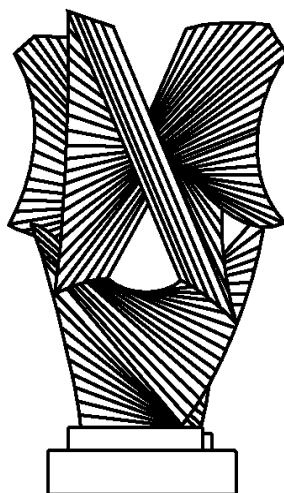


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Slices and Lumps

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THE LAW SCHOOL
THE UNIVERSITY OF CHICAGO

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SLICES AND LUMPS

2008 Coase Lecture
University of Chicago Law School

*Lee Anne Fennell**

So, slices and lumps . . . of what? In fact, the title's key words are not just nouns but also verbs. Together they form an answer to the question: What does the superhero invented by the property professor do to make the world a better place? Well, she slices and lumps. Resources or entitlements are sometimes more valuable when sliced up, and sometimes more valuable when lumped together. It can be hard, at times, to know which way the balance tilts. Even when we think we know, getting to the optimal configuration can be difficult. Enter "The Configurator," who unlike you or me, can costlessly sever or agglomerate entitlements whenever the reconfiguration yields more total social value than the original arrangement. In a zero transaction cost world—that parallel universe that Ronald Coase so skillfully rendered¹—these feats (and others) could be accomplished effortlessly by all of us, sans capes. But in our world, we need a little more help. In this lecture, I hope to convince you not only that The Configurator would be an excellent superhero to have around, but also give you some tools for spotting and responding to configuration challenges in law and in life.

The rest of the talk comes in four small slices. The first bit asks why we need to slice and lump in the first place. The second segment looks at why reconfiguration is so hard to accomplish and what we can do about it. The third piece examines some implications for law of thinking in slices and lumps. And the final installment addresses situations in which everyone involved in a slicing or lumping operation is a different temporal version of you.

I. WHY LUMP? WHY SLICE?

To get into this topic, start by thinking of things that arrive in chunks that you might want or need to divide up. For example, you might prefer a law firm job that would involve a little less work and a little less pay, or a home that expands only when you are entertaining, or a car that materializes only when needed and is priced accordingly, or a dog that provides half the

* Professor of Law, University of Chicago Law School. This lecture was delivered on February 19, 2008, in slightly modified form. Portions of the lecture draw on my prior work, including *Revealing Options*, 118 HARV. L. REV. 1399 (2005).

¹ R.H. Coase, *The Problem of Social Cost*, 3 J. L. & ECON. 1 (1960).

affection and requires half the walking. Sometimes external conditions *require* a split: you may be a co-owner of something—an inherited farm, a couch in a group house, a catering firm, that, for whatever reason, must be divided among claimants.

Next, think of all the things that arrive in fragments that you'd (alone or with others) like to put together. Savings to buy a car, or monetary contributions to purchase a public good such as a bridge. Effort to create a result, such as a research paper, a washboard abdomen, or legal reform. Votes to create a political result. Patent licenses to produce a particular product. Or the bits of extra space between cars parallel parked in front of the law school that you wish you could aggregate together to create a space large enough for your car. Getting part of the way there doesn't always get you a proportionate share of the total benefit (think of a partial bridge, or a partial parking space).

Both law and markets help to slice and lump. But you can't always get what you want, configuration-wise. Sometimes that's the efficient outcome. After all, it isn't only about what you want. These lumping and slicing operations always involve the interests of multiple parties (even if they are sometimes just different versions of yourself), and sometimes there is simply no gain to be had overall, once the interests of all relevant parties are taken into account. Maybe nobody wants the other half of your dog or the last three hours of your job each week, at least not at a price you'd find agreeable. On the other hand, we can't infer from the fact that a particular configuration doesn't exist that it wouldn't be efficient. Existing configurations can stick for good reasons (because they're the efficient configuration) or for bad reasons (because of transaction costs, including strategic behavior, that prevent value-enhancing reconfigurations).

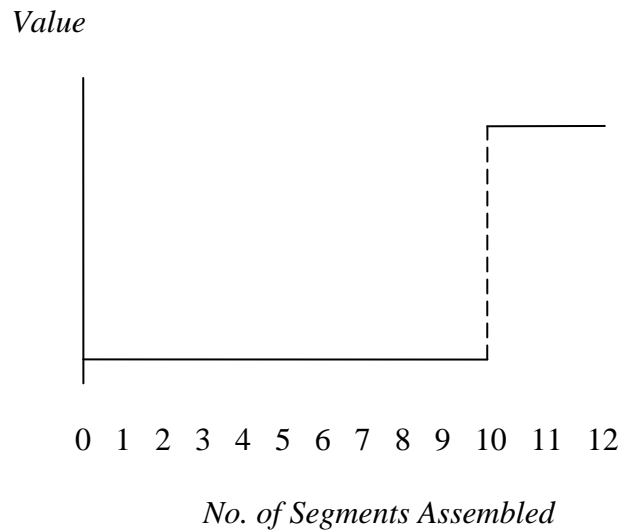
To sharpen our thinking about this question, we can turn to a tool from economics, the production function. The production function traces the relationship between units of input and units of output. Consider, for example, the relationship between dollars contributed to a charity and the good that the charity does in the world. Perhaps the relationship is linear, at least within a particular range, so that each additional increment produces the same amount of value. Or perhaps a plateau may be reached after which additional dollars do less good than the dollars that went before. Conversely, there may be a “snowball” effect so that as more contributions are added, each does more and more good. Or the curve may be in an S-shape, with a range of increasing effectiveness is followed by a range of diminishing returns. There are many possibilities.² The production

² For a discussion of production functions and their connections to interdependent decisionmaking, see, e.g., Pamela Oliver, Gerald Marwell, & Ruy Teixeira, *A Theory of the Critical Mass, I. Interdependence, Group Heterogeneity, and the Production of Collective Action*, 91 AM. J. SOC. 522 (1985).

function is a good, all-purpose mental tool for deciding how to stack together inputs. Should you study another hour for Property or switch over to Torts? How many people should you invite to your party? Well, you might want to consider what the production function is like for producing comprehension or revelry, respectively.

Of particular interest for our purposes are production functions that are seriously lumpy, that deliver outputs not in smooth, regular increments as units of input are added, but in large irregular jumps after a series of inputs.³ At the extreme is a pure step good that delivers all of its utility in one large chunk or “step.” A standard example is a bridge.⁴ Suppose you need to span a chasm that is a thousand yards long, and the bridge material arrives in one-hundred-yard segments.

Figure 1: The Bridge



As shown in Figure 1, value remains flat as the first nine segments are added, one by one. But then, when the tenth unit is added to create a

³ See, e.g., Michael Taylor & Hugh Ward, *Chickens, Whales, and Lumpy Goods: Alternative Models of Public-Goods Provision*, 30 *POLIT. STUD.* 350 (1982); Russell Hardin, *Group Provision of Step Goods*, 21 *BEHAV. SCI.* 101 (1976); Jean Hampton, *Free-Rider Problems in the Production of Collective Goods*, 3 *ECON. & PHIL.* 245 (1987).

⁴ Of course, bridges can vary widely along many dimensions, and would not literally take a step function. See RUSSELL HARDIN, *COLLECTIVE ACTION* 59 (1982). Still, the bridge offers a good intuitive picture of a step good.

completed bridge, suddenly value steps up all at once. The "step" not only marks out a threshold under which no surplus is provided, but also represents a plateau from which no further incremental improvements are possible. Thus, adding more lengths to the bridge beyond the necessary ten doesn't increase social value further. The trick is to get inputs that reach, but do not exceed, the critical level necessary to gain the big step of value, at least if the bridge is one that is worth building.

Lumpy goods create two problems (not uniquely, but often severely). First, they can be hard to assemble, especially if ownership of the input units is widely dispersed. Land assembly illustrates this point, where different landowners hold essential fragments and any one of them can derail the project by holding out. Public goods that have a step character can also present problems, especially if there are more potential contributors than are required to reach the critical threshold. Everyone will reason, correctly, that her individual contribution is likely to be either futile or superfluous, rather than pivotal.⁵ This structure can keep people from contributing, even when each would benefit from the good in excess of the contribution she is being asked to make.

Second, lumpy goods can be hard to divide. Lumpy or step goods may be the subject of competing claims and may need to be sliced up among disputing parties – a serious problem if such division is technologically impossible or will destroy the good or greatly reduce its value. A vivid example of this problem is the dispute over the baby that featured in Solomon's famous decision.⁶ Babies, it turns out, are extremely lumpy. Luckily, there are alternatives to physical division, and the Solomonic outcome illustrated one of them—an award to the claimant who clearly valued the child more. As the literature on this topic has noted, indivisibilities may be addressed through a variety of techniques, including slicing the good temporally (for example, through rotation systems); converting the indivisible good into something divisible, usually money, as by auctioning it off; giving claimants chances at the good that are proportionate to the strength of their claims; or giving to one claimant while compensating the others.⁷

Temporal slicing is an especially intriguing solution because it addresses a mismatch between the physical configuration that maximizes

⁵ See, e.g., Taylor & Ward, *supra* note 3, at 367-70 (discussing how the chance of being pivotal changes with group size); Ido Erev & Amnon Rapoport, *Provision of Step-Level Public Goods: The Sequential Contribution Mechanism*, 34 J. CONFLICT RES. 401 (1990).

⁶ For work analyzing Solomon's decision, see, e.g., STEVEN J. BRAMS & ALAN D. TAYLOR, FAIR DIVISION: FROM CAKE-CUTTING TO DISPUTE RESOLUTION 6-7 & n.2 (discussing the judgment and citing additional work providing formal analyses); Richard R.W. Brooks, *The Relative Burden of Determining Property Rules and Liability Rules: Broken Elevators in the Cathedral*, 97 NW. U. L. REV. 267, 282 & nn.62-64 (discussing the literature and providing analysis).

⁷ See, e.g., PEYTON YOUNG, EQUITY 13-14 (1994).

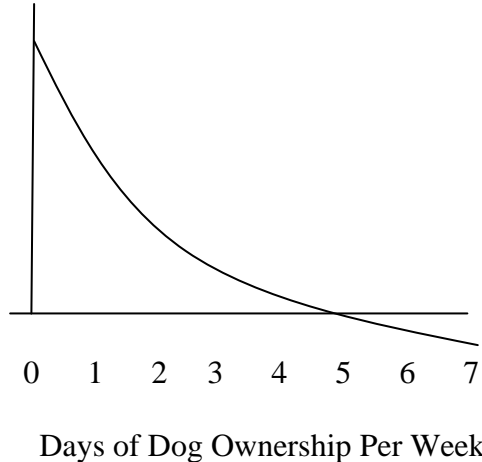
value and the amount of consumption that is optimal for an individual. In other words, it works for goods that are far more valuable when physically intact, when people do not want, and are unwilling to pay for, the whole thing. No formal slicing is necessary if people can agree to share the resource. In some cases we manage to do exactly that.⁸ We form clubs or enter communities to consume certain kinds of indivisible goods—swimming pools, tennis courts, clubhouses, and so on.

In other cases, markets or politics slice things up for us temporally. We have library books divided into lending periods, hotel rooms, rental cars, and so on. These slicings can produce efficiency gains. To illustrate, consider a recent innovation in temporal slicing, pet sharing.⁹ Companion animals, like babies or bridges, are lumpy and can't be physically divided. But the unit in which pets arrive is not necessarily the optimal unit in which their companionship is consumed.

Suppose that for one individual, Angus, dog ownership diminishing marginal returns, as shown in Figure 2.

Figure 2: The Unshared Pet

Marginal Utility of Dog Ownership for Angus



Most forms of consumption exhibit this diminishing marginal pattern.

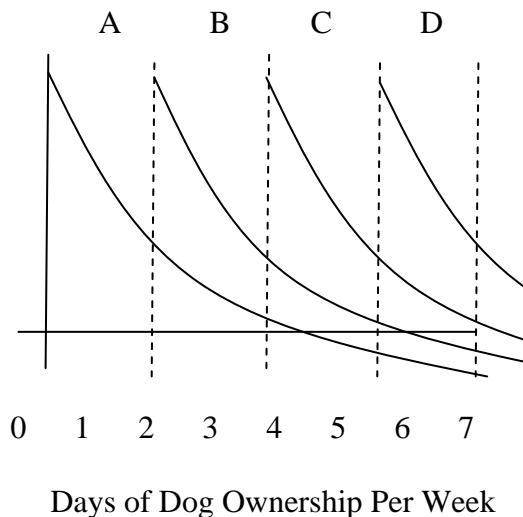
⁸ For some interesting applications of this idea, see Yochai Benkler, *Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production*, 114 YALE L.J. 273 (2004).

⁹ See Lisa Leff, *Busy? Fetch a Friend*, (AP), CHI. TRIB., July 30, 2007.

The second apple produces less utility than the first, and the third produces even less, and so on—and this is one reason you probably buy apples singly, or in small bags, rather than by the bushel or truckload. Indeed, we can view the utility function as a type of production function, here expressed in marginal terms, if we think of people as little factories that take in consumption units and generate utility.¹⁰ So for Angus, the dog is great fun for a few days a week, but the burden continues to grow as the week wears on and the benefits diminish accordingly, eventually producing marginal disutility as shown here. If the temporal units of Angus's dog ownership that produce the small marginal improvements on the righthand side of the dogweek could be lopped off and delivered to three additional individuals (Beth, Cam, and Doris) with identical utility functions, as shown in Figure 3, total utility can be increased.

Figure 3: The Time-Share Pet

Marginal Utility of Dog Ownership
for Angus, Beth, Cam, and Doris



There may be problems, of course. People may try to shirk on bathing the dog or taking him to the vet. A likely solution is to make the party serving up the time slices responsible for these duties, with costs to be split among the time-sharers. And there may be other disadvantages (for society, if the dog never gets properly trained, or for the dog's utility, if the constant

¹⁰ Cf. Herbert Hovenkamp, *Knowledge About Welfare*, 84 MINN. L. REV. 805, 831-32 (2000) (analogizing people to productive "plants" that require certain inputs to function efficiently).

parade of owners produces anxiety or confusion). But putting aside such spillovers, fragmenting an interest is efficient if the separately held slices are more valuable, in the aggregate, than the unified whole—after subtracting out the transaction costs associated with reconfiguration. This is a general point that goes beyond the case of physically indivisible goods. Even when we have something that is readily divisible, like a cake, it may be more valuable when split among different claimants—and splitting it up may not be entirely free of trouble.

II. DIFFICULTIES, AND OVERCOMING THEM

Now that we have a sense of why reconfiguration might add value, why is it often so hard to accomplish? And what can we do about it? Slicing and lumping problems both begin the same way: with a resource that is, at least allegedly, suboptimally configured. Two basic things are involved in any reconfiguration of that resource. First, the consent of those with stakes in the resource must either be obtained or overridden. Second, surplus from the reconfiguration must be divided up somehow. The two elements may occur simultaneously. For example, when a developer buys up parcels of land to assemble a large, unified tract, the same purchase prices that buy consent to the reconfiguration also parcel out the share of surplus each fragment-holder receives.¹¹ In other instances, consent is gathered up or overridden before the surplus is divided. Parties may consent to a reconfiguration based on a protocol for dividing up surplus, before they know exactly how much surplus each of them will get. To take another example, exercise of eminent domain first overrides consent and then, through compensation payments, determines how surplus is split up. But one way or another, both steps are required.

Here we can see that every problem of aggregating entitlements also involves splitting up something—surplus. For example, if two parcels of land are worth \$500,000 each, but worth \$1.5 million when joined together, there is an assembly surplus of \$500,000 that must be divided somehow between the parties who own the two parcels. Likewise, every problem of splitting that involves multiple claimants can also be conceptualized as a problem of aggregation, at least if the consent of each claimant to the split in question is an explicit or implicit condition of the slicing operation. For example, suppose a law firm wants to offer part-time jobs to associates – a tricky bit of slicing that will require subdividing both workloads and pay. This operation will only succeed if both the firm and the associate agree to

¹¹ Shares of the surplus may also be provided in kind, as where fishers participate in fragmenting a previously unified fish population. See Jonathan Remy Nash, *Allocation and Uncertainty: Strategic Responses to Grandfathering* (working paper, Feb. 7, 2008 draft, 29 n.82 (noting that fishers lose their "undivided ownership interest" in the captured fish, but gain individual ownership rights in those fish).

the new combination. Aggregating these two consents requires, in turn, finding a mutually agreeable way of splitting up the surplus the new arrangement will produce.

Already we see one potential sticking point: getting consent to a reconfiguration can be difficult, especially if many parties hold stakes in the resource as presently configured. If entitlements in the existing arrangement are protected by what Calabresi and Melamed term "property rules," no one has to agree to a change unless she decides to do so, at a price she finds agreeable.¹² This means each party effectively holds a veto power over the reconfiguration. Parties may behave strategically, each trying to squeeze a larger share of the surplus for herself by threatening to withhold consent to the change.

Law has at its disposal ways to counter this stickiness. Law can instead use "liability rules" to protect entitlements, allowing the entitlements to be taken away without consent, upon payment of an amount determined by a third party such as a court or agency.¹³ Eminent domain is a classic example. With liability rules in society's quiver, slicing and lumping doesn't seem hard at all. It is possible to reach a new configuration by simply overriding consent and mandating some division of the resulting surplus. So why not *always* do that? There are a few reasons, but one is particularly relevant to this discussion: The tool that society uses to overcome the bad stickiness of strategic behavior can also cut rather indiscriminately through the good stickiness that keeps losing reconfigurations (that is, those that are actually inefficient) from occurring. When a purchase occurs, we assume that the owner of the fragment would not part with the entitlement unless she received something that she valued more highly in exchange. When the sale is forced, we can't be sure. That's because payment is typically based on a third party's valuation, which might not compensate the fragment holder at her true valuation. This is not just a fairness issue, but also an efficiency problem as well—the assembly may not be moving the fragment to a higher-valuing user.

A property rule regime where consent is required provides a check on whether the entitlement rearrangement will actually produce social value. So it blocks the bad reconfigurations, but also possibly some of the good ones. Overriding consent produces the opposite risk, that bad reconfigurations will make it through the screen along with the good reconfigurations.¹⁴ This is a basic tradeoff seen in many areas of law: between false positives and false negatives.

¹² See Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092, 1106, 1116 (1972) (discussing property rules).

¹³ See *id.* at 1092, 1108-09 (discussing liability rules).

¹⁴ See Richard A. Epstein, *A Clear View of The Cathedral: The Dominance of Property Rules*, 106 YALE L.J. 2091 (1997) (discussing the inverse risks of property rules and liability rules).

Consider land assembly. Suppose Fran holds one of the property fragments essential to an development project by a would-be assembler, Arnie. When Fran refuses to sell—even when Arnie raises his offer to three and even four times the fair market value of Fran's fragment—how should we interpret her resistance? It could be an entirely honest expression of the fragment's value to her. If so, and if Arnie is unwilling to pay a price Fran will accept, then assembly would not have been efficient, and no inefficiency results when it fails to materialize. In other words, Fran may not be a holdout, but rather what Gideon Parchomovsky and Peter Siegelman have dubbed a "holdin"—someone whose refusal to sell is based on an honest subjective valuation.¹⁵

On the other hand, perhaps Fran really is a holdout whose price resistance is merely a ploy designed to garner a larger share of the surplus that will be generated by the assembly of the fragments. She may be bluffing when she turns down offer after offer from Arnie. If the bluff works, she may be able to extract a great deal of the assembly surplus. If Fran's bluff doesn't work, however, her artificially-high reservation price (or strategic refusals to deal) may prevent assembly of the interests in the hands of the higher-valuing Arnie. A liability rule would allow the deal to go through, which is the efficient result if Fran is just a holdout, but not if she's a holdin.

Our dilemma is clear enough. The property rule (consent required) regime might make reconfiguration too hard, but the liability rule (consent overridden) regime might make reconfiguration too easy. If we have to pick between too hard and too easy, what should we do? In particular contexts, there may be non-efficiency reasons that push us one way or another. But if we're making the call on efficiency alone, we might wonder about transaction costs in general and the potential for strategic holdout behavior in particular.

In competitive markets, we don't worry about a reconfiguration failing due to holdout pressure. If a hardware store resists selling me a sprocket that is crucial to getting my bicycle running again in an effort to squeeze more surplus from the deal, a competitor likely stands ready to sell instead. But many slicing and lumping situations involve unique goods like land, where good substitutes aren't readily available. Even in these cases, though, we can draw some distinctions. To hint at the intuition, compare a jigsaw puzzle, which might be enjoyed (albeit suboptimally) by a group of children even if one of its unique pieces is missing, with an electronic toy that just won't do anything entertaining without all its batteries. The difference is in the degree of complementarity among the elements, something that we can

¹⁵ See Gideon Parchomovsky & Peter Siegelman, *Selling Mayberry: Communities and Individuals in Law and Economics*, 92 CAL. L. REV. 75, 128–29 (2004).

capture by returning to production functions. Consider a prototypical assembly project—buying land to build a railroad. If we assume only one viable route, the railroad project is like the bridge in Figure 1—we need all the pieces or we have nothing of value. In other words, it is a step good.

The shape of the production function for, say, a shopping mall project might be significantly different. Even if the land assembler has her eye on a specific set of ten parcels ideally suited for the mall, she will probably be able to obtain most of the surplus associated with the project by assembling less than all ten parcels—whether by choosing a different site, building around troublesome holdouts, building a smaller mall, or changing the physical design. These possibilities make holding out risky—if one is really doing it for strategic reasons, one may end up stuck with the property rather than with a hefty share of surplus. Of course, some sites may be so unique and so well-located—say, in the heart of a particular urban neighborhood—that there is simply no good substitute elsewhere. But the basic intuition here is a helpful one. Other things equal, the lower the chance of a holdout, the less risky it is to insist that everyone involved consent to the reconfiguration.

What should we do in cases where holdouts present a real threat, or other sorts of transaction costs loom large? Ideally, we want a "just right" solution between the "too hard" of property rules and the "too easy" of liability rules. One possibility is to come up with a protocol for dividing surplus, and get the parties to consent to that protocol rather than to individually negotiated payouts. A familiar example is the algorithm for dividing a cake between two kids.¹⁶ Player 1 cuts the cake into two pieces, and Player 2 decides which piece to take. By making the pieces equal in her own eyes, the cutter insures that she will receive what she views as half the value of the cake. The same basic approach, with a few modifications, can be used to divide up marital property or inherited estates.

The solution is not perfect. Suppose the cake is heterogeneous – different portions of it feature different colors and flavors. If the divider knows that the chooser is crazy about lime green cake, for example, she might strategically cut the cake into two pieces of very unequal size: one containing only the lime portion, and the other containing the balance of the cake. This is a little risky, though, assuming the cutter doesn't care much for lime. The chooser might go with the bigger segment and stick the cutter with the lime sliver for spite. So if parties are somewhat risk averse, they

¹⁶ Cake-cutting games have been explored extensively in the literature. See, e.g., BRAMS & TAYLOR, *supra* note 6, at 8–29 (discussing cake-cutting and other cut-and-choose games); WILLIAM J. BAUMOL, *SUPERFAIRNESS: APPLICATIONS AND THEORY* 15–16 (1986) (describing solutions to cake-division problems); JOHN RAWLS, *A THEORY OF JUSTICE* 85 (1971) (describing a cake division exercise in which the person cutting will receive the last slice); Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement To Facilitate Coasean Trade*, 104 *YALE L.J.* 1027, 1034, 1072 & n.133 (discussing cake-cutting examples).

will feel some pressure toward an honest division.

Division-of-surplus protocols can also be used to assemble entitlements, such as contributions to a public good. I mentioned before that people might be reluctant to contribute to a step good like a bridge because they know how unlikely it is that their contribution will be pivotal, rather than futile or superfluous. To address this problem, contributions can be made conditional on enough others contributing (and refunded otherwise) so that the fear of making a futile contribution is eliminated. Likewise, refunds can be promised to all who contributed if too much is collected, so that nobody will fear making a superfluous contribution. Doug Lichtman has discussed a similar idea for getting around holdout problems in the patent field: a sort of "most favored nations" clause, whereby a licensee who needs to assemble patent rights promises each patent holder that nobody else will get a better deal.¹⁷ This bundles together any extension of surplus to one fragment holder with a parallel extension of surplus to all others. Somewhat similar ideas for dealing with land assembly have been proposed.¹⁸

Another technique, used for dissolving a partnership and consolidating the shares in one of the partner's hands, is known as the "Texas Shootout."¹⁹ It works like this: Partner 1 states how much one half of the enterprise is worth to her. Partner 2 then has a choice. He can buy out Partner 1's interest at that price. This amounts to exercising a call option or forced sale. Alternatively, he can demand that Partner 1 pay that much to buy out his own (Partner 2's) share. This amounts to exercising a put option or forced purchase. The Shootout, like the cake-cutting technique, relies on keeping the person who devises the payoffs from knowing which payoff she will receive.

These techniques are part of a family of self-assessed valuation mechanisms that have received attention from a number of legal scholars.²⁰ The basic idea behind all these techniques is simple: the person whose entitlement is at stake decides what it is worth. In the example just given, uncertainty about whether one will emerge as the buyer or the seller of the

¹⁷ Douglas Gary Lichtman, *Patent Holdouts in the Standard-Setting Process* 11-12 (May 2006), U Chicago Law and Economics, Olin Working Paper No. 292, available at SSRN: <http://ssrn.com/abstract=902646>.

¹⁸ See, e.g., Michael A. Heller and Roderick M. Hills, Jr., *The Art of Land Assembly*, HARV. L. REV. (forthcoming 2008), available at SSRN: <http://ssrn.com/abstract=1082491>; Amnon Lehari & Amir N. Licht, *Eminent Domain, Inc.*, 107 COLUM. L. REV. 1704 (2007).

¹⁹ See Richard R.W. Brooks & Kathryn E. Spier, *Trigger Happy or Gun Shy? Dissolving Common Value Partnerships with Texas Shootouts* (June 4, 2004) (unpublished manuscript), available at <http://www.ssrn.com/abstract=556164> (presenting a formal analysis of the technique and discussing past and ongoing work on this device and related methods of incentive-compatible valuation); see also Saul Levmore, *Self-Assessed Valuation Systems for Tort and Other Law*, 68 VA. L. REV. 771, 838-43 (1982) (discussing the potential for self-assessed valuation in partnership dissolution cases).

²⁰ See, e.g., Levmore, *supra* note 19; Richard A. Epstein, *Holdouts, Externalities, and the Single Owner: One More Salute to Ronald Coase*, 36 J.L. & ECON. 553, 582-84 (1993); Michael Abramowicz, *The Law-and-Markets Movement*, 49 AM. U. L. REV. 327, 364-73, 389-93 (1999); Abraham Bell & Gideon Parchomovsky, *Takings Reassessed*, 87 VA. L. REV. 277, 300-06 (2001);

entitlement creates offsetting pressures toward honesty. There are other ways to produce those dual pressures. The law of general average contribution in admiralty required merchants to place values on their shipments, which had two implications.²¹ First, if the shipment was lost at sea, the stated value would be the basis for compensation. Second, if someone else's shipment was lost at sea, the stated value would be the basis on which one would pay an assessment to compensate the owner of the lost shipment. Value the goods too low, and they're the first to be tossed into the sea in the case of a storm, and one receives too little compensation. Value the goods too high, and they stay on the boat, but you may get stuck with a big bill for compensating someone else.

Such mechanisms could, of course, be made mandatory rather than voluntary, overriding the ability to block the transfer but offering greater control over its price. One variant has been much-discussed in the eminent domain context—allowing homeowners to state the value of their homes for purposes of both property taxation and eminent domain compensation.²² Assess your property at too high a value, and you have to pay too much tax. Assess it too low, and you risk losing the property at a price that is inadequate. An idea like this presents many additional concerns, of course, as those writing on the topic have well noted. But the idea of devising a mechanism capable of eliciting truthful valuations is intriguing, and could have important applications to legal problems.

III. LEGAL LUMPS

Next, I want to move our focus outward from individual slicing and lumping situations to consider the legal implications of thinking in slices and lumps. First and most obviously, law can play a role in making it easier or harder to slice up unified things or lump together fragmented things. It can do so by overriding consent or establishing protocols for transferring entitlements. The tax system, for example, mandates contributions, which ensures that enough money will be aggregated to purchase public goods with step functions, such as bridges. Eminent domain allows certain kinds

²¹ My description of this device is based on Epstein, *supra* note 20, at 582–84; and Levmore, *supra* note 19, at 860 n.214. See also *Barnard v. Adams*, 51 U.S. 270 (1850) (discussing and applying the doctrine of general average contribution).

²² See, e.g., T. Nicolaus Tideman, *Three Approaches to Improving Urban Land Use* 52-69 (1969) (Unpublished PhD dissertation, U Chicago), 1969; Levmore, *supra* note 22, at 778-90; Daniel M. Holland & William M. Vaughn, *An Evaluation of Self-Assessment Under a Property Tax*, in *THE PROPERTY TAX AND ITS ADMINISTRATION* 79 (Arthur D. Lynn, Jr., ed. 1969); Thomas S. Ulen, *The Public Use of Private Property: A Dual-Constraint Theory of Efficient Governmental Takings*, in *TAKING PROPERTY AND JUST COMPENSATION: LAW AND ECONOMICS PERSPECTIVES OF THE TAKINGS ISSUE* 163, 182-83 (Nicholas Mercuro ed., 1992). A version of this approach has been used in Taiwan, as discussed in Yun-Chien Chang, *Accurate Assessment of Just Compensation? An Empirical Study of Ex Ante Assessments by Taiwan's Data* 9-11 (2007) (unpublished manuscript, on file with author).

of aggregations to occur more easily by substituting a liability rule for a property rule. Legal rules covering the partition of concurrent estates address the slicing of property interests (with the choice between partition in kind and partition by sale often being guided by the "lumpiness" of the land). Employment rules, such as those covering overtime pay, encourage particular slicings of jobs.

Even when parties accomplish their own lumping or splitting through contract, law has a role to play in determining whether the configuration agreed upon by the parties will be realized. For example, a talented and popular actor who performs for an entire season of a television show or an entire run of a play may generate many times more surplus than if she quits halfway through. Contracts seem capable of outlining just such a commitment, but what is to stop the actor from threatening to walk off the project partway through unless the contract is renegotiated on terms more favorable to him? Indeed, this is exactly what James Gandolfini, star of *The Sopranos* did a few years ago (it worked – he got more money).²³ By specifying contract remedies, the law has something to say about this as well.²⁴

Very often, law speaks to circumstances, conditions, or occurrences that have a "lumpy" or even "step good" quality.²⁵ A fishery remains sustainable or it enters a death spiral. A species of animal experiences a population crash, or it doesn't. Pollution is kept below a critical threshold, or it moves above it, generating catastrophic results. Law's task is to aggregate the necessary units of care or forbearance (whether by obtaining consent or overriding it) so that the unwanted result is avoided. And it must also split up the surplus (or, put differently, the costs avoided) associated with the change. This is easier said than done.

One complication occurs when the inputs involved are themselves lumpy—binary, indivisible choices that actors must make or not make. To use an example provided by Thomas Schelling, suppose that optimal control of a disease requires that 90% of the population receive a vaccination.²⁶ If it's not possible to be 90% vaccinated—only 0% or 100%—then requiring that everyone be vaccinated overdoes things, but letting people choose for themselves may lead to too little vaccination. To reach its goal, society must find a way to aggregate or override consent for 90% of the population, and distribute the surplus that is thereby produced. The benefits of disease control go to society generally, including those who fail to get vaccinated.

²³ This is one of several examples discussed in Steven Shavell, *Contractual Holdup and Legal Intervention*, 36 J. LEGAL STUD. 325, 327-28 (2007). Gandolfini's per episode pay was reportedly increased from an initial contractual level of \$400,000 to over \$800,000. See CNN, 'Sopranos' Kingpin Set for Raise, Mar. 18, 2003, <http://www.cnn.com/2003/SHOWBIZ/TV/03/18/television.sopranos.reut/>.

²⁴ See, e.g. Shavell, *supra* note 23.

²⁵ See, e.g., Taylor & Ward, *supra* note 3.

²⁶ THOMAS C. SCHELLING, MICROMOTIVES AND MACROBEHAVIOR 222-23 (1978).

One approach would be to auction off a limited number of no-vaccination permits and spread the proceeds among those who get the vaccination.

Consider another example. On a dark highway, a bicyclist and an automobile are together striving (with the law's encouragement) to produce a valuable good—crash-free coexistence. Their contributions to that result may not only be interdependent, but lumpy as well. If the bicyclist will wear a reflective helmet, the motorist may be able to maintain a higher speed than otherwise. Conversely, if the motorist has installed super-effective brakes on the car, the bicyclist may be able to dress all in black and veer playfully around the road without any accident occurring. Some inputs, like the kind of brakes on the car or wearing a protective helmet are binary investments in safety that an actor either makes or doesn't make, while others, like speed or distance from the curb, are continuous variables.

The law obviously has a lot to say about how contributions to safety get split up and how surplus from gains in safety get divided. But in deciding whether to leave parties to make their own calculations, or to mandate, tax, or subsidize particular inputs, law should be cognizant of lumpiness. One party's precautions may be selected from a continuous menu (e.g., choosing how close to the curb to ride or how fast to drive) while the other's come in discontinuous lumps (like buying antilock brakes or a special flashing helmet). In addition to finding the cheapest cost avoider (to use Calabresi's phrase),²⁷ then, it may be important to identify who is the cheapest precaution slicer – the party best able to scale the care inputs to avoid an accident.

Those examples might be categorized as the law *of* lumps. But choices must also be made about how lumpy or thinly sliced law itself will be. Law can tether together a variety of circumstances and prescribe a single response, or it can be sliced up to apply differently to different circumstances.²⁸ To tie this to our discussion of production functions, we might ask how a law's performance on dimensions like clarity, salience, administrability, and effectiveness tracks changes in the range of circumstances it covers. This way of putting things focuses on how input units of law are stacked together to produce outcomes, like law and order, in the world. But we might also think about law as an output, and ask about the relative costs of producing five special purpose laws versus one multi-purpose law. The calculus here may line up in some ways with choices about how many flavors of Pop Tarts to produce, given the costs of setting up the machinery to make each distinct variety.²⁹

²⁷ See GUIDO CALABRESI, *THE COSTS OF ACCIDENTS* 136–38 (1970).

²⁸ Law may also bundle together its treatment of different parties, as when a tort victim receives what the injurer is required to pay. Pierre Schlag, *The Problem of Transaction Costs*, 62 S. CAL. L. REV. 1661, 1670-71 (1989).

²⁹ See JOEL WALDFOGEL, *THE TYRANNY OF THE MARKET: WHY YOU CAN'T ALWAYS GET WHAT YOU*

One interesting and important choice is whether law arrives from the factory (legislature) presliced, so that rules of limited and precise applicability are generated, or whether instead the slicing is done in the field, through choices about application and enforcement. The lumping and slicing of law itself is a little different than that of private property entitlements, in that the protocol under which these reconfigurations takes place is typically political in nature, so that unanimous consent is not required for a change. Still, efficient lumping and slicing may be easier or harder in some contexts than in others, and we might want to know what institutional body is in the best position to do the job.

Slicing and lumping even comes into play in theorizing about law. Property scholars love to debate whether property is better conceptualized as a broad exclusion right wrapped around a clumpy thing, or as a bundle of sticks that can be mentally and legally disaggregated at will. Another subject of debate is why property comes in a limited menu of forms—the *numerus clausus*—rather than allowing open-ended customization.³⁰ By deciding what counts as property and what shapes and sizes it can come in, these debates influence how producers and consumers of law will interact with resources.³¹

There is much more to say on this topic, but the points are fairly simple: Law is itself often lumpy, the conditions that it seeks to bring about are often lumpy, and the inputs that people might use to contribute to these conditions are often lumpy.

IV. YOU AND YOUR OTHER SELVES

In the remaining time, I want to turn the discussion of slices and lumps inward to focus on intrapersonal problems of aggregation and division. Rarely do we see the twin problems of aggregating consent and dividing surplus as clearly presented as when people interact with their future selves.³² Suppose I would like to get into shape, and doing so will require

WANT (2007) (discussing impact of high fixed costs on the varieties of goods that are available).

³⁰See, e.g., Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The Numerus Clauses Principle*, 110 YALE L.J. 1 (2000); Henry Hansmann & Reinier Kraakman, *Property, Contract, and Verification: The Numerus Clauses Problem and the Divisibility of Rights*, 31 J. LEGAL STUD. 373 (2002); Bernard Rudden, *Economic Theory v. Property Law: The Numerus Clausus Problem*, Oxford Essays in Jurisprudence, 3d Series, 237, 249-63 (John Eekelaar & John Bell, eds., 1987); Nestor Davidson, *Standardization and Pluralism in Property Law* (unpublished draft, on file with author; presented at the 2008 Annual Meeting of the Association of American Law Schools).

³¹Nestor Davidson's focus on property types as "regulatory platforms" would be consistent with a producer-focused explanation of the *numerus clausus*. See Davidson, *supra* note 30.

³²The literature on intrapersonal dilemmas is vast and growing. For background on the topic, see, e.g., GEORGE AINSLIE, *PICOECONOMICS: THE STRATEGIC INTERACTION OF SUCCESSIVE MOTIVATIONAL STATES WITHIN THE PERSON* (1992); JONATHAN BARON, *THINKING AND DECIDING* 463-88 (3d ed. 2000); THOMAS C. SCHELLING, *STRATEGIES OF COMMITMENT AND OTHER ESSAYS* 63-124 (2006); JON ELSTER, *ULYSSES UNBOUND* 1-87 (2000).

me to exercise four days each week for the next year, something I find attractive as a general concept but aversive in the actual implementation. In one sense, we have a problem of aggregation. I need to aggregate bits of distasteful physical activity to produce a desired result. But it is also a problem of dividing up that activity among my temporal selves.

My selves are crafty, and each of them will come up with lots of reasons why “their” day should be one when I don’t have to exercise. Moreover, none of my selves will get to enjoy my new physical fitness until several months hence. Why, my today-self may say, should I work for free? What’s in it for me? Granted, I have a continuing identity that links my today-self with my one-year-hence self, but it’s not clear how close that relationship really is, as Derek Parfit’s work has explored.³³ There’s a further problem as well. The surplus that will be produced may well take some kind of a step shape. My today-self knows that tomorrow-and-tomorrow-and-tomorrow-selves are not really that reliable at going to the gym. If I just go a few times and then quit, it’s all for nothing, a half-built bridge.

I might, then, try to turn over some of the work to a third party charged with implementing the improvement plan, coordinating the efforts of all my selves and splitting up the surplus among them. But how can a third party enforce such a plan? Interestingly, Stephen King (the horror writer) and Ian Ayres (the Yale law school professor) have both taken a crack at answering this question. In Stephen King’s short story, “Quitter’s, Inc.,”³⁴ the protagonist is referred to a rather secretive clinic that boasts a wonderful success rate for getting people to stop smoking and lose weight. Its methods turn out to involve punishing lapses with physical violence against the client’s loved ones—electric shocks, beatings, and eventually, slicing off fingers. In other words, each temporal self faces sanctions from a third party enforcer for failing to cooperate with the other selves.

Ayres, along with cofounders Jordan Goldberg and Dean Karlan, has started a company (called StickK) that is also designed to help you keep your commitments to your self, such as losing weight or quitting smoking.³⁵ The Ayres plan also involves a third party enforcer, albeit one wielding a much smaller and more palatable stick. It works like this: You sign a contract and entrust money that will be returned to you only if you keep your commitment. Otherwise, the money goes to charity (but not a charity that you get to pick). Indeed, you can select an “anti-charity” or even a disliked individual who will get your money if you don’t keep your commitment.³⁶

³³ DEREK PARFIT, REASONS AND PERSONS 314-15 (1984).

³⁴ Stephen King, *Quitter’s Inc.*, in NIGHT SHIFT (1978).

³⁵ StickK, <http://www.stickk.com>.

³⁶ See <http://www.stickk.com/faq.php#stakes>

Now this is a far cry from electric shocks, but it still seems rather hard on the selves. The current self is deprived of money right now *and* asked to participate in an aversive self-improvement scheme. If the plan succeeds, the future self gets both the money and the improvement. If the plan fails, the future self loses the money (perhaps seeing it go to a hated destination), and doesn't get the improvement either. Of course, the whole scheme is undertaken and agreed to by a version of one's current self—but one that is relieved of any of the actual heavy lifting. Hersh Shefrin and Richard Thaler have distinguished between the "planner" self and the "doer" self.³⁷ The "planner" self has longer-range preferences, and tries to find a way to get the current "doer" self to fulfill those preferences. When the planner casts about for a precommitment tool, sticks are a natural choice. But the stick may smash down on the head of the future self, who is already suffering from the failure to meet a desired goal.

Thinking about the problem in light of the two reconfiguration steps—aggregating or overriding consent, and dividing surplus—may point us to other alternatives. Rather than threaten the present self with a bad outcome if she doesn't participate in the self-improvement scheme (something akin to trying to override consent) while leaving all the surplus with the future self, perhaps consent to the scheme could be bought from the present self by the future self. In other words, maybe we could have something that is more like a CarrotK.

Suppose I want to maintain an exercise regimen. I create a savings account that essentially works like a certificate of deposit, locking up the funds until a specified future date. However, I authorize a third party enforcer to access the fund for one reason: to reward my current self, in preapproved amounts provided at prespecified intervals, for sticking to the exercise goals. If the current self doesn't go to the gym, the money stays where it is, and the future self gets to enjoy it. Thus, the current self gets compensated for compliance, and the future self gets either the improvement or the money. A current self who is running short of cash would now have a powerful motive to go to the gym, so as to free up money that is under the control of the third party enforcer. It's certainly open to empirical question how effective this carrot would be; it might depend on the current self being fairly liquidity constrained. But, at a minimum, it means that people who both fail to exercise and fail to save will now succeed at one task or the other. It's even possible that people could succeed at both: The compliant current self, feeling virtuous for having met that week's exercise goal, might save the reward money rather than spending it.

³⁷ Hersh M. Shefrin & Richard H. Thaler, *The Behavioral Life-Cycle Hypothesis*, 26 *ECON. INQUIRY* 609, 611-12 (1988).

One more possibility deserves a quick mention. The law might assist people in making precommitments and sticking to them. In Illinois, for example, people can put themselves on a self-exclusion list that bans them from casinos or from collecting lottery winnings.³⁸

We could imagine more fine-grained versions of this idea. Jay Bhattacharya and Darius Lakdawalla proposed a voluntary smoking license that smokers could obtain to make buying cigarettes more expensive.³⁹ My variation on this idea would be a "choose your own sin tax."⁴⁰ Under this plan, the state *requires* people to have a license (really a "smart card") in order to buy cigarettes. To get a license, you have to choose a cigarette tax (it can be zero, or any positive percentage, and it can be increased by the smoker at any time—say, during moments of regret about smoking). The tax money goes into escrow to pay for any smoking-related illnesses that the smoker develops. But the smoker can get it back out in a lump sum, at any time, if she relinquishes her smoking license. The idea here is to impose on the current self a Pigovian tax—a tax designed to make up for the externality that self is imposing on others.⁴¹ As soon as the imposition stops and the imposed-upon (nonsmoking) self comes into being, that self is entitled to the proceeds of the tax.

There are many other design details that would have to be hammered out, including the process for getting a license reissued or your self-imposed tax lowered. But the idea of using law in creative ways to help people tackle intrapersonal aggregation is well worth exploring.

CONCLUSION

Slicing and lumping problems are everywhere. You knew that, even before the talk. What I've tried to add is an appreciation for the structure of these problems, some tools for spotting them in unexpected places, and some ideas for how to address them.

³⁸ See Illinois Gaming Board, Statewide Voluntary Self-Exclusion Program for Problem Gamblers, <http://www.igb.state.il.us/selfxclude/>. People who place themselves on such self-exclusion lists are usually (although not always) deterred from gambling. See Ted Gregory, *What Happens at Elgin Casino Stays at Elgin Casino, Man Finds*, Chi. Trib., Aug. 17, 2007, p.1 (reporting on man who won \$22,000 which he was not allowed to cash out because he had enrolled in the state's self-exclusion program). Private casinos can also offer such self-exclusion services, as Harrah's has. See <https://www.harrahs.com/harrahs-corporate/about-us-responsible-gaming.html>, discussed in TIM HARFORD, *THE LOGIC OF LIFE* 61 (2008).

³⁹ Jay Bhattacharya & Darius Lakdawalla, *Time-Inconsistency and Welfare* (Nat'l Bureau of Econ. Research, Working Paper No. 10345, 2004) available at <http://www.nber.org/papers/w10345>.

⁴⁰ See Lee Anne Fennell, *Revealing Options*, 118 HARV. L. REV. 1399, 1483-85 (2005).

⁴¹ See, e.g., Maureen L. Cropper and Wallace E. Oates, *Environmental Economics: A Survey*, 30 J Econ Literature 675, 680 (1992) (defining a Pigovian tax as "a levy on the polluting agent equal to marginal social damage").