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Slicing Spontaneity

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Spontaneous order, as famously explored by Friedrich Hayek, is the antithesis of top-down control; it emerges from a multiplicity of individual responses to dispersed informational signals.[1] Hayek's work emphasizes the role of market forces in providing those signals, and the role of law in providing the background conditions under which a spontaneous market-based order can arise and thrive.[2] Private property fits cleanly into this model. Yet there are many domains of great economic and social significance in which private property rights have not (or have not yet) been established; rather, resources are held in common. Examples range from shared roads and parks, to fisheries and forests, to the ambience or bustle in a neighborhood or business district. Establishing and sustaining spontaneous order in these contexts means finding ways for individuals to coordinate their dispersed actions in the absence of formal private property rights or top-down coercion.[3]

[1] *See, e.g.,* F.A. HAYEK, THE CONSTITUTION OF LIBERTY 140-41 (1960) [hereinafter HAYEK, CONSTITUTION] (discussing spontaneous order and citing MICHAEL POLANYI, THE LOGIC OF LIBERTY: REFLECTIONS AND REJOINDERS 159 (1951)); FRIEDRICH A. HAYEK, LAW, LEGISLATION, AND LIBERTY, VOL. 1: RULES AND ORDER 35-54 (1973) [hereinafter HAYEK, RULES] (examining manifestations of spontaneous order in natural and social systems); *see also* F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519 (1945) [hereinafter Hayek, *Knowledge*] (emphasizing the importance of harnessing dispersed knowledge).

[2] *See, e.g.,* FRIEDRICH A. HAYEK, LAW, LEGISLATION, AND LIBERTY, VOL. 3: THE POLITICAL ORDER OF A FREE PEOPLE 162 (1973) ("[T]his extensive social division of labour [in modern society], based on widely dispersed information, has been made possible entirely by the use of those impersonal signals which emerge from the market process and tell people what to do in order to adapt their activities to events of which they have no direct knowledge."); Hayek, *Knowledge*, *supra* note 1, at 526-28 (describing the coordinating and information-transmission function of prices). In Hayek's view, "the task of the lawgiver is not to set up a particular order but merely to create conditions in which an orderly arrangement can establish and ever renew itself." HAYEK, CONSTITUTION, *supra* note 1, at 141; *see also* HAYEK, RULES, *supra* note 1, at 47 (analogizing one function of government to the maintenance of machinery that serves the purposes determined by the aggregate decisions of producers and consumers).

[3] Large literatures have examined the conditions that support such informal cooperation, including the line of scholarship associated with Elinor Ostrom's groundbreaking work on common-pool resources. *See, e.g.,* ELINOR OSTROM, GOVERNING THE COMMONS (1990). Other work has examined how social norms support informal order. *See, e.g.,* ROBERT ELLICKSON, ORDER WITHOUT LAW (1991). Urban infrastructure and information commons have increasingly received attention. For a recent overview and discussion, see Yochai Benkler, *Commons and Growth: The Essential Role of Open Commons in Market Economies*, 80 U. CHI. L. REV. 1499 (2013) (reviewing BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES (2012)). A related line of literature examines the emergence or evolution of property rights. *See, e.g.,* ROBERT SUGDEN, THE ECONOMICS OF RIGHTS, COOPERATION, AND WELFARE (2d ed. 2004); Lee Alston & Bernardo Mueller, *Towards a More*

This paper focuses on the role of resource segmentation—the natural or artificial division of resources into appropriable units—in eliciting and maintaining coordination among resource users in the absence of formal property rights. My claim is that the appropriate segmentation of resources can reduce informal governance burdens and help to produce convergence between privately optimal and socially optimal choices.[4]

To take a simple example, a pie that has been divided into single-serving slices is easy for a group to share in a strife-free manner. Even if social norms might cut against taking "too much" of an undivided shared resource (such as a milkshake accessed with multiple straws, or a natural gas reserve lying under land held separately by a number of neighbors), it can be difficult to know how much is too much in the absence of visible, pre-divided shares. Self-serving bias takes on a rather literal meaning in such settings,[5] and excessive claims by multiple parties can generate losses through overly rapid or contentious extraction.[6] Segmentation is relevant not only where resources are extracted from a common pool, but also where effort or other resources must be contributed to a common project. Here too, success may depend on how the solicited contributions are broken up into standardized units.[7]

There are two basic reasons that resource segmentation matters to spontaneous order: it can reduce informal governance burdens by facilitating measurement, and it can produce convergence between privately and socially valuable choices by constructing choice sets. Consider first how resource segmentation supports governance. Segmentation, whether given by nature (individual animals, trees, pieces of fruit) or artificially constructed (boatloads, bushels, pie slices) provides a measuring rod for assessing draws on, or contributions to, common pools. Measurement enables monitoring by other participants that can facilitate the enforcement of social norms.[8] It also allows parties to monitor their own behavior and compare it with that of others. This process of comparison can support internalized norms of fairness and reassure actors that their own efforts or acts of forbearance are being reciprocated by others.

Evolutionary Theory of Property Rights, IOWA L. REV. (forthcoming [this issue] 2015).

[4] I do not mean to suggest that resource segmentation is *only* useful in the context of informal order; it is also foundational to formal order to the extent it eases enforcement burdens. It can also feature in any number of hybrid or evolving systems.

[5] *See, e.g.,* Linda Babcock et al., *Biased Judgments of Fairness in Bargaining*, 85 AM. ECON. REV. 1337 (1995) (examining self-serving evaluations of fairness and their capacity to impede settlement).

[6] *See, e.g.,* Gary D. Libecap & James L. Smith, *The Economic Evolution of Petroleum Property Rights in the United States*, 31 J. LEGAL STUD. S589, S591-92 (2002) (describing the costs of "extractive anarchy" in the oil and gas context); Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles To Governing the Commons*, 30 ENVTL. L. 241, 250 (2000) (noting similar issues with groundwater extraction).

[7] *See, e.g.,* Yochai Benkler, *Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production*, 114 YALE L.J. 273, 336 (2004) (noting the significance of divisible, granular segments of effort in sustaining models of peer production that rely on widespread volunteerism).

[8] *See, e.g.,* OSTROM, *supra* note 3, at 45, 94-100 (discussing the significance of monitoring).

Resource segmentation also helps produce convergence between privately and socially optimal choices. This result follows from two underappreciated concepts: irrelevant externalities and lumpiness.[9] A simple example illustrates the intuition. People who attend festivals create positive spillovers for others in attendance.[10] These positive spillovers create no inefficiencies if the person is motivated to attend the festival for her own reasons and would not do anything differently if she were able to collect payments from those who benefit from her presence. This last proviso—that she would not do anything differently—is more likely to be fulfilled if "attending the festival" is a discrete, binary action that must be performed in its entirety or not at all. When contributions or withdrawals from a common pool take such "lumpy" or discontinuous forms, the private and social optimum may more readily converge on a single choice, despite the presence of externalities.[11]

Because resource segmentation influences the prospects for cooperative behavior, it should be an explicit focus of law and policy. Law can, for example, take a direct role as a resource slicer or aggregator. Society may also help to edge chunky private decisions in the direction of social optimality through investments in infrastructure and the like. These legal and policy efforts can improve conditions for informal self-ordering around resources. They can also help foster the emergence of formal property rights or facilitate the use of market-mimicking regulation rather than command-and-control coercion. In short, segmentation can support spontaneous order.

The analysis here proceeds in three parts. Part I examines the significance of resource segmentation for governance in the absence of formal private property rights. Parts II shows how resource segmentation, by constructing choice sets, influences efficiency. Part III connects these two ideas and considers the implications for law and policy.

I. SEGMENTATION AND GOVERNANCE

The ways in which resources are sliced up, either naturally or by design, influences the prospects for informal order and coordination in the absence of formal entitlements. I start with an overview of the forms resource segmentation can take and then explain how governance costs might be affected by segmentation—for better or worse.

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[9] *See infra* Part II.A.

[10] *See, e.g.,* Carol M. Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 769 (1986) (describing a festival as "exponentially enhanced by greater participation").

[11] *See infra* notes 66-71 and accompanying text.

A. *Resource Segmentation: An Overview*

Resource segmentation, as used in this essay, refers to the natural or artificial division of natural resources, goods, or services into units that can be appropriated from, or contributed to, a resource system. Segmentation sometimes appears naturally but often is artificially constructed. For example, land does not naturally occur in discrete segments but it can be surveyed and demarcated into parcels for claiming. Similarly, where there is no well-defined resource unit, standardized or shared harvesting equipment (serving spoons, fishing nets, and so on) can produce one. Where it is not possible to break off well-defined physical quantities, an appropriation method may nonetheless place a practical limit on the amount of a resource that can be appropriated over a particular timespan. This creates a kind of temporal segmentation that may be measured in seasons, days, or hours.[12]

It is helpful to consider how resource segmentation connects to Elinor Ostrom's distinction between *resource systems* and *resource units*—that is, between *stocks* and *flows*.[13] Common-pool resources, in Ostrom's schema, represent resource systems or stocks that produce flows of resource units that individual actors can appropriate.[14] In the standard pasture fable,[15] the resource system (stock) is the grazing pasture as a whole and the resource units (flow) are the blades of grass that support the grazing cattle. Resource systems also require inputs, such as seeds and labor in the pasture context. What we often have, then, is a resource system marked by difficult exclusion into which commoners feed rival, privately owned inputs, and out of which they withdraw rival outputs, reducing them to private ownership.[16] Resource segmentation relates both to the draws private actors make upon the resource system, and to the contributions that they make to it.

With respect to draws from the system, it is natural to focus on the resource units themselves, such as individual fish, fruits, or trees. But access to resource systems may also be segmented in a variety of ways, generating claims over a subset of the flow that will be produced. For example, commoners may be limited to particular harvesting methods or technologies[17]—what Carol Rose calls "RIGHTWAY"[18]—or there may

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[12] *See, e.g.,* Elinor Ostrom, Understanding Institutional Diversity 228 (2005).

[13] Ostrom, *supra* note 3, at 30-33 (making this distinction and developing its implications).

[14] *Id* at 30.

[15] Garrett Hardin, *The Tragedy of the Commons*, 162 Science 1243, 1244 (1968).

[16] It is this abutment between individually and commonly owned elements that pulls incentives out of alignment in ways that may (but need not necessarily) lead to tragedy. *See* Armen A. Alchian & Harold Demsetz, *The Property Right Paradigm*, 33 J. Econ. Hist. 16, 22–23 (1973); Lee Anne Fennell, *Commons, Anticommons, Semicommons*, *in* Research Handbook on the Economics of Property Law 35, 37–38 & n.16 (Kenneth Ayotte & Henry E. Smith eds., 2011).

[17] *See, e.g.,* Gary D. Libecap, Contracting for Property Rights 91 (1989) (describing regulation of shrimp harvesting in Texas, which includes a restriction that "[d]uring the fall adult white shrimp season, only one

simply be standard equipment that is used by convention. Cattle grazing on a pasture provides an interesting example. The actual resource units in question (blades of grass) are too small, numerous, and difficult to observe to serve the purposes of segmentation. The cattle themselves, by contrast, represent a highly visible form of "harvesting equipment" with a (roughly) known capacity.[19] The resource system is thereby segmented de facto based on the number of cattle placed on the pasture. Fishing nets and boats can operate similarly, at least if they have relatively standardized capacities.[20] Rotations based on time represent another way of slicing up access to the resource units.[21]

Segmentation is as important for contributions to a resource system (time, effort, money, and so on) as for draws upon it. Indeed, we can recast contributions as forgone draws and vice versa. One of the most significant ways in which one contributes to a resource system is by *not* overdrawing it—keeping cattle off the pasture and the grass on the ground, or keeping fishing boats out of the water and the fish in the sea.[22] Conversely, by *not* contributing labor, money, or other inputs to maintain and improve a resource system, one is effectively withdrawing (or withholding) from the system that which is rival and amenable to private ownership—no less so than when resource units are appropriated.[23]

B. *Better Segments, Cheaper Governance*

To remain sustainable, a resource system must keep aggregate contributions above, and aggregate draws below, certain critical thresholds.

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net twenty-five feet in width can be pulled by any vessel").

[18] Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 DUKE L.J. 1, 9 (building on an enumeration of strategies provided in Steven N.S. Cheung, *The Structure of a Contract and the Theory of a Non-Exclusive Resource*, 13 J. L. & ECON. 49, 64 (1970)).

[19] *See, e.g.,* Ivo Baur et al., *Why Do Individuals Behave Differently in Commons Dilemmas? The Case of Alpine Farmers Using Common Property Pastures in Grindelwald, Switzerland*, 8 INT'L J. COMMONS 657, 659-62 (2014) (observing that "livestock provides the means to harvest from common property pastures," and describing a system used in Switzerland that measures a pasture's "maximum sustainable yield" in terms of summered "livestock units" based on animal species and age).

[20] *See, e.g.,* OSTROM, *supra* note 3, at 174 ("The cost of monitoring an apportioning scheme based on an easily observable factor—what technology a boat is using—is much lower than the cost for one based on the quantity of fish harvested."). New technologies capable of generating higher yields can, therefore, disrupt existing commons arrangements. *See* TERRY L. ANDERSON & PETER J. HILL, THE *NOT SO* WILD, WILD WEST 24-27 (2004) (observing that although technological change "usually lowers the cost of establishing property rights, it can also make the institutional entrepreneur's task harder if it increases access to resources").

[21] *See, e.g.,* OSTROM, *supra* note 12, at 228-33 & table 8.2 (providing a catalog of "choice rules" for allocating common-pool resources, including allocations based on location, time slot, quantity, and resource attributes).

[22] *See, e.g.,* SUGDEN, *supra* note 3, at 137 (describing a fishing ground vulnerable to overfishing as "a public good whose quality is maintained by the restraint of individual fishermen").

[23] There may of course be normative reasons to favor one characterization or the other; the point is simply that both characterizations are possible. *Cf.* Frank I. Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of 'Just Compensation' Law*, 80 HARV. L. REV. 1165, 1196–97 (1967) (noting the malleability of the line between causing harm and failing to provide benefits).

In the absence of prices to modulate the relevant demand or supply, some other coordinating mechanism must be used. This is where resource segmentation comes in. Norms of not taking too much or contributing too little are easier to follow, monitor, and enforce where activities or resources are broken into units that readily define how much is too much or too little.[24] But units that are too large, too small, or too hard to observe will not serve these beneficial purposes.[25] Improving segmentation, then, can improve the prospects for governance systems that rely on individual decisionmaking—spontaneous order rather than centralized control.

Most notably, segmentation influences how easily actors can meter their own resource appropriations and monitor those of others. The significance of monitoring to the successful management of common-pool resources has been well noted.[26] The way resources are broken up intuitively matters to monitoring by affecting the visibility of actors' draws and contributions.[27] Self-monitoring may be as important as the monitoring of others in some contexts.[28] For example, studies on the importance of feedback regarding energy use have demonstrated how making people aware of their usage, and how it compares to that of others, can influence their behavior.[29] Similarly, research suggests that larger portion sizes tend to increase consumption, as does an inability to keep track of the amount one has consumed.[30] Segmentation thus serves as a kind of "nudge" that can alter resource use.[31]

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[24] David Lewis gives an example in which ten friends routinely share a plate of twenty shrimp, with each person willing to limit herself to two shrimp as long as the others do the same. DAVID LEWIS, CONVENTION 96 (1969). While Lewis does not focus on the discrete nature of the food units and their ready divisibility by the number of sharers, these factors would clearly make the sharing equilibrium easier to maintain over the alternative "state of nature" outcome. *See id*.

[25] *See infra* Part I.C.

[26] Elinor Ostrom identifies "monitoring" as one of the eight "[d]esign principles illustrated by long-enduring [common-pool resource] institutions." OSTROM, *supra* note 3, at 90 table 3.1; *see id.* at 94-100 (discussing monitoring and sanctions); *see also* Kipling Williams, et al., *Identifiability as a Deterrent to Social Loafing: Two Cheering Experiments*, 40 J. PERSONALITY & SOC. PSYCH., 303, 307 (1981) (finding, in an experiment involving group cheering efforts, that making people believe their contributions were identifiable deterred "social loafing").

[27] *See* OSTROM, *supra* note 3, at 203-05 (noting the relevance of "physical attributes of the resource itself" to ease of monitoring, and describing some factors that can increase or decrease the visibility of appropriation actions, such as whether "appropriators all return to the same location at the end of their activities, so that the quantity of resource units each has acquired is open for casual inspection").

[28] The significance of opportunities for self-evaluation in group settings has been studied experimentally. *See, e.g.,* Stephen G. Harkins & Kate Szymanski, *Social Loafing and Self-Evaluation with an Objective Standard*, 24 J. EXPERIMENTAL SOC. PSYCH. 354. 361 (1988) (finding, in an experimental study, that facilitating self-evaluation against an objective standard was sufficient to encourage contributions to group efforts).

[29] *See, e.g.,* Ian Ayres et al., *Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage* (2009) NBER Working Paper No. 15386, http://www.nber.org/papers/w15386.pdf. Recent work in this area has explored additional dimensions relevant to shared energy usage settings. *See, e.g.,* Caroline Leygue et al., *Energy Sharing and Energy Feedback: Affective and Behavioral Reactions to Communal Energy Displays*, 2 FRONTIERS IN ENERGY RESEARCH 1 (July 2014) (exploring how information about individual usage within shared energy settings generates emotional responses like guilt, anger, and fear); Tom Hargreaves et al., *Keeping Energy Visible? Exploring How Householders Interact with Feedback from Smart Energy Monitors in the Longer Term*, 52 ENERGY POLICY 126, (2013) (examining longer-term effects, including on intra-household dynamics, of energy monitoring devices).

[30] *See generally* BRIAN WANSINK, MINDLESS EATING: WHY WE EAT MORE THAN WE THINK (2006).

[31] *See generally* RICHARD H. THALER & CASS R. SUNSTEIN, NUDGE (2008). Approaches that encourage self-awareness or facilitate self-monitoring may be viewed as a more autonomy-preserving form of intervention than

The measurement facilitated by segmentation also helps to keep rough accounts, which can sustain reciprocity among members of a relevant community.[32] One of the advantages of informal resource sharing is that it requires less specification of rights and duties—what Yochai Benkler terms "crispness."[33] Nonetheless, repeat play in a reasonably well-defined context will be facilitated by a shared understanding of the relevant unit of appropriation or exchange. An example or perhaps metaphor is the "give-a-penny-take-a-penny" saucer that appears by many cash registers; by making the unit explicit, the proprietor conveys that the saucer is not to be emptied into one's pocket nor filled with the contents of one's coin jar.

Segmentation plays a central role in formal rationing systems. For example, hunting and catch limits may be stated in terms of numbers of animals, or controlled through hunting seasons and methods.[34] Limits on portability, storage, or alienability similarly partition resources based on parties' personal capacities to use or consume.[35] But segmentation can check resource use even in the absence of formal rationing. For instance, a buffet's practice of providing smaller plates and cups not only slows consumption (some time and effort is required to reload or refill) but also communicates norms about what is an appropriate amount to consume.[36] Likewise, the lines demarcating parking spaces serve as focal points that generally induce compliance by motorists,[37] even in free lots where the risk of enforcement is minimal. Appropriate segmentation can also prevent *underuse* by making clear what one can legitimately claim without encroaching on the interests of others. For example, people may sit closer together on public benches that are divided by armrests than on undivided benches.[38]

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other manifestations of "libertarian paternalism." *See* Gregory Mitchell, *Libertarian Paternalism Is an Oxymoron*, 99 Nw. U. L. Rev. 1245, 1257 & n.46 (2005) (making this point and citing studies on the effects of (literal) mirrors on behavior).

[32] *Cf.* Ellickson, *supra* note 3, at 55-56 (discussing the "rough mental account" that a person in a close-knit community can keep with respect to her interactions with other community members); *id.* at 225-29 (describing the "Even-Up" strategy for cooperation and punishment of defection).

[33] Benkler, *supra* note 7, at 315-17.

[34] Such rationing methods can also form the basis for more formal property rights. *See, e.g.* Anderson & Hill, *supra* note 20, at 209-11 (discussing "individual transferable quotas" used in ocean fisheries).

[35] All-you-can-eat buffets are an intuitive example in which consumption capacity segments resource units, with portability prohibitions effectively constraining the time dimension. *See also* Richard A. Epstein, *Why Restrain Alienation?*, 85 Colum. L. Rev. 970, 979-82 (1985) (discussing role of alienability limits in a system of riparian rights); Lee Anne Fennell, *Adjusting Alienability*, 122 Harv. L. Rev. 1403, 1430-33 (2009) (examining limits on alienability, use, and storage as rationing devices).

[36] *See* Wansink, *supra* note 30, at 244, 60-61; Thaler & Sunstein, *supra* note 31, at 44.

[37] For a discussion of how focal points can solve coordination problems, see, for example, Richard H. McAdams, *A Focal Point Theory of Expressive Law*, 86 Va. L. Rev. 1649, 1658-63 (2000) (citing and discussing Thomas C. Schelling, The Strategy of Conflict (1960)).

[38] *See, e.g.,* Bill Main & Gail Greet Hannah, Site Furnishings: A Complete Guide to the Planning, Selection, and Use of Landscape Furniture and Amenities 98 (2009) (observing that armrests "can increase seating density, as people typically will sit closer together if their personal space is delimited by an armrest"). Of course, armrests may instead (or additionally) be motivated by concerns about overappropriation (or by a desire to filter users) given that they also keep people from lying down. *See id.*

Pre-segmented contributions can also reduce the burdens of enforcing norms about giving and reassure donors that they are contributing the "right" amount. For example, someone taking up a collection for a gift might indicate a round amount that everyone should contribute to make the planned gift possible. Charitable organizations, which must solve much larger-scale collective action problems, also commonly include suggested or recommended contribution amounts rather than issuing open-ended pleas for funds. Often the requested donation is conceptually concretized and quantified by reference to a discrete and tangible unit of assistance, such as a goat or a box of nails.[39] Where truly indivisible goods are involved, it may be enough to specify what the charity views as an acceptable and helpful donation level. For example, campaigns by zoos to acquire elephants—true lumpy goods—have solicited pennies from schoolchildren.[40] The March of Dimes campaign, started in 1938, was similarly able to elicit broad participation for an indivisible cause (fighting polio) by focusing on a contribution level that was broadly attainable.[41] Research also suggests the efficacy of establishing contribution tiers or categories in encouraging people to "round up" their contributions to achieve the next level.[42]

In-kind contributions also depend on proper segmentation. Blood donation, for example, features a standard donative increment—one pint.[43] In other contexts, segment construction becomes important. As Benkler observes, "peer production" labor "can be harnessed when a project is broken up into discrete modules, whose granularity is varied and sufficiently fine grained to allow individuals with diverse motivations to engage in the effort at levels appropriate for their motivations but still provide stable contributions to the whole."[44] Innumerable collective projects, from quilting bees to barn raisings, depend on the ability to

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[39]   *See, e.g.,* Oxfam America, Unwrapped, https://www.oxfamamericaunwrapped.com/ (specifying the monetary donations that would fund items such as a goat, a duck, soap, a vegetable garden, a medical kit, and school supplies); Habitat for Humanity, https://www.habitat.org/cd/giving/one/donate.aspx?link=1 (providing a "quick gift guide" that includes contributions ranging from "a box of nails" for $10 to "flooring" for $2000).

[40] For example, Judy the Elephant was purchased by the Oklahoma City Zoo in 1949 through donations of pennies, nickels, and dimes from 50,000 schoolchildren. *See* Judy Kuhlman, *Children Reach in Pockets for Oklahoma City Zoo Judy the Elephant Popular Campaign*, NewsOK, April 24, 1994, available at http://newsok.com/children-reach-in-pockets-for-oklahoma-city-zoo-judy-the-elephant-popular-campaign/article/2463998. Other animals have been acquired for other zoos through similar campaigns. *Id*.

[41] The phrase "March of Dimes," which played off the name of the popular newsreel "The March of Time" was coined by entertainer Eddie Cantor, a supporter of what was then known as The National Institute for Infantile Paralysis. See The March of Dimes, Eddie Cantor and the Origin of the March of Dimes, http://www.marchofdimes.org/mission/eddie-cantor-and-the-origin-of-the-march-of-dimes.aspx. Cantor's radio appeal in January 1938 yielded $268,000 in dimes (mailed to President Roosevelt) within a few days.

[42] James Andreoni & Ragan Petrie, *Public Goods Experiments Without Confidentiality: A Glimpse Into Fund-Raising*, 88 J. PUB. ECON. 1605, 1606, 1618-20 & fig. 3 (2004) (discussing this intuition and presenting experimental results suggesting that reporting contributions in categories can "shift contributions to a higher level").

[43] *See, e.g.,* American Red Cross, Donation FAQs, http://www.redcrossblood.org/donating-blood/donation-faqs#DonationProcess. *See also* SUGDEN, *supra* note 3, at 4 (giving the example of Britain's National Blood Transfusion Service as a public good supported by voluntary donations).

[44] Benkler, *supra* note 7, at 336.

disaggregate and assign appropriately segmented tasks to be completed before and during the interactive event. Making effective use of volunteers requires similar slicing of time commitments into discrete and manageable segments.[45]

C. *When Segmentation Fails*

If successful segmentation can lower governance costs and support spontaneous order, poor segmentation can make coordination more costly and unlikely. One way that segmentation can fail is when the demarcation of appropriable units is unclear. This phenomenon can be seen even in the context of private land holdings, where irregular shapes yield more boundary disputes.[46] But the point holds true for other interests as well. For example, surface boundaries that sufficed for mining placer claims were insufficient for subsurface quartz claims where it might become difficult to tell whether the same or different vein was being tapped.[47] Likewise atmospheric elements like ozone are hard to manage because they are "small (effectively invisible), highly mobile substances that are distributed throughout the earth's atmosphere."[48]

Segmentation problems can also arise when the appropriable units are very clear. Consider the example of college classrooms that are kept open during nights and weekends to be used as study rooms. A study of a number of college facilities undertaken decades ago found that "[t]he standard custom seems to award the whole room to the first student to take possession by squatter's rights."[49] Here, too-large units induce people to appropriate too much.[50] But segmentation that leads people to take or accept less than is really useful presents a problem as well. For example, Terry Anderson and Peter Hill have suggested that the Homestead Acts "specif[ied] a claim size that was generally inappropriate given the aridity

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[45] For example, the "One Brick" volunteer program that exists in several cities touts "commitment-free volunteering" in which participants attend discrete volunteering events on an a la carte basis. *See* One Brick Chicago, http://chicago.onebrick.org/.

[46] *See* Gary D. Libecap & Dean Lueck, *The Demarcation of Land and the Role of Coordinating Property Institutions*, 119 J. POL. ECON. 426, 450–53 (2011).

[47] *See* ANDERSON & HILL, *supra* note 20, at 117 (citing Gary D. Libecap, *Economic Variables and The Development of the Law: The Case of Western Mineral Rights*, 38 J. ECON. HIST. 338, 345-46 (1978)).

[48] Graham Epstein et al., *Governing the Invisible Commons: Ozone Regulation and the Montreal Protocol*, 8 INT'L J. COMMONS 337, 347 (2014).

[49] STUART M. STOKE ET AL., STUDENT REACTIONS TO STUDY FACILITIES 15 (1960). *See also id.* at 9-10 (describing "library seminar rooms" that are effectively turned into "large private offices" (albeit ones whose occupancy turns over frequently) because "the first student to study in one usually attempts to discourage others from sharing it"); ROBERT SOMMER, PERSONAL SPACE 56 (1969) (emphasis in original) (citing and discussing the Stoke et al. study).

[50] Stoke et al. expresses pessimism about being able to turn these classrooms into successful study quarters, but does note that experimentation "e.g. using folding partitions" might be tried. STOKE ET AL., *supra* note 49, at 15. Similar issues arise in the context of unsegmented natural resources. *See, e.g.,* Carol M. Rose, *From H2O to CO2: Lessons of Water Rights for Carbon Trading*, 50 ARIZ. L. REV. 91, 94 (2008) (observing that the western water system had an implicit cap: "the entire stream").

of land on the frontier."[51] Similar issues exist on the contribution side as well—asking too much or too little can backfire.[52]

Thus, segmentation can fail if it does not take a sufficiently visible form, or if it does not align well with the efficient scale of appropriation or use.[53] It may also fail if it does not produce relatively homogeneous appropriable or contributable units. Homogeneity need not be absolute; there can be, for example, multiple tiers of contribution, and people may appropriate different numbers of units based on their consumption needs. But some degree of standardization is required for segmentation to serve the metering and monitoring functions that reduce governance costs.[54]

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The possibility that better segmentation can reduce governance burdens provides a good reason for law and policy to pay attention to it. At some level, of course, the idea of resource segmentation merely stands in for a set of recognized factors that determine the success or failure of informal resource arrangements: the clarity of entitlements,[55] the importance of monitoring and metering,[56] the role of prominent relationships and focal points,[57] the use of marking and communication,[58] and the significance of reciprocity and notions of fairness.[59] But even if these other concepts collectively convey how and why resource segmentation lowers governance burdens, segmentation's congruence with these ideas suggests it is worth

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[51] ANDERSON & HILL, *supra* note 20, at 168-70. The Homestead Acts variously granted allotments of 160 acres, 320 acres, and 640 acres to those who met certain requirements, including living on and working the land for five years. *See id.*

[52] *See, e.g.*, Andreoni & Petrie, *supra* note 42, at 1619 (suggesting that reporting charitable contributions by categories or tiers "can be a powerful mechanism to affect contribution decisions" but observing that "[p]oorly chosen categories may reduce contributions or may have no effect on shifting contributions at all").

[53] It is possible that the efficient scale for use would differ from the efficient scale for (at least some types of) appropriation. The amount of land that can be successfully claimed and held through a first-in-time system like that used in the Oklahoma Land Runs might, for example, differ from the amount that is necessary for successful farming. For a discussion of some of the effects of costly racing during the 1893 Oklahoma Land Run, see ANDERSON & HILL, *supra* note 20, at 172-74. The possibility of a difference between optimal segmentation for appropriation and optimal segmentation for use speaks to the fact that the target resource (such as land) is never the only resource in the picture. Instead, there is always a linked "resource-appropriation environment" that forms a commons of its own. *See* Lee Anne Fennell, *Common Interest Tragedies*, 98 NW. U. L. REV. 907, 922-24 (2004).

[54] Such standardization does sacrifice some of the advantages of customization. But it may allow informal self-governance to succeed in place of top-down solutions that might be imposed by those who are less likely to possess good information about the needs of each claimant or contributor. I thank Richard Epstein for discussions on this point.

[55] *See, e.g.,* Carol M. Rose, *Possession as the Origin of Property*, 52 U. CHI. L. REV. 73, 81-82 (1985).

[56] *See supra* notes 26-31 and accompanying text.

[57] *See, e.g.,* SUGDEN, *supra* note 3 at 49-54; 98-107; McAdams, *supra* note 37, at 1658-63. Of particular relevance to resource segmentation is the capacity of landmarks, whether natural or constructed, to provide focal points. *See* RICHARD H. MCADAMS, THE EXPRESSIVE POWERS OF LAW 86-90 (2015); Richard Brooks, *Legal Landmarks*, IOWA L. REV. [this issue] (forthcoming 2015).

[58] *See, e.g.,* Rose, *supra* note 55, at 81-88.

[59] *See supra* note 32 and accompanying text.

paying attention to as a powerful and policy-malleable proxy.

An analogy to exclusion's role in property rights might be drawn here. Scholars recognize that exclusion is merely a means to an end—that of enabling people to make use of resources.[60] Exclusion proxies for an alignment between inputs and outcomes that could be achieved through other means, at least in theory, and it is that alignment that is really doing the work. But exclusion captures our attention as an interesting and policy-relevant feature of property rights. Segmentation should as well.

II. CONSTRUCTING CHOICE SETS

The ability of resource segmentation to lower governance burdens is only one facet of its importance for spontaneous order. Segmentation also constructs the choice sets that appropriators and contributors face—the menu of possible stopping points. The lumpiness of these choices can cause private and social payoffs to converge on the same decision point, even when externalities are present. On the other hand, sometimes lumpy choices will force an even greater divergence between optimal behavior and individual choices than would occur if all available decision points were open. Understanding how choice sets can create such convergence or divergence is important to the study of property rights because it helps explain why externalities (including those that commoners inflict or bestow on each other) may not spell the demise of a resource system.

A. Lumping Irrelevant Externalities

We can start with thumbnail sketches of two understudied concepts that drive the analysis here: lumpiness and irrelevant externalities. *Lumpiness* in a good, service, resource, or decision refers to the inability to produce or make use of just any old amount; rather, the thing must be produced or consumed (or sometimes both) in particular units.[61] A bridge is the ultimate lumpy good; if it is incomplete, it is of no use at all.[62] In many other cases, there are particular units or tiers that define feasible production and consumption levels. Here, the choice menu of a party who is deciding how much to contribute or withdraw does not comprise a continuous spectrum but rather a limited set of discrete nodes along it.

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[60] *See, e.g.,* J.E. PENNER, THE IDEA OF PROPERTY IN LAW 71 (1997) (observing that "exclusion is the practical means by which that [use] interest is protected"); Henry E. Smith, *Intellectual Property as Property: Delineating Entitlements in Information*, 116 YALE L.J. 1742, 1747 (2007) ("The right to exclude from a designated thing protects our interests in the use of things like cars or Blackacre; if no use could be made of a given thing, there would be no reason to exclude.").

[61] *See, e.g.,* Michael Taylor & Hugh Ward, *Chickens, Whales, and Lumpy Goods: Alternative Models of Public-Goods Provision*, 30 Pol. Stud. 350, 353 (1982).

[62] *See, e.g.,* RUSSELL HARDIN, COLLECTIVE ACTION 59 (1982) (noting and qualifying this point).

Irrelevant externalities are external effects that do not cause an actor to behave differently than she would if she fully took those effects into account.[63] People frequently undertake acts that incidentally benefit others even when they have no way of demanding payment from the beneficiaries. Sometimes this is due to altruism, cooperative norms, or more formal governance mechanisms, but in many cases the explanation is simpler: the actor would do the same thing even if she fully internalized all the costs and benefits. Consider, for example, a rose garden cultivator who makes her garden as beautiful for her own purposes as she would if she could collect viewing fees from her neighbors.[64] Likewise, people may efficiently engage in activities that harm others (like emitting pollutants) if they would still make the same choice after taking into account the effects on others.[65]

The two ideas come together in the spontaneous order context in following way: the lumpiness of choices can make it more likely that the choice one selects for one's own reasons will turn out to be the exact same choice that is socially best.[66] Where transaction costs preclude bargains to fully internalize externalities, resource segmentation may be able to do some of the work in encouraging socially valuable decisions. In other cases, however, lumpiness can push private choices further away from the social optimum. The following sections explain.

B. Fortuitous Lumps

Let us start with the optimistic account in which lumpy choices help produce convergence between privately and socially optimal decisions. Suppose an actor must decide whether to make a given chunky investment that will have positive spillovers on others, such as attending a particular event, buying a home on a particular block, or opening a store on a particular corner. If this investment is a binary choice—attend the event or

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[63] James Buchanan and Craig Stubblebine define "Pareto-relevant externalities" as those that exhibit the potential for "gains from trade." James M. Buchanan & W. Craig Stubblebine, *Externality*, 29 ECONOMICA 371, 374-77 (1962). Such potential gains exist only where the party affected by the externality would be willing to pay the actor producing it enough to alter her behavior—that is, where internalization would make a difference. *See id.* at 380 (making this point in the context of one party's choice to build a fence that will affect another party). Externalities are not Pareto-relevant if there is no such potential for gains from trade; because the affected party could not pay the actor enough to change her behavior, internalizing the external cost would make no difference. *See id.* at 374-77. I will refer to these simply as "irrelevant externalities" here to signify their irrelevance to efficiency. Such externalities may, however, remain relevant to distribution. *Cf.* DUKEMINIER, ET AL., PROPERTY 49 (8th ed. 2014) (observing that if an actor does not change her behavior after taking an external effect into account, the effect is no longer an "externality" but may still be distributively unfair).

[64] *See generally* David Haddock, *Irrelevant Externality Angst*, 19 J. INTERDISC. ECON. 3 (2007).

[65] *See* DUKEMINIER, ET AL., *supra* note 63, at 49.

[66] This core intuition is explored in a slightly different context in Mark P. Gergen, *The Use of Open Terms in Contract*, 92 COLUM. L. REV. 997, 1013-19 (1992). Gergen gives the example of a real estate broker who, despite reaping only a fraction of the benefits from a home's sale, will nonetheless undertake the efficient lumpy choice of putting a property on a multilist service as long as she internalizes a sufficient return from taking this step. *Id.* at 1014 & n.55.

not, say—then the actor need only internalize enough benefits to make her participation privately worthwhile in order to go ahead with the entire spillover-producing investment. If, on the other hand, her investments were infinitely divisible, then we might expect underinvestment, given that she does not get all the returns herself.[67]

A failure to appreciate the lumpiness of the choices that often confront agents has led to an overestimation of how often externalities matter to efficiency. Standard graphical depictions of externalities contribute to this misconception by portraying choice sets as continuous, so that any externality, positive or negative, will cause the privately selected stopping point for a given resource draw or contribution to diverge from the socially optimal stopping point.[68]

Figure 1 illustrates this point in the context of negative externalities.

Figure 1:
Externalities with Continuous Choice

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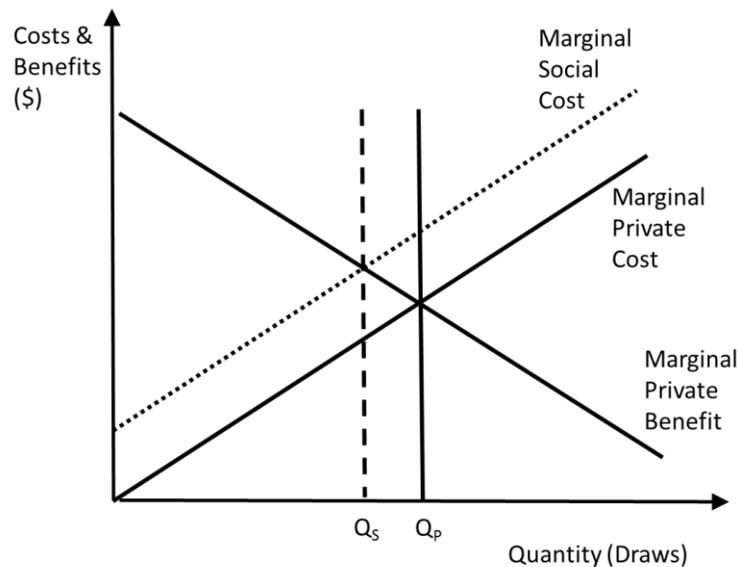
[67] Two important caveats to this assumption have been noted in the literature. First, if the actor has preferences that are more intense than those of the others who will enjoy spillovers, she may readily provide the good in question at a level that meets or surpasses the demand of all others. *See* David Haddock, *Irrelevant Externality Angst*, 19 J. INTERDISC. ECON. 3 (2007). Second, it is immaterial that an individual cannot recapture all of her own returns if she is in a setting where she is capturing comparably valuable positive spillovers from others *as a direct result of* her own spillover-causing activity. *See* Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 269 (2007). This might be the case where engaging in activities that cause spillovers, like research and development, are a necessary predicate to benefiting from the research and development of others. *See id.*

[68] Likewise, formal models standardly assume continuity.

The horizontal axis represents draws that an individual might make against a common resource, as through pollution or harvesting, while the vertical axis shows the impact in dollars. We would expect a rational actor to stop making draws at Q_P, the point where her marginal private cost and marginal private benefit lines cross; this is her private stopping point. The dotted social cost line reflects the higher marginal social cost of the draws, counting the impacts on others. The social stopping point, Q_S shows where the actor should stop making draws if these costs were taken into account.[69] Here, the negative externalities make the actor stop too late in making draws. A similar graph could be shown in which positive externalities make the actor stop too soon in making contributions that benefit others.

Lumpiness changes the story by limiting the menu of possible stopping points, as shown in Figure 2.[70]

Figure 2:
Externalities with Lumpy Choices
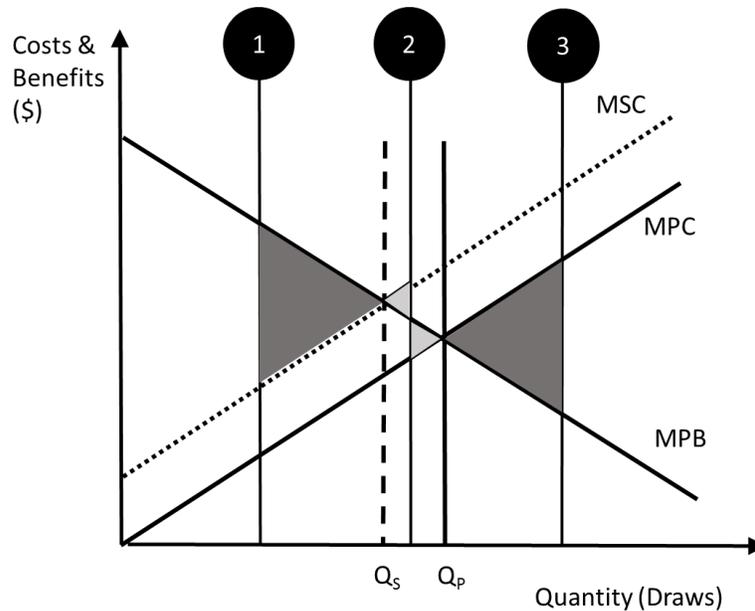
It is now no longer possible for the actor to choose any point along the horizontal axis as a stopping point; instead, there are only three possible stopping points, as indicated by the vertical lines labeled 1, 2, and 3. Imagine, for example, that these stopping points signify standard-sized

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[69] This graph assumes there are no positive externalities produced by the draws, so the marginal private benefit is also the marginal social benefit.

[70] For a different way of illustrating the effects of lumpiness on choices that involve externalities, see Gergen, *supra* note 66, at 1014, Diagram 1.

boatloads of fish or factory production runs that generate standard amounts of pollution, and that it is not possible to stop harvesting or production at intermediate points. The private actor cannot, therefore, stop at Q_P, the "private stopping point" identified earlier; she must choose between stopping a little sooner, at line 2, or stopping a lot later, at line 3. Given those options, she will choose the former. This is easy to see by comparing what she would lose relative to her ideal point if she went all the way to line 3 (the rightmost large dark gray triangle) with what she loses relative to her ideal point by settling for line 2 (the rightmost small light gray triangle).

This is also the socially optimal choice. Her neighbors or fellow commoners might be happier if she scaled all the way back to line 1, but they could not pay her enough to do so; moving to line 1 produces a social loss relative to settling for line 2. This is evident by comparing the social cost relative to society's ideal stopping point if she went all the way back to line 1 (the leftmost large dark gray triangle) with the social cost relative to society's ideal stopping point for settling for line 2 (the leftmost small light gray triangle). Thus, in this example, the lumpiness of the choice set fortuitously causes our actor to behave a bit better (stop a bit sooner) than she would if her choices were unconstrained.[71] Of course, there are other possible scenarios in which chunkiness proves less desirable, as the next section explains.

C. Lumps as Cliffs

Where resource segmentation produces lumpy choices about appropriation or provision, actors are deprived of the ability to select their ideal stopping points. The section above showed that sometimes this will push an actor in the direction of a more socially beneficial stopping point. But the opposite may also be true. An example in a context where spontaneous order is especially important—urban agglomeration—shows both sides of this point.

Suppose an exciting technology store (call it Dapple) with a busy downtown location must decide whether to open a second store in an uptown location. Because there is a minimum efficient scale for the new store, and no advantage to going beyond that scale, the choice is a binary one—open the store, or not. If the private returns from the store justify the choice, then it matters not at all that the Dapple placement will also create positive spillovers for commercial and residential properties nearby; Dapple will open the new store. If we further assume that opening a third store is

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[71] The statement in the text assumes that transaction costs would keep the parties from arriving at the socially optimal position if choices were unconstrained. If transaction costs were zero, then chunkiness would not provide the indicated advantage because the parties would reach the socially preferred position in any case. *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 8 (1960).

neither privately profitable nor socially beneficial, then Dapple's private choice about the number of stores will happen to converge with the socially optimal choice. This need not always be the case: it is entirely possible that taking all social benefits into account would call for more store openings than private self-interest produces. But the chunkier the choices are relative to the divergence between private and social payoffs, the more likely it is that the private and social prescription will "land" on the same choice.

At the same time, the lumpiness of the choice raises the stakes and increases the amount of inefficiency produced where the failure to internalize externalities *does* make a difference. Thus, if the private returns to a second Dapple store fall just a hair short of justifying the investment, an entire socially efficient store is lost. Suppose instead that Dapple faces a continuous choice about how large to make a single store. Here, it is more likely that positive or negative externalities associated with a larger or smaller footprint will be relevant to efficiency, since the menu of size choices is continuous and unlimited. But at the same time, the consequences are not as severe; rather than society losing an entire store as in the earlier example, all that is lost is some marginal square footage.

As this example suggests, land use policies—such as the ease with which an existing store can be expanded relative to the ease with which a new store can be opened—can influence the shape of the choices that actors make, and hence whether an urban actor is in a position to contribute to urban agglomerations in big or small steps. The difference can affect the sustainability of public goods and common-pool resources by altering the degree to which private choices align with the social optimum.

III. INTERSECTIONS AND IMPLICATIONS

The discussion above has identified two channels through which resource segmentation—the splitting up of contributable or appropriable units—might influence the prospects for sustainable order in the absence of formal entitlements. First, segmentation provides a metric that can facilitate informal governance. Second, segmentation constructs choice sets, which can affect how well private maximizing behavior aligns with the social optimum. Subpart A briefly examines how these two channels of influence interact. Subpart B considers how law and social policy might be made more sensitive to segmentation considerations. Subpart C examines how public investments and other policy choices can improve the odds that parties will be willing to make lumpy, socially valuable choices.

A. *Segmentation, Choice Alignment, and Governance*

The significance of resource segmentation for purposes of choice alignment intersects with its significance for governance. Understanding these interactions becomes especially important once we recognize the capacity of law, policy, and even technology to influence how resources are segmented. Consider again the limited menu of stopping points depicted in Figure 2 above. This lumpiness in available choices might be due to a technological constraint, or it might be socially or legally constructed. For example, suppose that the draws against the commons involve fence-building—an act that benefits the fence-builder but cuts off the scenic views of neighboring properties.[72] Further suppose that as a result of law, norms, or technology, fences must be constructed of prefabricated boards that come in standard sizes, effectively limiting the height of the fence to just three options: short (line 1), medium (line 2), and tall (line 3). For the reasons discussed above, the actor will choose the medium fence, which is also the socially preferred alternative on this limited menu.[73]

Suppose, however, that legal or technological changes permit intermediate choices, including ones that perfectly align with society's preferred stopping point, Q_S, and with the fence-builder's privately preferred stopping point, Q_P. There is now the possibility of reaching a Pareto-superior alternative through a bargain that would constrain the fence to the socially optimal level.[74] Of course, transaction costs may keep that result from being realized.[75] Meanwhile, the fence-builder is now free to diverge further from the socially optimal result than she could under the constrained choice set, by moving to her privately preferred stopping point.[76]

Whether the expanded menu produced by finer-grained segmentation makes things better or worse depends on how these effects interact. But it also depends in part on other impacts that the segmentation choice may have on the prospects for informal governance and cooperation.[77] Recall

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[72] For a stylized fence-building example involving continuous height choices (but a nonlinear height preference for the non-builder), see Buchanan & Stubblebine, *supra* note 63, at 377-80.

[73] *Supra* Part II.B.

[74] *See* Buchanan & Stubblebine, *supra* note 63, at 380. For this reason, we cannot rest easy simply because the current menu of choices produces convergence between an actor's privately optimal choice and the one that is socially optimal; that convergence may be an artifact of a constraint in the system that keeps us from a Pareto-superior solution. *See* CLEM TISDELL, ENVIRONMENTAL ECONOMICS 31 (1993) ("[I]f in the economy, externalities are infra-marginal or in other ways apparently Pareto irrelevant or even if they are absent altogether, this is not evidence that production is conducted in an optimal way. A different choice of techniques may lead to a greater overall output and in the new situation Pareto relevant externalities may exist.").

[75] *See, e.g.,* Buchanan & Stubblebine, *supra* note 63, at 377; *see generally* Coase, *supra* note 71.

[76] On the other hand, she might be forced to an even greater divergence from the social optimal by a limited choice set, if it led her (on facts different from those shown in Figure 2) to build higher than even she herself would prefer. *See* Part II.C, *supra*.

[77] Similar analysis might be used to evaluate other limited menus, such as the numerus clausus principle in property law. For a recent discussion of this principle as it relates to the emergence of new property forms, see Yun-chien Chang & Henry E. Smith, *The* Numerus Clausus *Principle, Property Customs, and the Emergence of Buchanan & Stubblebine, supra note 63, at New Property Forms*, IOWA L. REV. (forthcoming [this issue] 2015).

again the role of segmentation in facilitating metering and monitoring—including self-monitoring.[78] If actors only have access to fairly large-grained, standardized moves in interacting with each other, undercontributing or overdrawing becomes easier to observe. This can constrain self-serving behavior and reinforce reciprocity, leading actors to choose socially preferable options even when it is not strictly in their private self-interest.

Consider how these points interact in common-pool resource contexts, where there are no formal private property rights. These are the contexts in which it might be least plausible that parties could bargain their way to full internalization of externalities, since they lack well-defined property interests to trade over.[79] Restricting the choice menu through relatively chunky alternatives may, therefore, not mean forgoing any realistic opportunity to generate a finer-grained solution that would leave all actors better off. The limited menu may also be more likely to edge actors toward more socially desirable actions than they would select on their own where those pro-social choices are reinforced through social norms and reciprocity.[80] Thus, in repeat-play contexts involving common-pool resources, where informal governance considerations loom large and reciprocity is important, the lack of fine calibration in choosing how much to give or take may be a feature rather than a bug.

B. *Sensitivity to Segmentation*

The discussion in this paper suggests that scholars and policymakers should attend more closely to resource segmentation, given its capacity to bolster the prospects for informal order. As we have seen, the way in which draws against and contributions to resource system are demarcated can have significant effects on behavior—effects that should be studied and harnessed.

Consider, for example, zoning ordinances like New York's that state seating requirements for privately owned public plazas in linear feet, while giving limited attention to how this seating will be segmented.[81] To be sure, plazas over 10,000 square feet are required to provide moveable seating at a rate of one chair per 200 square feet.[82] The ordinance also encourages

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[78] *See supra* Part I.

[79] *See, e.g.,* Rose, *supra* note 55, at 81-82.

[80] Instructive in this regard is the way that reporting charitable contributions by categories or tiers may influence contribution levels. *See supra* note 42 and accompanying text.

[81] City of New York Zoning Resolution (Web Version), Art. III, ch. 7, §37-741 available at http://www.nyc.gov/html/dcp/html/pops/plaza_standards.shtml

[82] *Id.* at §37-741(e)(4). The general quantity requirement is one linear foot per 30 square feet of plaza area. *Id.* Thus, a plaza of 12,000 square feet would have to provide 400 linear feet of seating, 120 linear feet of which take the form of individual chairs (60 chairs, credited at 24 inches each). There are a number of other requirements about types and quantities of seating, although they place relatively few limits on how seating is to be divided up.

provision of individual seating in plazas of all sizes by granting 24 inches of credit for individual chairs, when their actual width averages only 19 inches.[83] Although these tweaks tend in the right direction, the baseline idea of specifying seating by the linear foot seems to embed a misunderstanding about the way urban space is used. An alternative approach might set performance standards[84] such as requiring plazas to actually seat a certain number of people during peak periods like lunchtime. This approach would require plaza designers to think about what makes spaces inviting to people, and how to break up space into chunks that people are comfortable appropriating.

More broadly, efforts to support spontaneous order could be advanced by making use of behavioral research investigating the impact of resource configuration on decisions to cooperate or defect. For example, recent experimental work has examined how a limited field of view for observing the appropriations of others influences behavior,[85] and how costly communication among appropriators requires tradeoffs between appropriating and communicating.[86] Some limited work has considered the significance of certain resource attributes, such as how clearly bounded and mobile resources are.[87] A focus on resource segmentation could extend these lines of research by examining how the resource itself—if cut into familiar, standardized units and harvested or collected in ways visible to all—can serve as a form of communication.

C. Shifting Cliffs

The externalities generated by lumpy appropriation or contribution decisions will often be irrelevant to efficiency, as Part II explained. As long as an individual will make the same choice for her own reasons as she would make under conditions of full internalization, it does not matter to

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See generally id., §37-741.

[83] *Id.* at §37-741(e)(4). An earlier version of the zoning code gave a larger amount of "credit" (30 inches) for each such seat. *See* WILLIAM H. WHYTE, THE SOCIAL LIFE OF SMALL URBAN SPACES 36, 112-13 (1980) (citing 1975 New York City zoning amendments).

[84] Performance zoning, at least in its pure form, focuses on impacts rather than on specifying particular uses. *See* DOUGLAS R. PORTER ET AL., FLEXIBLE ZONING: HOW IT WORKS 11 (1988); *see also* Jane Jacobs, DARK AGE AHEAD, 153–57 (2004) (advocating a "performance code"); Frederick W. Acker, Note, *Performance Zoning*, 67 NOTRE DAME L. REV. 363 (1991) (providing an overview of performance zoning). Although performance standards are more commonly contemplated in the context of controlling negative externalities, they might be applied to harness positive externalities as well. *See, e.g.,* Lee Anne Fennell, *Agglomerama*, B.Y.U. L. Rev. (forthcoming 2015), Part III.B.4, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2532270.

[85] *See, e.g.,* M.A. Janssen, *The Role of Information in Governing the Commons: Experimental Results*, 18(4) ECOLOGY & SOCIETY 4 (2013); *see also supra* notes 26-32 and accompanying text (addressing the significance of visibility to monitoring in a number of contexts).

[86] *See* Marco Janssen et al., *The Effect of Constrained Communication and Limited Information in Governing a Common Resource*, 8 INTERNAT'L J. COMMONS 617 (2014).

[87] *See, e.g.,* Epstein et al., *supra* note 48, at 347 (noting relative lack of work on resource attributes and citing existing literature).

efficiency that others are thereby harmed or benefited. This subpart focuses on the "for her own reasons" part of this statement. Attending to it shows how a focus on resource segmentation fits together with standard responses to externalities.

Pigouvian taxes and subsidies are familiar mechanisms for attempting to align self-interest with the public interest by charging or crediting an individual for the external impacts of her choices.[88] But other legal and policy moves—from funding supportive infrastructure to leaving offsetting spillovers untouched—can also make it worthwhile for an individual actor to pursue the socially preferred course. Significantly, externalities do not need to be fully internalized in order to produce socially optimal decisions; rather, only those externalities that are relevant to efficiency must be addressed in order to produce undistorted decisions. Stated more intuitively, taxes, subsidies, and similar instruments need only push the individual actor over the brink of doing the right thing or pull her back from the cliff of doing the wrong thing (where "right" refers to the choice that she would make if she were required to fully internalize all externalities).

Where lumpy choices are involved, very little may be required to give the actor that necessary push or pull.[89] Consider again an example mentioned at the beginning of the paper: an individual must decide whether or not to attend a festival, where doing so will visit positive benefits on others and will also be socially valuable on net when the actor's own interests are taken into account. Suppose that once the actor is at the festival, she will find it more pleasant to participate and throw off positive externalities than to lurk sullenly in a corner. The trick, then, is to make it worth her while to attend. She does not need to capture all the benefits that she will generate in order for this to be the case; rather, she need only find the proposition of attending to be a net positive. Minor subsidies in cash or in kind—even if much lower than the externalized benefits she will produce—can be enough to spur the lumpy attendance decision. Investments in infrastructure that reduce her costs of getting to a festival, for example, can push the balance sheet into positive terrain.[90]

There can also be instances in which *refraining* from charging back

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[88] Pigouvian taxes and subsidies are named after A.C. Pigou, who advocated using these instruments to address gaps between private and social payoffs. *See* A.C. PIGOU, THE ECONOMICS OF WELFARE, pt. 2, ch. 9, §§ 13–17, at 192–203 (4th ed. 1932); *see also* Maureen L. Cropper & Wallace E. Oates, *Environmental Economics: A Survey*, 30 J. ECON. LIT. 675, 680-82 (1992) (describing Pigouvian taxes and subsidies).

[89] *Cf.* Gergen, *supra* note 66, at 1015 (explaining that where tasks are lumpy in a principal-agent setting, "the trick for the principal is to get the agent started so that the agent's self-interest will take over"); *id.* at 1015-16 (observing that legal rules can at times help provide this motivational push).

[90] *Cf.* Rose, *supra* note 10, at 770 (discussing how public choices about roads and waterways encouraged commerce); Gergen, *supra* note 66, at 1010-11, 1015 (explaining how the structuring of oil and gas leases induce lessees to begin lumpy investments). Subsidies can take a variety of creative forms. *See, e.g.,* Baur et al., *supra* note 19, at 662, 669 (discussing the potential use of "marketing tools for alpine dairy products" to increase payoffs from grazing animals in areas where undergrazing poses a risk).

negative spillovers to an actor will facilitate that same actor's provision of positive externalities. For example, Keith Hylton has observed that certain liability-constraining rules in tort law may help to encourage (or at least not discourage) acts that, while creating some risk, also produce positive externalities that the individual is not able to capture.[91] Commentators have similarly noted the positive externalities that were generated by "icemen" who cleared roads in the Raleigh area following Hurricane Fran in 1996, the better to access customers whom they could price-gouge.[92] These accounts suggest that the promise of supernormal profits induced these entrepreneurs to undertake the (incidental) provision of a public good—cleared roadways.[93] Again, the lumpiness inherent in these situations diminishes the amount of a push that is necessary to cause people to perform acts that have positive spillovers.

Likewise, even small negative pressures may interact with resource segmentation to control draws against the commons. The pricing structure of some city bike sharing programs offers an interesting illustration. Chicago's Divvy system, for example, allows a patron who has purchased either an annual membership or a 24-hour pass to borrow a bike for free— but usage surcharges will accrue if she keeps the bike out for more than 30 minutes without returning to a Divvy station to check it out again.[94] There is no limit to how many 30-minute use segments one can rack up seriatim.[95] But returning to a station repeatedly is a minor hassle, and it reinforces the idea that the bikes are meant to be kept in circulation, not hogged by one person for an extended period. Like a tiny serving spoon, the setup communicates something about how much each patron is meant to take.

CONCLUSION

Resource segmentation matters. This paper has focused on two ways that segmentation may prove important to the success of spontaneous order. First, it can influence governance costs. Second, by constructing choice

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[91] Keith N. Hylton, *Duty in Tort Law: An Economic Approach*, 75 FORDHAM L. REV. 1501, 1502, 1508-09 (2006).

[92] *See* James McClure & Tyler Watts, *The Greatest Externality Story (N)ever Told* 20-21 (unpublished manuscript, June 19, 2014) available at: http://ssrn.com/abstract=2462262; Michael Munger, *They Clapped: Can Price-Gouging Laws Prohibit Scarcity?* Library of Economics and Liberty, Jan. 8, 2007, http://www.econlib.org/library/Columns/y2007/Mungergouging.html.

[93] *See* McClure & Watts, *supra* note 92, at 21. According to an account relayed by Michael Munger, the profit-making of the icemen was short-lived, as they were soon arrested for violating North Carolina's price control laws. *See* Munger, *supra* note 37 (citing the 1996 version of N.C. Gen. Stat. 75-36(a)).

[94] Divvy Pricing, https://www.divvybikes.com/pricing; *see also* Boulder B-Cycle, Pricing Page, https://boulder.bcycle.com/pricing.aspx (providing a similar pricing structure).

[95] Divvy, How It Works, https://www.divvybikes.com/how-it-works ("Take as many trips as you want during your Membership or Pass period."); *see also* Boulder B-Cycle FAQs, https://boulder.bcycle.com/About/FAQs.aspx ("Can I check out a bike immediately after returning a bike? Yes! There is no wait period required between B-cycle returns and checkouts.").

sets, it can help align private decisions with those that are socially optimal. As a first step toward fostering more robust and sustainable forms of spontaneous order, law and policy should take account of the role of resource segmentation as an important design element, and one that is often amenable to social construction.

The analysis here holds significance beyond the context of explicit public goods or common-pool resources. All systems of private property are mixed systems—spillovers are ubiquitous, and private property derives much of its value from the aggregate acts of contribution and appropriation taking place in the neighborhood, district, metropolis, or region. How well those mixed systems work depends on how well individual actors can coordinate their innumerable independent actions. The ability to harness and aggregate dispersed private information is the hallmark and core advantage of any system of spontaneous order. Resource segmentation represents a broad-spectrum technology for eliciting and transmitting information, by constructing choices and rendering those choices visible.

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