incentive.[123]

This complexity of two regimes coming together has to be offset against the benefits of the two separate regimes. The relationship of the regimes might be synergistic but will often be one of conflict, especially in terms of strategic behavior.

Where two regimes of common and private property come together and interact intensively, we have what I call a semicommons.[124] The

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119. *See, e.g.*, Lee Anne Fennell, *Commons, Anticommons, Semicommons*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 35 (Kenneth Ayotte & Henry E. Smith, eds., 2011); Carol M. Rose, *Thinking About the Commons*, 14 INT'L J. COMMONS 557 (2020).

120. Streets and other public places often show complex interactions of private and public elements, with concomitant strategic behavior. *See* Vanessa Casado Perez, *The Street View of Property*, 70 HASTINGS L.J. 367 (2019).

121. Jens Warming, *Om "Grundrente" af Fiskegrunde*, NATIONALÖKONOMISK TIDSSKRIFT 495 (1911), Jens Warming, *Aalgaardsretten*, NATIONALÖKONOMISK TIDSSKRIFT 151 (1931), *transl. in* P. Anderson, *"On Rent of Fishing Grounds": A Translation of Jens Warming's 1911 Article, with an Introduction*, 15 HIST. POL. ECON. 391 (1983); H.S. Gordon, *The Economic Theory of a Common Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954); Steven N.S. Cheung, *The Structure of a Contract and the Theory of a Non-Exclusive Resource*, 13 J. L. & ECON. 49, 66–67 (1970).

122. Michael Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 675 (1998).

123. Dean Lueck, *The Rule of First Possession and the Design of the Law*, 38 J. LEGAL STUD. 393, 422 (1995).

124. Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131 (2000); *see also* Fennell, *supra* note 119, at 46–49; Rose, *supra* note 119, at 563–64.

problem in the semicommons is that people may face even worse incentives than in the commons, because they may try to benefit themselves in the private property regime by using their access in the commons regime to impose costs on others—and likewise to appropriate benefits. The two regimes may be so intertwined that in addition to governance one may see special structures of entitlements to contain the strategic behavior. One such is the configuration of entitlements to make them harder to exploit. I argue that the long, thin, and scattered strips belonging to peasants in the medieval open fields obscured ownership when the strips were combined and thrown open for common grazing.[125] In this seemingly strange configuration, no one could strategically direct "goods" like manure or "bads" like trampling from the combined group of animals onto or away from (respectively) "their" plots in the non-commons period. The benefits of multiple access and the intertwining of use often lead to a semicommons in intellectual property.[126]

Complex governance rules can be used to manage the interface of regimes as well. Indeed, many of the governance rules for the commons are actually there to handle excessive behavior at the interface of common and private property. As we will see in the next Subsection, some more focused governance can take the form of equitable intervention. I have argued elsewhere that one function of traditional equity (loosely associated with equity and not confined to it) is to serve as meta-law—law about law—that will correct the law and modify its results when the law goes off the rails.[127] The need for meta-law is greatest when actors are misusing the law, as in unconscionability. And such misbehavior is especially hard to deal with through regular law when it involves multiple interacting actors and complex resources. So as a response to complexity and uncertainty from polycentric problems, conflicting rights, and strategic behavior—all of which are implicated here—it is to be expected

125. Smith, *supra* note 124.

126. BRETT M. FRISCHMANN, INFRASTRUCTURE: THE VALUE OF SHARED RESOURCES 302–03 (2012); Robert A. Heverly, *The Information Semicommons*, 18 BERKELEY TECH. L.J. 1127, 1184 (2003); Peter K. Yu, *Intellectual Property and the Information Ecosystem*, 2005 MICH. ST. L. REV. 11 (2005); Lydia Pallas Loren, *Building a Reliable Semicommons of Creative Works: Enforcement of Creative Commons Licenses and Limited Abandonment of Copyright*, 14 GEO. MASON L. REV. 271, 296–97 (2007); Smith, *supra* note 114, at 210.

127. *See* Henry E. Smith, *Equity as Meta-Law*, 130 YALE L.J. 1050 (2021).

that equity would be employed to rein in bad behavior at the interface of the commons and private property. A dramatic example is the important role that equity played in dealing with the use of water along a watercourse, a complex and variable resource involving many parties.[128] Likewise with borders across time, strategic behavior can be addressed through equity, as in the law of waste.[129]

3. Differential Formalism and Law Versus Equity. Above we encountered differential formalism as a general matter,[130] and it would take us too far afield to canvas the ways in which property law exhibits more formalism in some of its parts than in others. To the extent that it does, property law cannot be said to be homogeneous. Moreover, differences in formalism may be a sign that modular components are interacting. One component may be more formal than another, or we may be comparing a more formal interface with interactions within a module, which are more intensive and so more contextually sensitive—and so less formal.

Law and equity might, after the fusion of law and equity, seem a somewhat surprising example of different subsystems of the law that differ in their degree of formalism. In other work, I identify a function loosely associated with equity, namely meta-law.[131] Meta-law is a system that operates on the law—supplements it, aids it, suppresses its results, even sometimes modifies it—without the reverse being true: the first level system ("regular law") does not make reference to equity. I said that this meta-law function is loosely associated with equity, because the term "equity" and even equitable jurisdictional pedigree are not perfectly correlated with meta-law. Parts of the legal system called "equity" that trace their pedigree to equity jurisdiction are not meta-law (for example, certain purely technical rules of trust law). By the same token, there are parts of the law (doctrines like coming to the nuisance and modes like judicial

128. This is even true of prior appropriation, which is more use based and context specific than is usually thought. *See* Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445 (2008). And equity plays a big role here too. Duane Rudolph, *Why Prior Appropriation Needs Equity*, 18 U. DENV. WATER L. REV. 348, 363 (2015).

129. Duane Rudolph, *How Equity and Custom Transformed American Waste Law*, 2 CHARLOTTE SCH. L. PROP. J. 1 (2015).

130. *See supra* notes 62–69 and accompanying text.

131. Smith, *supra* note 127.

common law-making) that are meta-law.[132] Nevertheless, from remedies like the injunction to doctrines of unconscionability and constructive fraud, from anti-forfeiture principles to equitable defenses, equity kicks in when certain triggers—based on some combination of bad faith, disproportionate hardship and vulnerability—push us into a system of more direct and open-ended scrutiny for morality and fairness.[133] In systems generally, it is great uncertainty and complexity that call for meta systems. In the law, problems of polycentricity (many connected parties or elements), conflicting rights, and especially opportunism are especially amenable to such treatment. The expense and uncertainty of going to a higher level can be more than offset by the benefits of targeted specialization, among which is the ability of regular law to be simpler and more general than it would be if it had to anticipate or react to all sorts of complexity, especially that arising from opportunism.

When it comes to equity, we are dealing with a different dimension of structure than the modules of property law we have been considering so far. If those are "horizontal," then equity in its major theme of meta-law is "vertical," in the sense of being law about law and intervening into the law, rather than from "within" it.

4. Degrees of Modularity. Because of the challenges of complexity, including the need to communicate in rem rights to a large and indefinite audience, property shows a characteristic modularity. One aspect of this modularity is the importance of a legal thing in property, making property law in some sense a law of things.[134] Nevertheless, this does not mean that modularity is absolute or that things are exogenously given.

Modularity is a method of managing complexity.[135] If a system permits interaction to be more intense within than across modules, operations within modules and even changes to a module can happen without massive ripple effects. This relates to the phenomenon of organized complexity leading to a rugged fitness landscape, rather

132. *See* John C.P. Goldberg & Henry E. Smith, *Wrongful Fusion: Equity and Torts*, *in* EQUITY AND LAW: FUSION AND FISSION 309 (John C.P. Goldberg et al. eds., 2019).

133. Smith, *supra* note 127; Henry E. Smith, *Equitable Defences as Meta-Law*, *in* DEFENCES IN EQUITY 17 (Paul S. Davies et al. eds., 2018).

134. Smith, *supra* note 15.

135. BALDWIN & CLARK, *supra* note 8; Langlois, *supra* note 8.

than a random one.[136] Organization (and ruggedness) come in degrees, and the property system is not fully but nearly decomposable.[137] Take legal things, which are not identical to physical things, and can indeed cover non-physical resources. The idea is to find collections of resource attributes that go together, usually in the sense of being complementary, and that as a group interact less—even if they do interact—with the outside context (e.g., neighboring parcels, the environment).[138]

One attraction of the architectural approach is that it points to variables that can be operationalized. Using network models we can measure the degree of modularity and show how bundles and legal things might emerge endogenously as tight collections, not just aggregations of Hohfeldian legal relations.[139] And such a theory built on information can employ the tools of information theory.[140]

Returning to the legal thing, we see that far from being monolithic or absolute, we can endogenize legal thinghood itself and make it a matter of degree. And thinghood can undergo redefinition, in incremental fashion in courts and in a more thoroughgoing way through legislation.[141]

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136. Alston & Mueller, *supra* note 41, at 2265–67.

137. Smith, *supra* note 15, at 1701–02. On near decomposability, SIMON, *supra* note 4, at 195–98.

138. For a recognition of the role of complementarities, *see, e.g.*, LEE ANNE FENNELL, SLICES AND LUMPS: DIVISION AND AGGREGATION IN LAW AND LIFE (2019); Lee Anne Fennell, *Property as the Law of Complements*, *in* RESEARCH HANDBOOK ON PRIVATE LAW THEORIES 155 (Hanoch Dagan & Benjamin Zipursky eds., 2020); Smith, *supra* note 107, at S267–74 (analyzing "organizational dimension" of property); Smith, *supra* note 15, at 1693, 1703–04 (discussing clustering of complementary attributes); *see also* BARZEL, *supra* note 45, at 3–16 (setting forth theory of property rights based on resource attributes).

139. See sources cited *supra* note 40. Classically, modules would not overlap, and this can be an advantage, but the architectural approach can leave that question open. *Cf.* James Y. Stern, *The Essential Structure of Property Law*, 115 MICH. L. REV. 1167 (2017) (arguing for central role of thing-exclusivity in property).

140. Sichelman, *supra* note 85; *see also* Smith, *supra* note 56, at 1125–57. Even possession is a technology for delineating things that is nonessential on an information-based theory that endogenizes legal things. *See* João Marinotti, *Tangibility as Technology*, 37 GA. ST. U. L. REV. 671 (2021).

141. *See, e.g.*, Smith, *supra* note 100, at 2069. Thus, the shifting tides of thinghood are consistent with this approach rather than posing a problem for it. *See* Meghan L. Morris, Property and the Social Life of Things (draft) (on file with author). Morris's examples are a mix of land and water and show some characteristics of "fluid property." *See supra* notes 114–15 and accompanying text.

5. Spontaneous Versus Directed Evolution. Often property theorists come down in favor of seeing evolution in the law as spontaneous or directed. Sometimes the former is associated with the common law and the latter with legislation, but the Legal Realists could be taken as asking judges to engage in direct reengineering of property law. By the same token, libertarians and classical liberals often argue for the merits of what they see as spontaneous common-law evolution, even an evolution that tracks and in turn facilitates custom and private ordering outside the law.[142]

I want to suggest that reality is . . . more complex.[143] Property law is a mixture of spontaneous and directed evolution. Custom does feature importantly in the law,[144] and sometimes some changes are big enough to require legislation. This is particularly true in property where system effects (not least from in rem rights) are important. This is not a counsel of despair or a plea for the untouchability of property law—which brings us to the question of institutional sources of innovation in property law.

6. Common Law and Legislation. Another hybrid relevant to property is institutional. Property law is shaped both by courts and legislatures (sometimes acting through agencies). When it comes to major changes in the menu of property rights, legislation has many advantages, and by and large the *numerus clausus* does also stand for a tendency for legislatures to take the lead in major innovations in property law.[145] These advantages include clarity, universality, comprehensiveness, stability, prospectivity, and implicit compensation, and are reminiscent of Lon Fuller's criteria for the rule of law.[146] And compared to other areas of private law, legislation has a long history in property extending back to the Middle Ages. Also, given

142. FRIEDRICH A. HAYEK, LAW, LEGISLATION AND LIBERTY 46–47 (1973); Richard A. Epstein, International News Service v. Associated Press*: Custom and Law as Sources of Property Rights in News*, 78 VA. L. REV. 85, 101–02 (1992).

143. Perhaps the kind of complexity I have in mind is close to that explored by Eugen Ehrlich. *See* EHRLICH, *supra* note 53; David Nelken, *Eugen Ehrlich, Living Law, and Plural Legalities*, 9 THEORETICAL INQUIRIES IN LAW 443 (2008) (arguing that Ehrlich's living law captured the interdependence of official and unofficial law).

144. David L. Callies & Ian Wesley-Smith, *Beyond Blackstone: The Modern Emergence of Customary Law*, 4 BRIGHAM-KANNER PROP. RTS. CONF. J. 151 (2015).

145. Merrill & Smith, *supra* note 62, at 58–68.

146. LON FULLER, THE MORALITY OF LAW 38–91 (rev. ed. 1969) (discussing criteria of generality, clarity, non-contradiction, constancy, and non-retroactivity).

the rugged fitness landscape from organized complexity and the difficulty of reaching some maxima though incremental change, legislation has been the source of major remodularizations and changes in legal style.[147]

This hybrid institutional sourcing of property law helps make sense of some puzzles and complaints in certain areas. Common law courts are not good at coming up with quantified regulations and have limited ability to craft entire regulatory regimes. Thus, in oil and gas, common law courts have been criticized for not doing more to combat the tragedy of the commons, and the fault is laid at the door of myopic formalism (again!),[148] with its false analogies like *ferae naturae* ("fugitive" resources are like wild animals).[149] This has things backwards. The analogy expresses the difficulty for common-law rules to deal with fluid resources, which is very different from denying the problem.[150] Instead, what the common law can do is target the most flagrant abuses and serve as a platform for further legislation and regulation, as has happened in oil and gas.[151]

This relationship of loose but nontrivial common law concepts and other institutions can be generalized. We will encounter it in Part III again in connection with aerial trespass.

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147. Yun-chien Chang & Henry E. Smith, *Structure and Style in Comparative Property Law*, *in* COMPARATIVE LAW AND ECONOMICS 131–60 (Theodore Eisenberg & Giovanni B. Ramello eds., 2017).

148. *See, e.g.*, BRUCE M. KRAMER & PATRICK H. MARTIN, THE LAW OF POOLING AND UNITIZATION 2–5 (3d ed. 1989); Laura H. Burney, *A Pragmatic Approach to Decision Making in the Next Era of Oil and Gas Jurisprudence*, 16 J. ENERGY NAT. RES. & ENV'T L. 1, 11 (1996) ("To clarify the contours of the pragmatic approach I envision, and to demonstrate its value, I will contrast it to two formalistic approaches used throughout the Great Era. As noted above, by analogizing to the law of wild animals, many early judges myopically adhered to common-law rules rather than venturing to fashion a unique jurisprudence for oil and gas law."); John Parmerlee, *Mines and Minerals-Leases-Rentals Accruing Under a Subterranean Gas Storage Lease*, 21 U. KAN. CITY L. REV. 217, 219–20 (1953) ("If the law pertaining to minerals in this country is to retain its stability and uniformity it is mandatory that this vicious analogy drawn between natural gas and animals ferae naturae which has reared its ugly head be destroyed without delay."); Kenneth J. Vandevelde, *The New Property of the Nineteenth Century: The Development of the Modern Concept of Property*, 29 BUFF. L. REV. 325, 354–57 (1980) (portraying the *ferae naturae* "rule" as an inadequate way station between an absolutist conception of property and an emerging reasonableness rule).

149. *See, e.g.*, Henry E. Smith, *Exclusion and Property Rules in the Law of Nuisance*, 90 VA. L. REV. 965 (2004); Rance L. Craft, *Of Reservoir Hogs and Pelt Fiction: Defending the* Ferae Naturae *Analogy Between Petroleum and Wildlife*, 44 EMORY L.J. 697, 699, 713–14 (1995) (documenting hostility and collecting references).

150. Smith, *supra* note 149; Craft, *supra* note 149.

151. Smith, *supra* note 149, at 1027–37.

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Returning to my invocation of Flatland, the problem with flattening the law is that everything starts looking flat. Thus, when it is proposed that we need a complex hybrid of exclusion and governance, it looks like exclusive focus on exclusion. When complexes of private, common, and public property are put forth, they can look like privatization to some and collectivism to others. Differential formalism is still formalism and so we are back to caricatures of Langdell and such bogeymen. And by falling short of homogeneous formalism, the architectural approach seems to have opened the door to the Chancellor's Foot.[152] Or modularity can be taken as hermetically sealed, a priori monolithic concepts that are unchanging—when they are exactly the opposite and ironically promise to capture legal evolution better than supposedly more nuanced theories.[153] Or thinghood can be taken as too protean to be meaningful (as it would be if there were no theory to endogenize it).[154] Indeed, any realistic theory is going to have to come to grips with the blend of spontaneous and directed evolution and the mix of institutional providers that we actually see—and to one degree or another are almost bound to see.

Nonetheless, the architectural framework is not a fudgy "middle way" or split-the-difference waffling. It asks us to see complexity where we ignore it, and to allow for structure in dimensions we typically rule out of bounds without comment. Whether or not information-based, complexity-oriented architectural theories will make headway in measuring relevant quantities and making fine-grained predictions, such theories do clear away some Flatland-style preconceptions and thereby allow for a, yes, more realistic, view of property institutions. It is to the reality of property we now turn.

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152. *See, e.g.*, Robert E. Scott, *Contract Design and the Shading Problem*, 99 MARQ. L. REV. 1, 11–12 (2015); Robert E. Scott & Jody P. Kraus, *The Case Against Equity in American Contract Law*, 93 S. CAL. L. REV. 1323 (2020).

153. *Compare* Gregory S. Alexander, *Governance Property*, 160 U. PA. L. REV. 1853, 1855 n.3 (2012) (arguing that architectural theory cannot handle "governance property") *with* Smith, *supra* note 100, at 2073 n.71 (showing that governance in the architectural theory is not limited to external relations and so its notion of "entity property" is similar to Alexander's "governance property"); *see also* David A. Dana & Nadav Shoked, *Property's Edges*, 60 B.C. L. REV. 753 (2019).

154. Wyman, *supra* note 46.

III. PROPERTY'S ARCHITECTURE IN PRACTICE

The real test of the architectural framework in property is like that of architecture itself: how does it fare in the real world? For one thing, does it hold up—or fall down? Does it allow us to serve our purposes more effectively?[155]

1. Possession. Let me return to the concept of possession and how it plays out in practice. Possession has been notoriously hard to pin down because it is impossible to come up with a definition that covers when someone is in control, when someone maintains such control, and at the same time gives standing to sue to "possessors" for purposes of trespass, nuisance, and the like. As a result, great effort is put into trying to show how some extended kind of control is maintained when, say someone parks a car on the street and walks blocks away or leaves a vacation home over the winter.[156] Notions of "constructive possession" start to abound, and the Realist critique that possession is an empty and totally protean notion gains some plausibility.

What we need are specialized and interacting notions of possession. First, the law must draw on social norms and context in the establishment of possession: what counts as control and manifested intent to control sufficient for a claim of a legal status of possession

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155. Architecture itself has seen debates over the role of modularity in design. *See* CHRISTOPHER ALEXANDER ET AL., A PATTERN LANGUAGE: TOWNS, BUILDINGS, CONSTRUCTION (1977); Christiane Herr, *Generative Architectural Design and Complexity Theory*, INTERNATIONAL CONFERENCE ON GENERATIVE ART (2002), https://www.researchgate.net/publication/30870757/download; *see also* Henry E. Smith, *Restating the Architecture of Property*, *in* 10 MODERN STUDIES IN PROPERTY LAW 19, 25 (Sinéad Agnew & Ben McFarlane eds., 2019). Perhaps in law there is an analog to the contrast between the era of empirical rules of thumb and the emergence of engineering based on mathematical formulas. A. Rupert Hall, *Engineering and the Scientific Revolution*, 2 TECH. & CULTURE 333 (1961). One suspects that, when it comes to law, we are still mostly in the earlier phase.

156. For a variety of approaches, *see, e.g.*, HERBERT THORNDIKE TIFFANY, THE LAW OF REAL PROPERTY § 20 (3d ed. 1939) ("speaking generally . . . one is in possession of land when he is in occupation thereof, with the intention, actually realized, of excluding occupation by others, or when not in actual occupation, he claims the right of exclusive occupation, and no person is in occupation opposing his claim"); GEORGE W. THOMPSON, COMMENTARIES ON THE MODERN LAW OF REAL PROPERTY § 13.03(a) (1939) ("Possession, whether actual or constructive, is said to be the right of exclusive physical control, coupled with the intent to possess."); 3 AMERICAN LAW OF PROPERTY 765 (A. James Casner ed., 1952) ("[A]ctual and legal possession of land exists when an actual *possessio pedis* is established with the degree of actual use and enjoyment of the parcel of land . . . which the average owner would exercise over similar property under like circumstances.").

and a right to possess.[157] And while Kocourek thought we could mostly make do with a concrete notion of possession and the right to possess, current case law treats someone who has established control as being "in possession" on an ongoing basis.[158] That is, if someone establishes possession (as in the concrete notion of possession) and no one else takes possession, this status of "possession" continues even if the facts of control no longer obtain. So if I park my car and walk away, I am in possession until someone takes it (e.g., a converter). Beyond that, one can lose possession and have only the right to possess, or one can acquire ownership and along with it a right to possess. A right to possess is not possession, but the right to be put in possession. This notion is at the heart of ejectment and replevin.

2. Aerial Trespass. To see how these notions can combine in subtle ways, consider the law of aerial trespass.[159] The law of aerial trespass became controversial in the 1920s and 1930s because landowners brought trespass claims, seeking injunctions, against overflights. They

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157. *See, e.g.*, MICHAEL J.R. CRAWFORD, AN EXPRESSIVE THEORY OF POSSESSION 60–121 (2020); LUKE ROSTILL, POSSESSION, RELATIVE TITLE, AND OWNERSHIP IN ENGLISH LAW 7–24 (2021); Thomas W. Merrill, *Ownership and Possession*, *in* LAW AND ECONOMICS OF POSSESSION 9 (Yun-chien Chang ed., 2015).

158. *See* KOCOUREK, *supra* note 52, at 365–71. RESTATEMENT OF THE LAW SECOND, TORTS (AM. LAW INST. 1965):

> § 157. Definition of Possession
>
> In the Restatement of this Subject, a person who is in possession of land includes only one who (a) is in occupancy of land with intent to control it, or (b) has been but no longer is in occupancy of land with intent to control it, if, after he has ceased his occupancy without abandoning the land, no other person has obtained possession as stated in Clause (a), or (c) has the right as against all persons to immediate occupancy of land, if no other person is in possession as stated in Clauses (a) and (b).

RESTATEMENT OF THE LAW SECOND, TORTS (AM. LAW INST. 1965):

> § 216. Definition of Possession of Chattel
>
> In the Restatement of this Subject, a person who is in "possession of a chattel" is one who has physical control of the chattel with the intent to exercise such control on his own behalf, or on behalf of another.

159. STUART BANNER, WHO OWNS THE SKY?: THE STRUGGLE TO CONTROL AIRSPACE FROM THE WRIGHT BROTHERS ON (2008); THOMAS W. MERRILL & HENRY E. SMITH, PROPERTY: PRINCIPLES AND POLICIES 13–16, 258–59 (3d ed. 2017); WILLIAM B. STOEBUCK, NONTRESPASSORY TAKINGS IN EMINENT DOMAIN 155–62 (1977); Eric R. Claeys, *On the Use and Abuse of Overflight Column Doctrine*, 2 BRIGHAM-KANNER PROP. RTS. CONF. J. 61 (2013); Richard A. Epstein, Intel v. Hamidi: *The Role of Self-Help in Cyberspace?*, 1 J.L. ECON. & POL'Y 147, 154–55 (2005); Thomas W. Merrill, *Accession and Original Ownership*, 1 J. LEGAL ANALYSIS 459, 467 (2009); Christopher M. Newman, *Using Things, Defining Property*, *in* PROPERTY THEORY 69, 89–98 (James Penner & Michael Otsuka eds., 2018); Smith, *supra* note 100, at 2079–80.

invoked the strictness of trespass—no harm need be shown—and the hoary maxim *cujus est solum, ejus est usque ad coelum et ad inferos* ("whoever owns the soil owns also to the sky and to the depths"), or *ad coelum* for short. Before that, it had not mattered whether or in what sense owners claimed upward because the only kinds of invasions possible were close enough to the surface to interfere with the owner's own activities. Because use of airspace for airplane flights entering the column of space did not seriously interact with owners' activities except at low altitudes, extreme and literal invocations of trespass made little sense. Courts were further worried that recognizing anything close to that would lead to takings claims, which likewise made little sense. This might even be true if a federal navigation servitude were recognized but in derogation of owners' rights. As a result, courts pronounced that *ad coelum* was never the rule.[160] This probably meant not that owners had no claims upward (and downward) but that the literal versions of *ad coelum* being pushed by landowners were never true. Instead, owners could claim in the ordinary sense only what they could actually possess, and they would have to show substantial harm as part of a trespass case based on an invasion of effectively unpossessed superjacent airspace.[161] At the same time, courts recognized owners' priority in the unpossessed airspace in the sense of having a right to build up further (as long as it was not spiteful).[162] Aircraft operators could not complain about

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160. United States v. Causby, 328 U.S. 256 (1946), in which Justice Douglas offered his famous dictum:

> It is ancient doctrine that at common law ownership of the land extended to the periphery of the universe—*Cujus est solum ejus est usque ad coelum*. But that doctrine has no place in the modern world. The air is a public highway, as Congress has declared. Were that not true, every transcontinental flight would subject the operator to countless trespass suits. Common sense revolts at the idea. To recognize such private claims to the airspace would clog these highways, seriously interfere with their control and development in the public interest, and transfer into private ownership that to which only the public has a just claim.

Id. at 260–61; *see also* Hinman v. Pacific Air Transp., 84 F.2d 755 (9th Cir. 1936); Swetland v. Curtiss Airports Corp., 41 F.2d (N.D. Ohio 1930), *modified on other grounds*, 55 F.2d 201 (6th Cir. 1932); Thrasher v. City of Atlanta, 173 S.E. 817 (Ga. 1934); Smith v. New Eng. Aircraft Co., 170 N.E. 385 (Mass. 1930); Johnson v. Curtiss Northwest Airplane Co. (Minn. Dist. Ct. 1923), *reprinted in Current Topics and Notes,* 57 AM. L. REV. 905, 908–11 (1923); Gay v. Taylor, 19 Pa. D. & C. 31 (1932); Commonwealth v. Nevin, 2 Pa. D. & C. 241 (1922).

161. *See, e.g.*, *Hinman*, 84 F.2d at 759 ("Appellants do not, therefore, in their bill state a case of trespass, unless they allege a case of actual and substantial damage."). For a strong version of this, see RESTATEMENT SECOND, TORTS § 159(2) (AM. LAW INST. 1965).

162. *See, e.g.*, *Causby*, 328 U.S. at 260–61; Smith v. New Eng. Aircraft, 170 N.E. at 389–90;

new buildings unless they had an easement. Further, there are slight hints that the substantial-harm requirement was not meant to narrow the notion of actual possession: invasions of airspace, especially permanent ones, were still per se trespasses.[163]

In rejecting the extreme version of the "title" theory of *ad coelum*, the courts are probably best seen as clarifying rather than reconfiguring the rights to airspace. Traditional invocations of *ad coelum* were a shorthand that did not need to take account of air travel. The

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cf. 3775 Genesee St., Inc. v. State, 415 N.Y.S.2d 575, 577 (Ct. Cl. 1979) (finding no taking where landowner had no reasonable possibility of building into the stratum of airspace subject to the condemned avigation easement). After his high-price offers were refused, the plaintiff in *Hinman* erected some blocking structures, which were enjoined as a private and public nuisance in subsequent litigation. *See* United Airports Co. of Cal. v. Hinman et al., 1940 U.S. Av. Rep. 1 (S.D. Cal. 1939). Thanks to Brian Lee for this discovery.

163. Even in *Causby*, Justice Douglas made it clear that possession and ordinary trespass as on the surface do not end at literal physical occupation by plaintiff's structures and such:

> We have said that the airspace is a public highway. Yet it is obvious that if the landowner is to have full enjoyment of the land, he must have exclusive control of the immediate reaches of the enveloping atmosphere. Otherwise buildings could not be erected, trees could not be planted, and even fences could not be run. The principle is recognized when the law gives a remedy in case of overhanging structures are erected on adjoining land. The landowner owns at least as much of the space above the ground as he can occupy or use in connection with the land. *See Hinman v. Pacific Air Transport*, 9 Cir., 84 F.2d 755. The fact that he does not occupy it in a physical sense—by the erection of buildings and the like—is not material. As we have said, the flight of airplanes, which skim the surface but do not touch it, is as much an appropriation of the use of the land as a more conventional entry upon it. We would not doubt that if the United States erected an elevated railway over respondents' land at the precise altitude where its planes now fly, there would be a partial taking, even though none of the supports of the structure rested on the land. The reason is that there would be an intrusion so immediate and direct as to subtract from the owner's full enjoyment of the property and to limit his exploitation of it. While the owner does not in any physical manner occupy that stratum of airspace or make use of it in the conventional sense, he does use it in somewhat the same sense that space left between buildings for the purpose of light and air is used. The superjacent airspace at this low altitude is so close to the land that continuous invasions of it affect the use of the surface of the land itself. We think that the landowner, as an incident to his ownership, has a claim to it and that invasions of it are in the same category as invasions of the surface.

Causby, 328 U.S. at 264–65 (1946) (footnotes omitted). *See also* Smith v. New Eng. Aircraft Co., 170 N.E. 385 (Mass. 1930); *see also* Smith v. New Eng. Aircraft Co., 270 Mass. 511, 522, 170 N.E. 385, 390 (1930) ("For the purposes of this decision we assume that private ownership of airspace extends to all reasonable heights above the underlying land. It would be vain to treat property in airspace upon the same footing as property which can be seized, touched, occupied, handled, cultivated, built upon and utilized in its every feature.").

regime for aircraft that emerged early in the era of air travel clarified an ambiguity, although landowners may not have seen it that way.[164]

In this flurry of judicial activity, what was left a little unclear was whether an airplane flying super low would be subject to the substantial-harm requirement. For that matter, there was an idea, based on early legislation, that 500 feet was some kind of zone in which normal possession and trespass would apply, but that was never clearly spelled out.[165] Presumably against a defendant flying an airplane one inch from a structure it would be easy to prove substantial harm, so this really was not an issue, apart from procedural issues, like making out summary judgment.

Until now. With the advent of drones (or unmanned aircraft systems), just such issues are coming to the fore.[166] Because drones can hover and typically fly closer to the ground, we need a way of reconciling the navigation servitude and ordinary notions of possession along with the per se/substantial harm divide within the law of trespass to land. One method would be to declare a height limit below which per se trespass would apply, but, again, courts are not good at this type of rule, and it is clear that a single height (say 200 feet) would not be universally appropriate. On the other hand, the idea of extending the "substantial harm" regime down to the grass tops and the paint on the top of buildings seems too unprotective of owners. And it is hard to deny that owners could build further upward if they chose to.

To address this problem in common law fashion and leave room for legislation and regulation, we can exploit the specialization of different possession-related notions and their interrelations. Working upward, per se trespass applies at the surface. Step a toe onto someone's land and you've trespassed. Displacing the landowner's physical objects is also per se trespass. Coming into the envelope of an activity—space regularly occupied by that activity—is also a trespass per se. The space between two nearby towers would be trespass

164. Smith, *supra* note 100, at 2079–80; *see also* Abraham Bell & Gideon Parchomovsky, *Reconfiguring Property in Three Dimensions*, 75 U. CHI. L. REV. 1015 (2008).

165. Troy A. Rule, *Airspace in an Age of Drones*, 95 B.U. L. REV. 155, 166, 168–69 (2015).

166. *See, e.g.*, Dana & Shoked, *supra* note 153, at 802–08; Robert A. Heverly, *The State of Drones: State Authority to Regulate Drones*, 8 ALBANY GOV'T L. REV. 29 (2015); Lane Page, *Drone Trespass and the Line Separating the National Airspace and Private Property*, 86 GEO. WASH. L. REV. 1152 (2018); Rule, *supra* note 165.

per se. And a bubble around buildings and activities that would be needed for normal function should also be a per se trespass. Beyond that, the owner is not in (current) possession but has only a right to possess, which peters out at an indefinite height. Within the right-to-possess zone, the owner has first dibs on using the space and also can sue for invasions of this space that cause substantial harm to the subjacent airspace and or surface (or conceivably the subsurface). Any interferences not in superjacent airspace would fall under the law of nuisance (or negligence) at most.[167]

3. Nuisance. The law of nuisance is especially interesting from an architectural point of view. It lies at the shift from exclusion to governance strategies.[168] Thus, invasion is important but not always. Nuisance also involves conflicting presumptive rights, which invites meta-law, whether this is denominated equity or not.[169]

Nuisance naturally leads to borderline cases. In his paper in this Symposium, Bob Ellickson sets out a recent controversy over an apartment building in Houston.[170] Houston has no zoning and relies heavily on covenants. A developer proposed replacing a two-story apartment house in a residential area with a twenty-three-story, mixed-use condominium building. The trial court denied an injunction but awarded the successful plaintiffs $1.2 million in damages.[171] The appellate court reversed on the grounds that the nuisance, assuming there was one, was prospective.[172] This doesn't answer the question we want answered: once built, would the apartment building be a nuisance? It should be noted at the outset that traditionally nuisance law does not see apartment buildings as nuisances.[173] An apartment building is not invasive (not that that ends the inquiry, but it is strike one), and courts in this country have rejected the idea of being able to acquire rights to light and air prescriptively (unlike

167. *See* RESTATEMENT (FOURTH) OF PROPERTY vol. 2, div. I, ch. 1. § 1.2A (AM. LAW INST., Council Draft No. 2, Nov. 27, 2019).

168. Smith, *supra* note 149.

169. Goldberg & Smith, *supra* note 132, at 315–21.

170. Robert C. Ellickson, *Can an Apartment Building Be a Nuisance? An Essay for Henry Smith*, 10 BRIGHAM-KANNER PROP. RTS. J. 57 (2021).

171. Loughhead v. 1717 Bissonnet, L.L.C., 2014 WL 8774079 (Tex. Dist. Ct. 2014).

172. 1717 Bissonnet, LLC v. Loughhead, 500 S.W.3d 488 (Tex. Civ. App. 2016).

173. Maureen E. Brady, *Turning Neighbors into Nuisances*, 134 HARV. L. REV. 1609 (2021); Ellickson, *supra* note 170.

the doctrine, albeit quite limited, in England of "ancient lights").[174] According to the reconciliation of conflicting rights, the fact that an activity lowers the market value of another parcel does not automatically make the activity a nuisance. Nevertheless, reasonableness in nuisance law is more oriented to the effect on the potential plaintiff than the merits or conduct of the defendant and its activity.[175] Moreover, the history of labeling apartment buildings possible or near nuisances has bad overtones.[176] As mentioned earlier, numeric height limits are also not the forte of common law courts.[177] Not surprisingly, covenants and zoning have been the tools to achieve height restrictions. Indeed, common law courts have acted to prevent runaway dependencies, and hence complexity, at the interfaces between packages of rights.[178]

4. Integration of Property. Finally, let me sketch another application of the complexity approach. Returning to the bundle of rights,

174. Fontainebleau Hotel Corp. v. Forty-Five Twenty-Five, Inc., 114 So.2d 357 (Fla. Dist. Ct. App. 1959); *but see* Prah v. Maretti, 321 N.W.2d 182 (Wis. 1982) (holding that blocking solar access can be a nuisance); s*ee generally* Sara C. Bronin, *Solar Rights*, 89 B.U. L. REV. 1217 (2009); Troy A. Rule, *Shadows on the Cathedral: Solar Access Laws in a Different Light*, 2010 U. ILL. L. REV. 851 (2010). The building of the addition to the Fontainebleau was motivated in part by spite, and as Lynda Butler argues, a court could have curbed the malicious interference without holding that solar rights could be acquired by prescription or implication. Butler, *supra* note 22, at 85–86. If we resuscitate the notion of equity, I wonder if activity like that in *Fontainebleau* might be addressable: even though the addition was not purely out of spite, and so would not count as a spite structure under current doctrine, certain aspects of it—its location and lack of windows—were purely spiteful. Might we be able to see some aspects as separable?

175. This is evident in a range of approaches in scholarship from outside the United States. *See, e.g.*, PENNER, *supra* note 109, at 143–56; Christopher Essert, *Nuisance and the Normative Boundaries of Ownership*, 52 TULSA L. REV. 85 (2016); Donal Nolan, *The Essence of Private Nuisance*, 10 MODERN STUDIES IN PROPERTY LAW 71 (Sinéad Agnew & Ben McFarlane eds., 2018).

176. Vill. of Euclid v. Ambler Realty Co., 272 U.S. 365, 394–95 (1926) ("[I]n such sections very often the apartment house is a mere parasite, constructed in order to take advantage of the open spaces and attractive surroundings created by the residential character of the district. . . . Under these circumstances, apartment houses, which in a different environment would be not only entirely unobjectionable but highly desirable, come very near to being nuisances."); David Callies, Village of Euclid v. Ambler Realty Co., *in* PROPERTY STORIES (Gerald Korngold & Andrew P. Morriss eds., 2d ed., 2009); Richard H. Chused, Euclid*'s Historical Imagery*, 51 CASE W. RSRV. L. REV. 597 (2001); *see also* Brady, *supra* note 173.

177. It is true that the proposed building was much larger than any previous structure, and I do not absolutely rule out the possibility that in some area a crystalized custom of restraint in building might be provable. This is highly unlikely, especially in the case at hand.

178. *See infra* notes 183–87 and accompanying text. *See also* Smith, *supra* note 13. Such dependencies can be transmitted through liability for damages, which also counts against the result in the trial court in *Loughead*.

it is worth noting that there are subtle differences recognized in law as to how integrated a stick (if you will) is into the bundle. Easements are add-ons to the bundle of rights, and they can be created through a grant or by various other means including prescription and implication. Covenants are more contractual, but servitude law lends them some of the attributes of property, most prominent the ability to run to successors. The requirements for running, including the touch and concern test, may have to do with keeping bundles from becoming complex and hard to evaluate in the presence of imperfect land markets.[179] Appurtenant easements automatically run, but under traditional servitudes law, covenants only run if they satisfy a list of requirements including intent and touch and concern.[180] This last requirement guarantees a close association—I would say dense epistatic connections—with the rest of the bundle.[181] By contrast, even more integrated than easements in terms of integration with the bundle are so-called natural rights, which are like easements but are automatically part of the bundle and cannot be abandoned though lack of use.[182] These include lateral support and natural drainage in a defined channel. These rights are if anything more epistatically connected with the bundle than the typical easement. And finally we have various other legal relations that are not even analogized to easements because they are so integral to the package, such as the right to possession, and many that are implicit, such as various privileges of use that are indirectly protected by the right to exclude.

One implication of viewing the bundle as one of structured complexity is that it helps explain why the law pushes for coherent bundles and disfavors "extraneous" bundling. If the sticks in the bundle are not entirely separable, valuation and assessment are more complex and uncertain than where there is separability.[183] Far

179. *See* Antony Dnes & Dean Lueck, *Asymmetric Information and the Law of Servitudes Governing Land*, 38 J. LEGAL STUD. 89 (2009); Smith, *supra* note 13. The key to the complexity involved is inseparability, which can cause the kinds of wild swings in fitness associated with unorganized complexity. Otto A. Davis & Andrew Whinston, *Externalities, Welfare, and the Theory of Games*, 70 J. POL. ECON. 241 (1962).

180. *See, e.g.*, CHARLES E. CLARK, REAL COVENANTS AND OTHER INTERESTS WHICH "RUN WITH THE LAND" (2d ed. 1947).

181. Smith, *supra* note 13.

182. *See, e.g.*, Duenow v. Lindeman, 27 N.W.2d 421 (Minn. 1947); Kleinberg v. Ratett, 169 N.E. 289 (N.Y. 1929); Scriver v. Smith, 3 N.E. 675 (N.Y 1885); *see also* Smith, *supra* note 13 (discussing natural servitudes).

183. *See* Davis & Whinston, *supra* note 179.

from being limited to the *numerus clausus*, the law more controversially prevents people from tailoring packages of property rights through the addition of extraneous covenants. The right to a weekly haircut may seem innocent enough, but doctrines like touch and concern prevent interdependencies from getting out of hand even if someone sees fit to create them.[184]

This worry about information and complexity can help justify the law's approach to personal property servitudes as well. With some ambiguity, the law has generally disfavored and even disallowed servitudes in personal property.[185] These kinds of servitudes certainly pose a problem of notice.[186] As with touch and concern and real covenants, the law tries to keep legal things and the packages of rights over them in manageable units.[187]

Taking a step back, the hypothesis that property law is shaped by organized complexity leaves a lot of room for further work. How interconnected are the attributes of resources and the activities of actors, and what patterns do they actually fall in—or should fall in? And although seeing a role for organized complexity does provide a partial rationale for some traditional doctrines, it is not Pollyannish in any sense. Organized complexity is not chaos, and it not the case that any intervention into property law will cause more problems than it solves. By the same token, though, the law is not so simple that successful tinkering along any margin will necessarily improve matters. Reflecting organized complexity, we need to find a mix of spontaneous and directed change that will get us to reachable maxima. We must ask how law and institutions are both simple and complex and how they transcend the conventional reductionist dichotomies. A

184. Smith, *supra* note 13. In contrast to the haircut covenant, private transfer fee covenants present a clearer complexity problem. *See id.*; *see also* R. Wilson Freyermuth, *Private Transfer Fee Covenants: Cleaning Up the Mess*, 45 REAL PROP., TRUST & ESTATE L.J. 419 (2010) (setting forth problems presented by private transfer fee covenants and evaluating and proposing solutions).

185. Zechariah Chafee, Jr., *Equitable Servitudes on Chattels*, 41 HARV. L. REV. 945 (1928); Zechariah Chafee, Jr., *The Music Goes Round and Round: Equitable Servitudes and Chattels*, 69 HARV. L. REV. 1250 (1956) (commenting on a decision departing from the general understanding).

186. Molly Shaffer Van Houweling, *The New Servitudes*, 96 GEO. L.J. 885 (2008).

187. *See* Christopher Newman, *Using Things, Defining Property*, *in* PROPERTY THEORY: LEGAL AND POLITICAL PERSPECTIVES 69 (James Penner & Michael Otsuka eds., 2018); Matt Corriel, *Up for Grabs: A Workable System for the Unilateral Acquisition of Chattels*, 161 U. PA. L. REV. 807 (2013); *see also* Robert C. Ellickson, *The Inevitable Trend Toward Universally Recognizable Signals of Property Claims: An Essay for Carol Rose*, 19 WM. & MARY BILL RTS. J. 1015 (2011).

loosely connected set of sometimes formal, sometimes contextualist legal concepts is likely to be a big part of the picture.[188]

CONCLUSION

We live in a reductionist age. In property theory, our discourse is so all-encompassing that its flatness itself has been obscured. We can wind up explaining our theoretical intuitions instead of coming to grips with the real world.

The world is not flat and neither should be property theory. The unfortunate current flatness of property theory shows up in its assumptions about complexity and leads us to expect more homogeneity and less structure in the law than we find—and should expect to find. This flattening and dichotomous approach characterizes the bundle of rights as usually conceived; the allergy to system in property and private law generally; assumptions about all or no (and preferably no) formalism; mistaking the architectural theory as exclusively focused on information costs; and expectations that property law will mirror the complex world directly. Instead of passively reflecting the world's complexity, property law employs devices familiar from complex systems theory to manage complexity in order to attain favorable combinations of information costs and benefits. These include the spectrum of delineation devices running from exclusion to governance; hybrids of private, common, and public property; differential formalism and law versus equity; degrees of modularity; combinations of spontaneous and directed evolution of property law and institutions; and reliance on both common law and legislation. Property is more than the sum of its parts.

We need to leave Flatland. And the first step is to put more—not all—of the complexity of the world back into our theories. Especially now that complex systems theory, network analysis, and complexity economics give us more tools, we have less excuse for the extreme reductionism of the flattest versions of the bundle of rights, mishmashes of property and contract, equity-less law, and the like. Property needs architecture.

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188. *See* Deakin, *supra* note 23; Lawson, *supra* note 23; Smith, *supra* note 23. This view of property law thus has close affinities with comparative institutional analysis and the New Private Law. *See* Barak Richman, *New Institutional Economics*, *in* THE OXFORD HANDBOOK OF THE NEW PRIVATE LAW, *supra* note 22, at 103 (comparing the New Insitutional Economics and the New Private Law).