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Smooth and Bumpy Laws

Adam J. Kolber*

Modest differences in conduct can lead to wildly different legal outcomes. A person deemed slightly negligent when harming another may owe millions of dollars. Had the person been just a bit more cautious, he would owe nothing. Similarly, when self-defense is deemed slightly negligent, a person may spend several years in prison. Had the person been just a bit more cautious, he would have no criminal liability at all. Though the law must draw difficult lines, the lines need not have such startling effects. We can adjust damage awards and the severity of prison sentences anywhere along a spectrum.

A legal input and output have a “smooth” relationship when a gradual change to the input leads to a gradual change to the output. The prior examples are not smooth but “bumpy”: a gradual change to the input sometimes dramatically affects the output and sometimes has no effect at all. The law is full of these bumpy relationships that create hard-to-justify discontinuities.

In this Essay, I discuss the relative advantages of smooth and bumpy legal relationships and explain how the choice of an input-output relationship differs from the choice between rules and standards. I argue that smooth relationships will often create less “rounding error” than bumpy relationships by more closely approximating our underlying moral norms.

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Introduction.....	656
I. Continuous and Discrete Variables	659
II. Input-Output Relationships	661
A. Smooth Relationship (Continuous Input and Continuous Output)..	661
B. Bumpy Relationship (Continuous Input and Discrete Output)	662
C. Lockstep Relationship (Discrete Input and Discrete Output)	664
D. Random Relationship (Discrete Input and Continuous Output)	665
E. Rules and Standards	666
F. Summary	668
III. Choosing a Relationship.....	669
A. Step 1: Identify the Underlying Normative Theory	669
1. Punishment Should Be Smooth, But Criminal Law Is Often Bumpy.....	670
2. Tort Theory Should Perhaps Be Smooth, But Tort Law Is Often Bumpy	673
3. Laws Governing Other Laws Are Often Not Smooth.....	675
4. Bargaining Will Generally Not Smooth Substantive Law	677
5. Factual Uncertainty Is a Tough Call	678
B. Step 2: Craft Law to Match Theory as Closely as Possible	681
1. Bumpy Needs.....	681
2. Trading Off Accuracy with Other Goals.....	682
C. Step 3: If Necessary, Rely on Generalizations.....	683
1. Considerations Generally Favoring Smooth Laws.....	683
a. Incentives	683
b. Treating Similar Cases Similarly	684
c. Preserving Morally Relevant Information.....	685
d. Historical Trend	685
2. Considerations Generally Favoring Bumpy Laws	687
a. Cost and Administrability	687
b. Bumpy Needs and Law Governing Law	687
3. Context-Dependent Considerations	688
a. Human Psychology	688
b. Political Compromise.....	689
D. Summary.....	689
Conclusion	690

INTRODUCTION

The law examines aspects of our conduct that vary along a spectrum. We can act extremely carefully, extremely carelessly, or anywhere in between. We can culpably cause harms that are de minimis, disastrous, or anywhere in between. But even when our conduct is best understood along a spectrum, the law has a limited number of responses: we either owe full compensation or

none at all; we are either convicted and subject to at least a minimum sentence or acquitted and free to go home.

Everyone knows the law draws difficult lines. But why must line drawing have such startling effects? A slightly incautious driver who causes an accident may owe millions of dollars. Had he been a bit more cautious and still been in an accident, he'd owe nothing. A man who has sex with a woman negligently believing she consents may be convicted of rape and sentenced to several years in prison.¹ Had he made the same mistake but been slightly more cautious, he might have had no criminal liability whatsoever. In both cases, small changes to an input (level of caution or reasonableness of belief) can lead to a dramatically different outcome. These results are puzzling because we can fine-tune damage awards and the severity of prison sentences anywhere along a spectrum.

While scholars have sometimes recognized the all-or-nothing nature of legal outputs,² they have largely failed to consider the relationship between legal inputs and outputs. An input and output have what I call a "smooth" relationship when, as the input gradually changes, the output gradually changes. By contrast, an input and output have what I call a "bumpy" relationship when a gradual change to the input sometimes dramatically affects the output and sometimes has no effect at all.

Whether a relationship is smooth or bumpy is important because smooth relationships often do a better job of preserving morally relevant information than do bumpy relationships. For example, when tort law converts a continuous input like level of caution into a discrete output like "owes full compensation," the bumpy relationship causes us to lose seemingly valuable information about just how incautious a person was. At least until we reach the point of punitive damages, we have to pigeonhole various levels of caution into one of two results: no compensatory obligation or a full compensatory obligation.

1. See, e.g., State in the Interest of M.T.S., 609 A.2d 1266, 1279 (N.J. 1992); JOSHUA DRESSLER, UNDERSTANDING CRIMINAL LAW 585 (6th ed. 2012) ("[T]he general rule is that a person is not guilty of rape if he entertained a genuine and reasonable belief that the female voluntarily consented to intercourse with him.").

2. See, e.g., LEO KATZ, WHY THE LAW IS SO PERVERSE 139–81 (2011); Michael Abramowicz, *A Compromise Approach to Compromise Verdicts*, 89 CALIF. L. REV. 231 (2001); Larry Alexander, *Scalar Properties, Binary Judgments*, 25 J. APPLIED PHIL. 85, 95–96 (2008); Stephanos Bibas, *Plea Bargaining Outside the Shadow of Trial*, 117 HARV. L. REV. 2463 (2004); John E. Coons, *Approaches to Court Imposed Compromise—The Uses of Doubt and Reason*, 58 NW. U. L. REV. 750 (1963); John E. Coons, *Compromise as Precise Justice*, 68 CALIF. L. REV. 250 (1980); Lee Anne Fennell, *Lumpy Property*, 160 U. PA. L. REV. 1955 (2012); Douglas N. Husak, *Partial Defenses*, 11 CAN. J. L. & JURIS. 167 (1998); Jeff L. Lewin, *Comparative Nuisance*, 50 U. PITT. L. REV. 1009 (1989); John Makdisi, *Proportional Liability: A Comprehensive Rule to Apportion Tort Damages Based on Probability*, 67 N.C. L. REV. 1063 (1989); Gideon Parchomovsky et al., *Of Equal Wrongs and Half Rights*, 82 N.Y.U. L. REV. 738 (2007). For a challenge to Leo Katz's defense of the all-or-nothing nature of the law, see Adam J. Kolber, *Smoothing Out Vague Laws* (Apr. 8, 2014) (unpublished manuscript) (on file with author).

Bumpy relationships do not always cause the loss of morally valuable information. Sometimes, we have to select a discrete outcome. In such cases, the law has bumpy needs. For example, the Constitution mandates that the president be at least thirty-five years old.³ Although nothing magical happens precisely when a person turns thirty-five, there may be no practical way to smooth the relationship between maturity and eligibility for the presidency—you cannot be a little bit president.⁴ Similarly, if death is a discrete event,⁵ then it is no surprise that a will transfers assets to heirs at a particular moment in time. If a person is either alive or dead, we cannot make sense of the claim that a person is 80 percent dead.

Even when bumpy relationships do cause the loss of morally valuable information, the loss may be warranted. When legal decision makers can only choose among a few outputs, they have less discretion, and that is sometimes desirable. Also, when deciding among just a few outputs, we typically expend fewer resources examining pertinent inputs. For example, it is cheaper and easier to decide if a driver was unreasonably dangerous than to figure out precisely how dangerous he was. So various issues related to cost, administrability, warranted discretion, and the like sometimes make it undesirable to smooth the law.

In a wide variety of circumstances, however, we do not have bumpy needs; we are describing smooth phenomena, and we can pass legislation to make the law smoother in an administrable, cost-effective manner. Indeed, I argue that, while the matter is context sensitive, there are good opportunities to smooth the law. In this Essay, I can only point suggestively to general areas of law that could likely benefit from smoothing. More definitive conclusions require a careful comparison of what a particular law is supposed to do relative to what it actually does and whether the deviation is warranted by various costs, allocations of discretion, and so on. I also provide a taxonomy of input and output relationships that may help identify places where the law can better fit with our best theories.

The evolution of law over the last several generations may reflect movement toward smoother jurisprudence. The doctrine of comparative negligence likely seemed impractical when it was first considered, but now most jurisdictions have adopted some version of it,⁶ along with some set of contribution principles that tie damages more closely to tortfeasors' actual

3. U.S. CONST. art. II, § 1, cl. 5.

4. In principle, however, even this relationship could be smoothed. For example, the younger a candidate is below the age threshold, the larger the supermajority of electoral votes he could be required to win. Or, the younger a candidate is below the threshold, the fewer powers he could be afforded by the Constitution if elected.

5. See KATZ, *supra* note 2, at 158–63. I have doubts about Katz's view that death is a discrete occurrence, but I accept it in the text for purposes of illustration. See Kolber, *supra* note 2.

6. 57B AM. JUR. 2D *Negligence* § 801 (2004).

conduct.⁷ Even the much-bemoaned proliferation of federal criminal statutes⁸ may reflect an attempt to more closely connect defendants' culpability or dangerousness to the punishment they receive. These changes suggest that it is at least possible to make the law smoother.

Even when smoothing is too costly or difficult, we must still be attuned to the difference between smooth and bumpy jurisprudence for two main reasons. First, the binary thinking that pervades the law leads to pathologies in judicial opinions. Forced to associate a continuous variable with one of two polar opposite outcomes, judges often feel the need to justify their decisions as though they were clear-cut.⁹ In doing so, they tend to make the case at issue seem much closer to the pole they ultimately choose than is warranted by the circumstances. In fact, cases that are genuinely close to a pole are the ones most likely to settle before a judge or jury is required to make a final determination.

Second, even though smooth laws can be costly, theories are free. Those who seek to understand and shape the law must begin with a vision of what justice truly requires. From that vision, we inevitably make all sorts of sacrifices to practical considerations. But if we cut off our vision too soon in order to accommodate these considerations, we never know if we have sacrificed too much or in the wrong places. My goal is to begin the inquiry.

I.

CONTINUOUS AND DISCRETE VARIABLES

Legal decision making takes certain features of our conduct as inputs. To decide a lawsuit over a car accident, for example, we examine raw facts like driver speed, angles of view, and slipperiness of the road. Eventually, we produce a legal determination (or output), such as a verdict for the defendant or an amount of money the defendant must pay the plaintiff.

Inputs and outputs can be grouped into two types. Some are "continuous," by which I mean they can be represented by real-number values along some range.¹⁰ Consider typical inputs to a legal determination of negligence in a car accident. A person can drive more or less quickly, have a smaller or larger field

7. UNIF. CONTRIBUTION AMONG TORTFEASORS ACT § 7 (amended 1955), 12 U.L.A. 194 (2008); *see also* RESTATEMENT (THIRD) OF TORTS: APPORTIONMENT OF LIAB. § 23 cmt. a (2000) (allowing intentional tortfeasors to seek contribution).

8. Gary Fields & John R. Emshwiller, *As Criminal Laws Proliferate, More Are Ensnared*, WALL ST. J. (July 23, 2011), <http://online.wsj.com/news/articles/SB10001424052748703749504576172714184601654>.

9. *See* Parchomovsky et al., *supra* note 2, at 745 ("The need to make all-or-nothing decisions leads courts to tie themselves in doctrinal knots or to deviate from established legal principles, causing confusion and uncertainty."); *see also* Roy Sorensen, *Vagueness Has No Function in Law*, 7 LEGAL THEORY 387, 391 (2001) ("[J]udges suppress vagueness because they hate being in a position where they will be forced to render an insincere verdict.")

10. *Cf.* SHERMAN K. STEIN & ANTHONY BARCELLOS, *CALCULUS AND ANALYTIC GEOMETRY* 75 (5th ed. 1992) ("A function is said to be *continuous* if, when considered on any interval in its domain, its graph has no jumps—it can be traced without lifting pencil off paper.")

of vision, and drive on a road with better or worse traction. We can represent these values as points along a range of possible speeds, angles of view, and forces of friction. The ultimate legal output from a case involving a car accident, typically a monetary value, is also continuous: it can range from no money at all to a fraction of a penny to billions of dollars. Similarly, the severity of a prison sentence is continuous: it can range from minutes to decades.¹¹

Other types of inputs and outputs are “discrete,” by which I mean they take on a relatively small set of values that do not neatly blend into each other. Typically, for example, a motion will be granted or denied, a piece of evidence admitted or excluded, and a statute deemed constitutional or unconstitutional. These situations do admit other possible outcomes: motions can be limited in various ways, jurors can receive limiting instructions, and parts of laws can be deemed constitutional. So we cannot say that these variables are binary. But the set of possible outcomes in these contexts is often small, and the possible outcomes typically do not flow into each other gradually the way that fines or prison sentences can be gradually adjusted within a range of values.

When converting inputs to outputs, the law often makes use of theoretical intermediaries to aid the analysis. Such intermediaries sometimes function as inputs and sometimes function as outputs. For example, we consider a variety of inputs to decide whether or not a defendant had a duty to a plaintiff. The presence or absence of a duty is an intermediate consideration. It does not necessarily resolve a case. If, for example, the defendant did have a duty, we would consider yet other facts to decide whether or not he was negligent. In this further analysis, the presence or absence of a duty would serve as an input that, when combined with other intermediaries, helps decide an ultimate legal output.

Some intermediaries are continuous and some are discrete. For example, whether one has a duty is likely understood as discrete (you either have a duty or not), while one’s level of caution is likely understood as continuous (you can have any level of caution between extremely cautious and extremely incautious).

It is not always obvious whether a variable is continuous or discrete. Consider, for example, a law that criminalizes driving above ninety miles per hour. A pertinent input is the *continuous* variable representing speed, since we’ll gather that information for fact-finding purposes and then assess whether or not a person’s speed was above or below the limit. Alternatively, we could

11. Most sentencing systems have a “duration fetish,” acting as though duration is the only pertinent measure of punishment severity. See Adam J. Kolber, *The Comparative Nature of Punishment*, 89 B.U. L. REV. 1565, 1606 (2009). In fact, many other variables matter as well, such as how distressing the conditions of confinement are. See Adam J. Kolber, *The Subjective Experience of Punishment*, 109 COLUM. L. REV. 182 (2009). Nevertheless, duration is surely a pertinent variable.

characterize the input as a *discrete* variable representing just two possible values, above the limit or within it.

While the difference is not critically important, for purposes of my upcoming taxonomy I describe the input based on our best theory of what the law is supposed to accomplish. So in the speed limit context, I would deem the input continuous because we know that the criminal law is ultimately designed to curb dangerous driving and that dangerousness depends on how fast the person was driving. Thus, when characterizing inputs, we cannot just superficially examine positive law but must consider how our best normative legal theory treats the input.

Notice that the terms “continuous” and “discrete” refer to individual variables, be they inputs, outputs, or theoretical intermediaries. As such, legal scholars occasionally recognize differences between continuous and discrete variables.¹² What they neglect to consider, however, is the important relationship between inputs and outputs. When an input is continuous but an output is discrete, we often lose valuable information—information that, upon reflection, proves morally relevant. I will soon describe various ways in which inputs and outputs can relate to each other and how some such relationships tend to preserve or destroy relevant information. Terms like “smooth” and “bumpy” will apply not to individual variables but to the *relationship* between a particular input and a particular output.

II.

INPUT-OUTPUT RELATIONSHIPS

In this Section, I describe four ways to characterize the relationships between legal inputs and outputs. Since these relationships have not previously been analyzed, I choose arbitrary but hopefully memorable terms to describe them.

A. Smooth Relationship (Continuous Input and Continuous Output)

An input and output have a “smooth” relationship when, as the input gradually changes, the output gradually changes in the appropriate direction. A dimmer switch for a light bulb has a smooth input-output relationship. As you gradually turn the knob clockwise, the light emitted gradually increases. As you gradually turn the knob counterclockwise, the light emitted gradually decreases. The relationship is smooth because as you gradually change the input (the knob setting), the output (the amount of light emitted) gradually changes in the appropriate direction. In more technical terms, we could say that the light switch converts one analog signal into another.

Just as the turning of a knob and the amount of light in a room can have a smooth relationship, so too can an input and an output of a legal determination.

12. See, e.g., *supra* note 2.

Consider strict liability in tort.¹³ One important input is the continuous variable representing the amount of harm a defendant caused. One important output is the continuous variable representing the amount of compensation owed by the defendant to the plaintiff. The relationship between the two is smooth because as the amount of harm caused gradually increases, so too does the amount of compensation owed. If, by contrast, every injury were compensated with \$10,000, the relationship would not be smooth.

Whether or not a legal relationship is smooth may depend on precisely how a law is applied. For example, punitive damages *could* be understood in a smooth fashion. Suppose punitive damages were only awarded when defendants acted from reprehensible motivations. In cases demonstrating such motivations, punitive damages could smoothly increase the more reprehensible the defendant's motivations were.¹⁴

On the other hand, courts sometimes permit punitive damages for unintentional conduct that merely represents an extreme form of negligence.¹⁵ If punitive damages do not gradually increase with the egregiousness of the negligence but rather kick in suddenly at some high level, then punitive damages would not be entirely smooth. Punitive damages are also less than entirely smooth to the extent that we firmly cap damages at a multiple of compensatory damages.¹⁶

B. Bumpy Relationship (Continuous Input and Discrete Output)

An input and output have a "bumpy" relationship when a gradual change to the input sometimes dramatically affects the output and sometimes has no effect at all. Consider a traditional light switch. When the switch begins to arc from the off position to the on position, it has no effect at all on the light in the room. Then, at some particular place along the path of the switch, the light suddenly turns on and the room is full of light. The bumpy relationship here converts a continuous input (the spatial location of the switch) into a discrete output (light on or light off). In more technical terms, we could say that the light switch converts an analog input into a digital output.

13. See generally RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIAB. (1998).

14. Cf. *BMW of N. Am., Inc. v. Gore*, 517 U.S. 559, 575 (1996) ("[T]he most important indicium of the reasonableness of a punitive damages award is the degree of reprehensibility of the defendant's conduct.").

15. Ronen Perry, *Economic Loss, Punitive Damages, and the Exxon Valdez Litigation*, 45 GA. L. REV. 409, 441 (2011) ("[W]hile punitive damages were originally awarded in cases of malicious and mean-spirited conduct, the doctrine has been gradually expanded to cases of recklessness and even gross negligence.").

16. Some states, for example, have imposed a maximum ratio of punitive damages to compensatory damages. See *Exxon Shipping Co. v. Baker*, 554 U.S. 471, 496 (2008). The Supreme Court has said that ratios that are too high may be deemed unconstitutionally excessive. See *State Farm Mut. Auto. Ins. Co. v. Campbell*, 538 U.S. 408, 416 (2003) ("The Due Process Clause of the Fourteenth Amendment prohibits the imposition of grossly excessive or arbitrary punishments on a tortfeasor.").

Contests, such as sporting events, are usually bumpy. The team that wins the Super Bowl in nail-biting overtime gets the same title as the team that wins in a blowout. The continuous input (the difference in scores) produces a discrete output (the identity of the winning team). The bumpiness of athletic events builds suspense because it amplifies the significance of small differences.

Some sporting events are a bit less bumpy than the Super Bowl because they have more potential outputs. Olympic medals, for example, are distributed in gold, silver, and bronze. But the Olympics are still quite bumpy because the medals do not reflect the closeness of the competition among the top three performers and make no distinctions at all among those who finish fourth or later. In a race, for example, we simplify the total information about each athlete's performance to produce the familiar discrete outcomes: the three medal recipients. But the relationship between race times and medal recipients is still bumpy. The awards only recognize the order of the first three finishers, no matter how close they were to each other or how close they were to the rest of the pack.

A legal input and output can also have a bumpy relationship. For example, federal courts have jurisdiction to hear cases when litigants are citizens of different states and the amount in controversy exceeds \$75,000.¹⁷ The relationship between the amount in controversy (a continuous input) and the presence of federal jurisdiction (a discrete output) is extraordinarily bumpy. The amount in controversy has no effect at all on jurisdiction as it gradually increases from zero until the moment when it exceeds \$75,000, at which point federal jurisdiction is suddenly available.

Bumpy relationships are often appropriate when deciding how laws affect the operation of other laws, as is common in civil procedure, evidence, and constitutional law. In the case of diversity jurisdiction, outside of a revolutionary overhaul of our court system, cases will either be heard in federal court or not. So even though the amount in controversy is a continuous input that can take on a very wide range of values, the relationship is understandably bumpy because the presence or absence of federal jurisdiction is discrete and cannot vary in a smooth fashion with the pertinent input.

To see another bumpy legal relationship, suppose we must decide which of two parents should have sole custody of a child. Assume that due to geographic or other limitations, the parents cannot share custody or allow visitation. In such a case, courts will seek to determine the interests of the child in going to each parent, and custody will depend on the "best interests of the child."¹⁸ Strength of interest seems best represented by a continuous variable.

17. 28 U.S.C. § 1332 (2012).

18. *See, e.g.,* *Nehra v. Uhlar*, 43 N.Y.2d 242, 246, 248 (1977) ("It is undisputed that the best interest of the children must govern in the adjudication of custody.").

So, suppose that, on a scale of 1 to 10, the child's interests in going to the mother score 9.3 and to the father score 8.7. Though there is a relatively modest difference in the weight of interests associated with the custody of each parent, by hypothesis, custody can only be awarded to one of them. Under the best interests standard, the child should go to the mother because we cannot gradually adjust custody of the child.¹⁹

As noted, the terms smooth and bumpy refer to relationships between particular inputs and particular outputs. Of course, legal determinations often have multiple inputs and multiple outputs. Whenever possible, it is best to describe each relationship separately. So, for example, when strict liability applies in tort, there is a smooth relationship between harm caused and damages awarded. There is, however, a bumpy relationship between the criteria used to decide whether strict liability applies in the first place. For example, strict liability applies to tortious harms caused by activities deemed "abnormally dangerous."²⁰ The dangerousness of the activity (a continuous input) has a bumpy relationship with the discrete variable determining whether or not strict liability applies.²¹ But even though the relationships technically apply to a particular input and a particular output, we can speak informally of a law or a body of law as smooth or bumpy based on the kind of relationships that predominate.

C. Lockstep Relationship (Discrete Input and Discrete Output)

So far, I have described smooth relationships, in which continuous inputs gradually change continuous outputs, and bumpy relationships, in which continuous inputs are pigeonholed into discrete outputs. Two less common relationships are worth mentioning as well.

An input and output have a "lockstep" relationship when a discrete input maps onto a discrete output. The volume setting on most portable audio equipment today illustrates a lockstep relationship. You press a button to raise or lower audio volume in discrete increments, and the volume changes accordingly in discrete increments. You cannot raise or lower the volume by half of an increment.

Some people believe that whether an entity like a fetus is entitled to a right to life under the Constitution follows a lockstep relationship. They believe an organism has a right to life when a divine entity gives it a soul. On this view, the relevant input to the constitutional question is a discrete fact about the

19. If we loosen the hypothetical conditions such that we can assign partial custody or visitation rights, then we could partially smooth the relationship between the strength of a child's interests in being with a parent and the extent of that parent's right to custody.

20. See RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL HARM §§ 20(b), 22(a) (Proposed Final Draft No. 1, 2005).

21. Technically, the applicability of strict liability is better understood as a theoretical intermediary than as a final output, but the difference does not prove important.

organism (the presence or absence of a soul), and the output is similarly discrete (a right to life or not). An entity with a human soul deserves full rights of personhood, and one without deserves no personhood rights at all. People who hold such views are defending a lockstep relationship between a discrete input and a discrete output.

By contrast, one might argue that the weight to give the personhood rights of an organism depends on the extent to which it has some property, like intelligence. Very intelligent organisms deserve full rights of personhood, while less intelligent organisms deserve weaker rights. According to this view, the inputs into the legal question are continuous, since intelligence is a continuous characteristic. And the outputs are continuous, since we could give weightier personhood rights as an entity's intelligence increases. If entities have personhood rights by virtue of features they possess to varying degrees, the weight to give those rights plausibly depends in a smooth way on the degree to which they possess the features. Though I find neither of these theories especially attractive,²² they illustrate how a lockstep theory of personhood can entail a lockstep set of legal rights, while a smooth theory of personhood can entail a smooth set of legal rights.

D. Random Relationship (Discrete Input and Continuous Output)

The last relationship describes the conversion of discrete inputs into continuous outputs. By allowing a fairly small number of inputs to potentially take on a very large range of output values, such "random" relationships seem to add noise into an input-output relationship. In particular, when a single discrete input is allowed to map onto more than one possible output, the outcome you actually get is indeterminate.

Consider, for example, an antenna-based television with poor tuning abilities. The input is the viewer's choice of channel, a discrete variable. The output is the continuous variable that represents the frequency to which the antenna is tuned. As you pick among discrete television channels, the television signal varies, so that you do not always tune in to an actual station when you select a particular channel, and you don't tune in to the same frequency every time you select that channel.

At times, we certainly tolerate indeterminacy in the law and may even find occasion when it is advantageous.²³ But generally speaking, we do not

22. Peter Singer has argued that equality among humans cannot be based on the possession of traits like intelligence or a sense of justice because we possess these traits to varying degrees. See PETER SINGER, *PRACTICAL ETHICS* 18–22 (2d ed. 1993). Contra John Rawls, Singer argues that basing equality on the possession of natural characteristics would lead us to expect a smooth relationship, in my terminology, between the extent to which a person has some characteristic and the weight we should give his interests. Compare *id.* at 18–19, with JOHN RAWLS, *A THEORY OF JUSTICE* 507–08 (1971) (suggesting that natural capacities can be understood as "range properties").

23. See generally Adam M. Samaha, *Randomization and Adjudication*, 51 WM. & MARY L. REV. 1 (2009).

seek to promote random jurisprudence.²⁴ If the goal of smooth laws is to preserve normatively relevant information, random laws do the opposite: they introduce meaningless noise.

E. Rules and Standards

The input-output relationships I describe are not directly related to the rule-standard distinction.²⁵ The rule-standard distinction is iconically illustrated by prohibitions on speeding. A prohibition on “driving over sixty-five miles per hour” is a rule: it draws a bright line and affords little discretion to those who interpret it. We may choose a rule-based prohibition on speeding because it makes clear what conduct is prohibited and is easy to apply. The rule does not fit perfectly, however, with the overarching norm to drive safely, since there are conditions under which people should drive slower than the speed limit and conditions under which it would actually be quite safe to drive faster. By contrast, a law prohibiting “driving at an unsafe speed” is phrased as a standard. It reflects the overarching norm that should govern driver conduct but gives less concrete guidance than does the rule-based version and requires more discretion to apply.

The rule-standard distinction helps us formulate a threshold test to distinguish permitted and prohibited conduct. It says nothing, however, about whether the penalty associated with crossing the threshold kicks in gradually or dramatically. Assume, for example, that in response to dangerous driving, legislators institute a law with a flat \$100 fine for violations. Since crossing the threshold costs \$100 no matter how fast you were driving, the law has a bumpy relationship between excess speed and punishment. Notice that the law is bumpy no matter whether the threshold is formulated as a rule (a speed limit) or as a standard (a dangerousness prohibition). We look at the variable that matters to us (be it speed or level of safety) and convert it into one of two outputs. You are either subject to a \$100 fine or to no penalty at all. The penalty is bumpy because, after the legal threshold is crossed, the law is insensitive to how much a person speeds or how dangerously he drives.

24. At first glance, workers' compensation schemes may appear to reflect random jurisprudence. Under such programs, we pair injuries like the severing of an arm with particular amounts of compensation, often expressed in terms of weeks of pay. See, e.g., Federal Employees' Compensation Act, 5 U.S.C. § 8107(c) (2012) (stating the pricing schedule for federal employee compensation, including 160 weeks' compensation for a lost eye and 205 weeks' compensation for a lost foot). But even if we assume (doubtfully, in my view) that these injuries can be understood in discrete terms, the compensation paid is not really continuous. If compensation is measured in weeks' pay, there is still a one-to-one pairing between the input and output. In that case, worker's compensation would have a lockstep relationship between injury and amount of compensation. A relationship would only be random if a discrete input could lead to many different outputs along a continuum. Perhaps we see such relationships generally, though we usually seek to avoid them.

25. On the rule-standard distinction generally, see, for example, FREDERICK SCHAUER, *PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE* (1991) and Cass R. Sunstein, *Problems with Rules*, 83 CALIF. L. REV. 953 (1995).

By making the penalty more flexible, we could smooth it out. Rather than imposing a fixed \$100 fine for driving above the speed limit, we could impose a \$10 fine for each mile-per-hour one drives above the speed limit. Similarly, we could smooth application of the standard. Rather than imposing a fixed \$100 fine for driving at an unsafe speed, we could impose a fine proportional to the recklessness of the driver given particular road conditions. Hence, whether a threshold is framed as a rule or a standard, the penalty for violation can be either smooth or bumpy. The smooth-bumpy distinction simply captures a different feature of law than does the rule-standard distinction.

It is true that penalties can themselves be thought of as rules or standards. The penalty for speeding could be posed as a rule (“\$100”) or as a standard (“a fine in such amount that the offender gets what he deserves”). But rules and standards still vary along a dimension of smoothness. For example, the penalty for speeding could be a \$100 fixed fine or a \$10 fine for each mile-per-hour driven above the limit. Both penalties are equally rule-like. They are easy to apply and leave judges with little discretion. Still, the fixed fine is very bumpy while the fine pegged to speed is rather smooth. Thus, no matter whether we use rules or standards, we still need to separately consider the smoothness of the law.

Earlier, I noted that diversity of citizenship cases in federal court must have an amount in controversy exceeding \$75,000. In *Freeland v. Liberty Mutual Fire Insurance Co.*,²⁶ the parties had diversity of citizenship in a dispute concerning precisely \$75,000. The Sixth Circuit dismissed the case for lack of jurisdiction, however, because the amount in controversy was one penny short of *exceeding* the \$75,000 requirement.²⁷ The case provides some grounds for disliking the rule-like nature of the criteria for diversity jurisdiction. One could argue that the amount-in-controversy requirement is meant to reflect the gravity of the litigation. If so, a standard-based examination of the litigation might better reflect whether federal jurisdiction is appropriate than an arbitrary rule-based dollar cut-off like the one we actually use. Importantly, however, one cannot argue that the law is too bumpy, absent a proposal to create a court with, say, 50 percent federal jurisdiction and 50 percent state jurisdiction. At least at first glance, it seems impractical to create fractional hybrids of federal and state court.

As a final example (that I will later discuss in more detail),²⁸ consider the difference between contributory and comparative negligence. Contributory negligence is bumpy because if a plaintiff’s negligence contributes to his injury, he cannot recover from the defendant at all. Though a plaintiff’s negligence is a matter of degree, it gets converted to a binary output: the plaintiff was either contributorily negligent or not. By contrast, comparative

26. 632 F.3d 250 (6th Cir. 2011).

27. *Id.* at 251.

28. *See infra* Part III.C.1.d.

negligence is smooth with respect to a plaintiff's negligence because, in its purest form, the extent of a plaintiff's negligence determines the extent to which his award is reduced. However, the choice between contributory and comparative negligence is principally a substantive question about the nature of tort compensation—namely, whether a plaintiff's negligence should cause a smooth or bumpy reduction to his award for damages—not a debate about rules and standards.

There are, of course, certain similarities between rules and standards on the one hand and smooth and bumpy laws on the other. For example, standards generally do a better job of capturing underlying normative concerns than do rules. Similarly, I claim, smooth laws often do a better job of capturing underlying normative concerns than do bumpy laws. Also, rules are usually cheaper to administer than standards, just as bumpy laws, as I will later discuss, are usually cheaper to administer than smooth laws. But superficial similarities aside, we are addressing two different features of the law. Moving right may take you east, while moving left may take you west. But east and west and left and right draw importantly different distinctions.

F. Summary

Here is a summary of the relationships I identified, based on typical kinds of inputs and outputs. Recall that theoretical intermediaries are sometimes used as inputs and sometimes as outputs:

	Continuous Output	Discrete Output
Continuous Input	Smooth	Bumpy
Discrete Input	Random	Lockstep

The taxonomy may not definitively classify every possible input-output relationship in the law. Suppose, for example, that I enter a contract to buy thousands of low-priced widgets such that the amount I must pay is equal to the number of widgets delivered. Is there a smooth relationship or a lockstep relationship between the number of widgets delivered and the money owed? Assuming widgets are indivisible, I would technically classify it as a lockstep relationship. But the relationship seems quite smooth in the sense that there is a close fit between the extent of contractual performance by the manufacturer and the buyer's obligation to pay.

Either way, taxonomizing input-output relationships is not a goal in itself. Its purpose is to help us identify places where inattention to input-output relationships leads the law to deviate from our underlying theories. Such deviation is our overarching consideration, as I describe in more detail in the next Section.

III.

CHOOSING A RELATIONSHIP

To evaluate how well a law works, we need to compare it to our best view of how it ought to work. If our best theory about how a law should operate recommends a continuous output, but we can only choose among discrete outputs, then we have to round to the nearest output. We sometimes round to the nearest output, however, even when doing so is not justified by concerns such as cost, feasibility, and administrability. In cases where we round unnecessarily, we make what I am calling “rounding error.” And contrary to the usual usage of the phrase, rounding error can be enormous, from millions of dollars changing hands inappropriately to decades spent in prison without good justification.

Deviations from theoretical ideals are sometimes acceptable, but they periodically have disastrous consequences. The 1897 sitting of the Indiana General Assembly nearly passed a bill to legislate a “mathematical truth.”²⁹ Among other errors, the bill calculated the value of pi as 3.2.³⁰ Rounding pi would indeed make calculations easier, but we would quickly regret it as buildings collapsed, cars exploded, and planes fell out of the sky.

In this Section, I describe the relative advantages of different input-output relationships and how to minimize rounding error. Since many inputs of interest to the law are continuous, I focus on the relative advantages of smooth and bumpy relationships since both take continuous inputs.

A. Step 1: Identify the Underlying Normative Theory

To evaluate how well a law works, we must have a view about what the law should be doing. Our underlying legal theory must tell us, for example, which inputs and outputs are relevant at all. Imagine if we collected the bulk of government revenues by taxing people in proportion to their height. Doing so would create a very smooth relationship between height and taxes owed, but the underlying theory is surely nonsensical. As important as it is to choose the correct relationship between inputs and outputs, the task is hopeless if we examine the wrong variables.

Once we choose appropriate inputs and outputs, a theory would ideally tell us how to map each possible input value to an output value. Such maps could be very complex. Instead of saying just that an input and output are smoothly related, for example, they could say the relationship is linear or exponential or something else entirely. And if multiple inputs interact with each

29. See PETR BECKMANN, A HISTORY OF PI 174–77 (5th ed. 1982); H.R. 246, 1897 Gen. Assemb. (Ind. 1897), available at http://www.agecon.purdue.edu/crd/Localgov/Second%20Level%20pages/indiana_pi_bill.htm.

30. H.R. 246, 1897 Gen. Assemb. (Ind. 1897) (asserting erroneously the “important fact . . . that the ratio of the diameter and the circumference [of a circle] is as five-fourths to four”).

other in unusual ways, perhaps the mapping would have to be multidimensional.

But once armed with a complete map of how every input should affect an output, we could compare that map to a similar mapping of a law meant to implement the theory.³¹ By comparing the two maps, we would see exactly where the law deviates from theory. If we had such maps, we wouldn't need the taxonomy provided in this Essay, since our overarching concern is with the deviation between theory and practice. All I've done is identify some of the most likely places where theory and practice diverge.

In reality, of course, most theories do not come with detailed input-output maps. Even if they did, we would still have to translate the theoretical mapping into one that could be applied in real-world legal contexts. But even when we lack perfect information to map every input value to an output value, we can at least determine which input-output relationships are smooth, bumpy, lockstep, or random. Doing so can help us assess when and where the law is making errors and whether we are only rounding to the nearest outcome when justified under the circumstances.

There is no single answer as to what the input-output relationships in law and theory should be. The choice among relationships depends on the phenomena in question. I briefly illustrate by considering prominent theories of punishment and of tort law.

1. Punishment Should Be Smooth, But Criminal Law Is Often Bumpy

Both retributivist and consequentialist punishment theories seem to require smooth relationships between the most pertinent inputs and outputs of the criminal justice system.³² Under a simple retributivist theory, criminals should be punished in proportion to the seriousness of their offenses,³³ and offense seriousness is largely a function of culpability.

Culpability seems to be a continuous variable: consider any particular crime scene, and it will be easy to imagine slight modifications of the facts that make the offender a bit more or less culpable. An offender could have pursued his victim more or less doggedly, chosen a safer or more vicious weapon, stabbed his victim more or less forcefully, and so on. So if the pertinent continuous input (culpability) yields a proportional continuous output (punishment severity), then retributivists who subscribe to the widely held

31. Depending on what precisely interests us, we can compare our underlying legal theory to either how some law is supposed to work or how it works in actual practice if it has already been implemented.

32. For a more detailed discussion, see Adam J. Kolber, *How to Smooth the Criminal Law* (Apr. 8, 2014) (unpublished manuscript) (on file with author).

33. See DOUGLAS HUSAK, *Already Punished Enough*, in *THE PHILOSOPHY OF CRIMINAL LAW* 434, 436 (2010) ("A corollary of the 'just deserts' theory is the principle of proportionality, according to which the severity of a punishment should be a function of the seriousness of the offense.").

principle of proportionality should seek laws that support this smooth relationship.³⁴

Unlike retributivists, consequentialists do not focus directly on culpability. Rather, they believe that criminal punishment is principally about preventing crime by deterring, incapacitating, and rehabilitating offenders.³⁵ But the strength of the grounds for deterring, incapacitating, and rehabilitating varies as a matter of degree. An offender who demonstrates himself to be just a bit more dangerous than another will, generally speaking, warrant a bit more severe punishment. Holding costs constant, more dangerous offenders generally warrant more deterrence and incapacitation, while the opposite is true of less dangerous offenders. All else being equal, punishment theorists should support smooth criminal laws to implement their theoretical views.

Despite the smoothness of retributivist and consequentialist theories of punishment, under the law, a crime is committed when an offender satisfies all of the elements of a criminal statute beyond a reasonable doubt. Either each element is satisfied and the offender is liable for punishment under the statute or at least one element is not satisfied and the offender receives no punishment at all. Similarly, defendants will either satisfy the elements of some defense and receive no punishment or fail to satisfy it and be punished. Though we seem to be examining smooth phenomena, criminal law is bumpy, and scholars need to do more to determine when the bumpiness is justified.

Consider the *actus reus* of attempt. A man wakes up one morning and decides to rob a bank. He purchases a rifle and a ski mask and creates a sweatshirt that says in big letters, "Robbery: Hand over the \$." He drives around to find a bank to target, puts on his ski mask and sweatshirt, parks the car fifty meters from the bank entrance, and then walks up, rifle in hand, to a teller so the teller can read his sweatshirt.

The man has clearly attempted to rob the bank, but *when* did he first commit the offense? Jurisdictions vary in the formal tests they use to make the determination.³⁶ But it seems that his culpability and the evidence of his dangerousness gradually increase as he progresses along his path. Nevertheless, the law draws a sharp dividing line. At one point in time, he has no criminal liability whatsoever, and just a moment later, he has sufficient criminal liability to receive several years' incarceration.

None of this means that anyone with any culpability or any dangerousness must be punished. If it did, we would all warrant some punishment. There is

34. Theodore Sider argues that certain dichotomous views of an afterlife are suspect: "[A]ny just criterion must judge created beings according to a standard that comes in degrees, or admits of borderline cases; but no such criterion can remain simultaneously just—or at least non-arbitrary—and consistent with" certain views of an afterlife that sharply divide people between Heaven and Hell. Theodore Sider, *Hell and Vagueness*, 19 FAITH & PHIL. 58, 59 (2002).

35. See C.L. TEN, CRIME, GUILT, AND PUNISHMENT 7–8 (1987).

36. DRESSLER, *supra* note 1, at 391–96.

presumably some level of culpability and some level of dangerousness below which the costs of criminal punishment exceed the benefits. Alternatively, one might say, we are entitled to live free of the burden of criminal punishment so long as our culpability and dangerousness are below some critical level.

If the line at which criminal punishment becomes justified precisely corresponded with crossing the actus reus line for attempt, and if punishment gradually kicked in when you crossed the line, I would have no criticism. There would be a smooth relationship between culpability or dangerousness and amount of punishment. The problem is that criminal liability for crossing the threshold often corresponds with minimum sentences of several years in prison, not with modest punishments like community service or short prison stays. Such penalties are apt to either round up the punishments of people with low levels of culpability and dangerousness who just barely cross the threshold into criminality, or else set the threshold for attempt liability so high that we fail to punish people with significant levels of culpability and dangerousness.

Many jurisdictions,³⁷ following the Model Penal Code,³⁸ provide a renunciation defense for attempts. In such jurisdictions, even if a defendant attempted a crime, he has no criminal liability if he abandoned the attempt “under circumstances manifesting a complete and voluntary renunciation of his criminal purpose.”³⁹ But while the defense may help us identify those who are less dangerous or less culpable than other attempters, it does nothing to smooth the law. The renunciation defense shifts the line where we deem someone guilty of attempt, but wherever the line is drawn, it still has the same harsh effect of shuttling some people to prison for at least the minimum statutory sentence and letting others, with just a bit less culpability, return to their homes.

Sentencing may smooth over many of the bumps in criminal law, but structural impediments like sentencing minima and maxima mean that sentencing cannot eliminate all of the bumps. Consider the bumpiness that emerges when police pressure people to commit crimes. In one case, a person sufficiently pressured to commit aggravated assault will have a complete entrapment defense and be able to go home. Another very similar person, pressured just a bit less, will not have a successful entrapment defense and be subject to at least several years in prison under a statutory minimum.

Aside from the structural impediments to smoothing sentences, punishments may be bumpy simply because judges fall victim to bumpy thinking. For example, there is some authority for judges to mitigate sentences when someone has a defense that is almost but not quite successful.⁴⁰

37. See, e.g., N.Y. PENAL LAW § 40.10(3) (McKinney 2009).

38. MODEL PENAL CODE § 5.01(4) (1962).

39. *Id.*

40. See *State v. Steadman*, 827 So. 2d 1022 (Fla. Dist. Ct. App. 2002) (granting downward departure from sentencing guidelines where an undercover officer repeatedly purchased drugs from the defendant in order to increase his sentence); see also *State v. Jeannotte*, 947 P.2d 1192, 1194–95

Nevertheless, judges may not adequately mitigate punishment in such cases because they think that a jury already considered the defense but was unconvinced.⁴¹ Judges may think of defenses in a bumpy fashion that is unwarranted by our leading theories of punishment. With greater recognition of the bumpiness of our criminal laws, courts may look with fresh eyes on how partial defenses warrant greater reductions in sentences.⁴²

2. Tort Theory Should Perhaps Be Smooth, But Tort Law Is Often Bumpy

Traditional corrective-justice theories of tort law should arguably be committed to smooth jurisprudence. In determining whether or not a legal duty of non-negligence has been breached, for example, we typically ask whether the defendant's conduct reflected the caution of a reasonably prudent person "exercising those qualities of attention, knowledge, intelligence, and judgment which society requires of its members for the protection of their own interests and the interests of others."⁴³ Since the exercise of qualities like attention, knowledge, intelligence, and judgment seem to vary along continua, we would expect that the theoretical intermediary—level of caution—would vary as a matter of degree as well. And when level of caution serves as an input into how much the defendant owes the plaintiff, we might expect the amount to vary smoothly with the level of caution.

Nevertheless, tort defendants are typically either liable for the full amount of a plaintiff's damages or not liable at all. A defendant who took just enough caution to be on the safe side of the line will owe nothing, while a defendant who was just a bit riskier than the reasonably prudent person may owe millions. Even though the amount of caution a person exercises varies along a spectrum, it has a bumpy relationship to the amount of money awarded.

Some scholars understand torts as a kind of wrongful behavior.⁴⁴ Negligence is wrong, at least in part, because it reflects insufficient caution. But if torts are wrongs, it seems like the more incautious one's behavior, the more wrongful it becomes. Instead, we typically treat insufficient caution as a

(Wash. 1997) (recognizing "failed defense" mitigating circumstances for "self-defense, duress, mental conditions not amounting to insanity, and entrapment").

41. In *Hines v. State*, for example, a sentencing judge refused to grant a downward departure based on the victim's aggressive and provoking behavior because the jury rejected the defendant's self-defense claim. 817 So. 2d 964, 965 (Fla. Dist. Ct. App. 2002). An appellate court reversed, smoothly reasoning that "[c]onduct that is legally insufficient to excuse the defendant's actions may nevertheless be legally sufficient to warrant a downward departure sentence." *Id.*

42. See, e.g., Husak, *supra* note 2, at 169 (arguing that partial defenses call for mitigation in sentencing where the defense is "desert-based"); Stephen J. Morse, *Diminished Rationality, Diminished Responsibility*, 1 OHIO ST. J. CRIM. L. 289, 289 (2003) (arguing for a "generic, doctrinal mitigating excuse of partial responsibility that would apply to all crimes, and that would be determined by the trier of fact").

43. RESTATEMENT (SECOND) OF TORTS § 283 cmt. b (1965).

44. See, e.g., John C.P. Goldberg & Benjamin C. Zipursky, *Torts as Wrongs*, 88 TEX. L. REV. 917 (2010).

condition of negligence but become insensitive to its level once we cross the negligence threshold (at least until we cross some further threshold where punitive damages begin). A full account of torts as wrongs should explain why damage awards are only loosely tied to wrongfulness.

Many corrective-justice theorists view torts as a system of compensation: when people are injured by a legal wrong, they are owed compensation that puts them back in the position they were in prior to commission of the wrong.⁴⁵ Ordinarily, the costs of non-negligent accidents lie where they fall. But might there be cases of marginal negligence where it is unfair to expect a defendant to pay full compensation? We could certainly imagine gradually instituting the obligation to repay as a person crosses a carelessness threshold.

Suppose I ask a stranger at a coffee shop to watch my computer while I use the bathroom. When the stranger's attention drifts, someone steals the computer. The stranger later apologizes profusely, but neither of us knows whether he has legal liability. In seeking an amicable and just arrangement, the stranger might offer some money as partial compensation. Doing so need not be a discounted estimate of his future liability but could simply reflect views about what justice requires under the circumstances. There is no obvious reason why the reasonable person standard should demarcate a bumpy boundary between liability and the presence or absence of an obligation to fully compensate.

Nevertheless, I say that tort theory should *probably* advocate smooth relationships because corrective justice theorists might have a justification for its bumpy relationships. As between two individuals, they might say, the one who was just a bit negligent ought to bear the cost of an accident relative to one who was not negligent at all.

This explanation is not very satisfying, however. Particularly when a defendant has just crossed the border of negligent conduct, an injury will largely be attributable to bad luck. Even if one thinks that our responsibility for the results of our actions extends beyond our moral culpability,⁴⁶ it is not obvious why we instantaneously take on full responsibility for the injury.

45. Cf. 1 MARILYN MINZER ET AL., DAMAGES IN TORT ACTIONS § 3.01 (2010) ("The general purpose of compensatory damages in tort actions is to give the injured party a sum of money which will restore him, as nearly as possible, to the position he would have been in if the wrong had not been committed; in other words, to make the plaintiff whole.").

46. A central question in the debate over "moral luck" is whether it is appropriate to treat people differently from a moral perspective even when they are alike with respect to all actions within their control. See generally MORAL LUCK (Daniel Statman ed., 1993); John C.P. Goldberg & Benjamin C. Zipursky, *Tort Law and Moral Luck*, 92 CORNELL L. REV. 1123 (2007). For a discussion of whether moral luck is smooth or bumpy, see Kolber, *supra* note 32.

The difference in our treatment of non-negligent and just barely negligent actors presses on a question somewhat different from those in the moral luck debate. Namely, what justifies treating two people very differently when their conduct varies only slightly along some clearly relevant continuum?

I do not purport to resolve the substantive theoretical debate here. At a minimum, though, corrective justice theorists should try to offer an explanation. When one's moral theory leads to sharp discontinuities in results as corrective justice seems to, it would be helpful to know why. Tort theorists should explain what it is about justice, if anything, that warrants the bumpiness of so many aspects of negligence. Is corrective justice fundamentally bumpy? Or are we worried about the cost and administrability of assessing negligence more smoothly? These and other possible suggestions have different implications. If the explanation is about costs and administrability, then we need to test it by examining empirical facts or running experiments. If, however, the explanation is about the fundamental nature of justice, then theorists must tell a convincing story about the nature of corrective-justice input-output relationships.

Notice that when we have already settled on a particular theory of law, consideration of input-output relationships can help us craft laws to implement the theory. On the other hand, when we are trying to select a preferred theory, a theory's input-output relationships represent one of many considerations that figure into our assessment of the theory's overall quality.

3. *Laws Governing Other Laws Are Often Not Smooth*

Tort and criminal law address natural phenomena that generally strike me as best addressed by smooth relationships.⁴⁷ But tort and criminal law are not the only areas that raise questions about the theoretical nature of inputs and outputs. Similar questions arise in every area of law.

When law operates not on natural phenomena but on other laws, as the law of evidence does, we should expect to see laws that are, by design, bumpy or lockstep. The purpose of evidence law is to determine whether certain information is admissible, inadmissible, or admissible for limited purposes. Generally speaking, we do not want information to be fractionally admissible. I have argued that the loss of morally relevant information is a frequent cost of bumpy laws. But in evidence law, our goal is often to *conceal* information, even morally relevant information, and so information loss is not always an

47. There certainly may be natural phenomena, however, that do not have smooth relationships. For example, when the relative concentration of ions in a neuron reaches a particular level, the neuron fires. If we think of ion concentration as a continuous input (because it can take on a large range of values) and the firing variable as discrete, we could say that neurons have a bumpy input-output relationship. Cf. RAY KURZWEIL, *THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY* 150 (2005) (stating that “[a]n axon firing is not entirely digital but closely approximates a digital process” while “[m]ost every function in the brain is analog and is filled with non-linearities (sudden shifts in output, rather than levels changing smoothly)"); John von Neumann, *The General and Logical Theory of Automata*, in 5 JOHN VON NEUMANN COLLECTED WORKS 288, 306–07 (A.H. Taub ed., 1963) (“It seems that we are indeed justified in assuming that [the nervous system] is a digital mechanism, that it transmits messages which are made up of signals possessing the all-or-none character . . . [E]ach impulse, simply either is or is not there, with no further shadings.”).

ultimate cost. Similarly, constitutional law tells us whether some other law is permissible. To the extent we seek a determination of permissibility, our needs are bumpy. Generally speaking, a law is either constitutional or not.

Like those areas of law governing other laws, contract law governs the operation of private agreements. Not surprisingly, we let parties decide to some extent whether contractual remedies should have smooth or bumpy relationships to contractual inputs. Most contracts likely have a relatively smooth relationship between performance and the damages that follow from inadequate performance. If my wholesaler fails to deliver promised widgets toward the end of our supply contract, I will be entitled to modest damages for the lost sales I expected to make. On the other hand, if the wholesaler had only just begun to perform his obligations, the damages will be much higher. There is a fairly smooth relationship between the extent to which a party upholds its end of an agreement and the damages that follow from a shortfall.

In other cases, parties might create a bumpier contract. Suppose a company planning to stage a concert contracts with another to install fire alarms. If the state requires a certain number of fire alarms for the concert to proceed, the parties might structure the contract with a critical point of discontinuity. If the fire alarm company does not install the minimum required by law, the concert will be cancelled and very high damages will follow if alternative arrangements cannot be made. While courts do limit contractors' ability to establish damages however they would like,⁴⁸ courts should have no difficulty recognizing the bumpy relationship in this contract between the extent of performance and the damages that follow.

Even when parties structure a contract to have a bumpy relationship between widgets delivered and damages for breach, we could say that the contract reflects a smooth relationship between the input we really care about, the extent to which the purchaser's contractual needs are fulfilled, and the output we really care about, the amount of damages owed. When the wholesaler delivers widgets below some critical value, the wholesaler has satisfied few if any of the purchaser's contractual needs and will owe substantial damages.

The overarching point, however, is that we cannot hope to evaluate the merits of some aspect of law until we know what the law is supposed to do. I have suggested that criminal law and tort law, directed as they are to certain natural phenomena, ought to be smooth. Evidence and constitutional law govern the operation of other laws and so we can often justify their bumpy nature. Contract law can be understood as giving parties some flexibility to craft agreements with smooth or bumpy features. In all cases, we must consider the fit between our theoretically recommended input-output relationships and

48. RESTATEMENT (SECOND) OF CONTRACTS § 356 (1981) (limiting the availability of liquidated damages).

the law's actual input-output relationships to determine when and where the law makes rounding errors.

4. *Bargaining Will Generally Not Smooth Substantive Law*

Having noted that negligence law and aspects of criminal law are quite bumpy, one might wonder whether settlements and plea bargains smooth out the bumpiness. If they do, the law will be much smoother than I have suggested, since the vast majority of tort and criminal cases get resolved before trial. The short answer, however, is that bargaining will not smooth the substance of the law, at least not if the bargaining occurs in the shadow of the law.⁴⁹

In settlement negotiations, parties may discount expected compensation based on uncertainty about the trial outcome. They may also bargain implicitly or explicitly about how to share the cost savings of avoiding trial, including the time value of money. But if we put aside such considerations to focus on the substance of the law itself, we should not expect bargaining to smooth the substance of the law when bargaining occurs in the shadow of bumpy laws.

For example, some courts have held that driving above the speed limit can constitute negligence per se.⁵⁰ So suppose a driver traveling just slightly above the speed limit injures a pedestrian. Whether or not the driver was negligent might otherwise have been a close call. But by traveling just slightly above the speed limit, he may be deemed negligent per se. If so, the plaintiff will not settle for much of a discount relative to the expected outcome at trial. He might settle to receive his money faster or to reduce litigation costs. But when the underlying facts and applicable laws are clear, settlements will not smooth the substance of the law.

Similar comments apply to plea bargains. Prosecutors and defense attorneys will surely reduce a defendant's sentence in exchange for the defendant accepting responsibility and for sparing the state the costs of trial. But if the parties know that a trial will lead to a particular bumpy result and they bargain in the shadow of that result,⁵¹ there's no obvious reason why a prosecutor will take any further steps to ease the severity of a defendant's sentence. No doubt, settlements and plea bargains *seem* to smooth the law, but the smoothing is likely a function of epistemic uncertainty and cost savings rather than a genuine smoothing of substantive law.

49. Robert H. Mnookin & Lewis Kornhauser, *Bargaining in the Shadow of the Law: The Case of Divorce*, 88 YALE L. J. 950, 968 (1979) (“[T]he outcome that the law will impose if no agreement is reached gives [negotiating parties] certain bargaining chips—an endowment of sorts.”).

50. See *Wise v. Fiberglass Systems, Inc.*, 718 P.2d 1178, 1182 (Idaho 1986); *Dahl v. Turner*, 458 P.2d 816, 823 (N.M. Ct. App. 1969).

51. Bibas, *supra* note 2, at 2466 (stating that most “scholars view the shadow of trial as the overwhelming determinant of plea bargaining”).

Of course, it is possible that bargaining parties will negotiate beyond the shadow of bumpy laws. If the parties have smooth intuitions about corrective justice or criminal justice, they may reach agreements smoother than those possible at trial. That would raise an important question, however: Why would we allow smooth tort and criminal law relationships in bargaining contexts but require bumpy relationships at trial? There would seem to be no principled reasons for treating the two contexts differently. Hence, bargaining contexts either fail to smooth the substance of the law or, if they do smooth the substance of the law, they force us to examine why we permit such smoothing in some approaches to conflict resolution but not others.

5. Factual Uncertainty Is a Tough Call

As just discussed, in bargaining contexts, parties almost certainly discount outcomes based on uncertainty about their likelihood. This raises the question of whether we ought to similarly discount outcomes at trial. Currently, factual uncertainty at trial usually has a bumpy relationship with case outcomes. In tort, for example, most issues are decided by a preponderance of the evidence standard. Plaintiffs win when a fact finder determines it is more likely than not that a tort occurred. The law is sensitive to uncertainty—if there's no preponderance of evidence, plaintiffs lose—but it is sensitive in a very bumpy fashion. Whether we are 51 percent confident the defendant wronged the plaintiff or 99 percent confident makes no difference.

It is no simple matter, however, to determine whether the relationship between factual uncertainty and case outcomes should be smooth or bumpy. Consider a scenario described by Saul Levmore: Suppose we know for sure that *X* and *Y* acted negligently toward a person who suffered \$99 worth of damages as a result. We know that either *X* or *Y* caused the injury, but we don't know which one. There is a two-thirds chance that *X* caused it and a one-third chance that *Y* caused it. Under our current approach, *X* will owe the full \$99 in damages while *Y* will owe nothing because the preponderance of evidence indicates that only *X* was liable.⁵² As I noted, the relationship between likelihood of liability and the case outcome is clearly bumpy.

We could instead smooth the relationship between likelihood of liability and damages owed by requiring probabilistic payouts. We could make *X* pay two-thirds of the damages (\$66) and *Y* pay one-third of the damages (\$33). This is a better result if one thinks that defendants should be liable in proportion to the likelihood of their liability. Under such a view, the proportional method described here is perfect. It creates no error at all.

52. See Saul Levmore, *Probabilistic Recoveries, Restitution, and Recurring Wrongs*, 19 J. LEGAL STUD. 691, 693 (1990); see also David Kaye, *The Limits of the Preponderance of the Evidence Standard: Justifiably Naked Statistical Evidence and Multiple Causation*, 1982 AM. B. FOUND. RES. J. 487.

Alternatively, one might argue, what we really care about is making parties that are more likely tortious than not pay full compensation. If so, we should determine which party was probably tortious and make that party pay full compensation. From this all-or-nothing perspective, our current bumpy approach is preferable. The expected error from our current approach is \$66,⁵³ but if *X* and *Y* each paid his own probabilistic share, the expected error would be \$88.⁵⁴ Thus, our traditional rule makes sense if we view uncertainty in a bumpy, all-or-nothing fashion.⁵⁵

Suppose, however, that victims are frequently injured by the negligence of either *X* or *Y* and that two-thirds of the time *X* is the cause and one-third of the time *Y* is the cause. In that case, probabilistic payouts work better.⁵⁶ As the number of injuries gets arbitrarily high, two-thirds of the time damages will be caused by *X* and one-third of the time by *Y*. Probabilistic payouts, unlike our current approach, would force both *X* and *Y* to pay the amount of injuries they actually caused.

The bottom line is that tort cases currently have a very bumpy relationship between likelihood of liability and damage awards. Whether or not we should understand justice under uncertainty as a smooth or bumpy phenomenon is a very complex question.

When it comes to justice under uncertainty, I have shown that our systems of adjudication *could* smooth uncertainty without resolving whether or not they *ought to*. We know that the pertinent input (namely, confidence in liability or guilt) is a continuous variable. The question is whether the output should be discrete (for example, “no liability” or “full compensation”), as it usually is, or continuous (for example, a percentage of full compensation). Until we resolve the underlying question about how the law ought to treat factual uncertainty, we cannot determine whether or not we are making rounding errors.

Similar comments apply in criminal contexts. There is no widespread agreement about precisely what confidence level is required to find guilt beyond a reasonable doubt.⁵⁷ Let us assume that a 95 percent confidence level

53. Two-thirds of the time *X* will appropriately pay full compensation and *Y* will pay none. So two-thirds of the time, there will be no error at all. One-third of the time, however, *X* will overpay \$99 and *Y* will underpay \$99. The expected error is $(1/3)(\$99) + (1/3)(\$99) = \$66$.

54. Two-thirds of the time *X* will genuinely be responsible, and so he will underpay \$33 and *Y* will overpay \$33. In addition, one-third of the time *Y* will be responsible and underpay \$66 while *X* overpays \$66. Hence the expected error is $(2/3)(\$33 + \$33) + (1/3)(\$66 + \$66) = \$88$.

55. Imagine playing at a roulette wheel where two-thirds of the places where a ball can land are red and one-third are black. If for some reason the house pays even odds when you win on either color, you should bet all the money you wish to gamble on red. Your expected value would be higher than if you put two-thirds of your money on red and one-third on black. Similarly, it may make sense in the tort context to put all of our money, so to speak, on the party that has a two-thirds probability of being a tortfeasor.

56. Levmore, *supra* note 52, at 697.

57. LARRY LAUDAN, TRUTH, ERROR, AND CRIMINAL LAW: AN ESSAY IN LEGAL EPISTEMOLOGY 44 (2006) (citing 90 percent and 95 percent as common unofficial estimates).

is required. Compare, then, one defendant for whom we are 96 percent certain of guilt to another very similar defendant for whom we are 94 percent certain. The former receives his full punishment, perhaps life in prison, while the latter receives no punishment at all, even though our confidence in their guilt is almost indistinguishable. Hence, criminal trials appear to have a bumpy relationship between confidence in guilt and assignment of punishment. Once the established standard of proof is satisfied, level of confidence has little or no formal effect on punishment severity.⁵⁸

Again, the bumpy treatment of uncertainty in the criminal law may seem surprising because we do not have bumpy needs with respect to uncertainty. We could imagine much smoother approaches. For example, we could vary burdens of proof with the seriousness of crimes.⁵⁹ Or we could assign more severe punishments when evidence of guilt is stronger.⁶⁰ In any event, in a world with limited punishment resources, if there are two offenders convicted of separate but essentially identical crimes, except that the strength of the evidence against one is stronger than against the other, our limited resources are better spent on the one for whom we are more confident of guilt.⁶¹

Having considered the relationship between case outcomes and confidence in our liability judgments, we can return to the issue of settlements and plea bargains from a different perspective. Typically, we think of these bargained agreements as cheap forms of justice that lack the detail of full trials. But one thing they clearly do is take uncertainty into consideration. If it turns out that uncertainty should be smooth, then perhaps we should turn our view of settlements and plea bargains on its head. Such forms of bargaining smooth uncertainty more than full trials. They may have more severe deficiencies along other dimensions (they involve less fact finding, for example), but they likely promote smoother decisions under uncertainty than do more elaborate and expensive trials.

Importantly, we can't have it both ways. Unless justice is indifferent to the smoothness of uncertainty, either trials have the advantage of being bumpy with respect to uncertainty or else plea bargains and settlements have the advantage of being smooth. Parties may appreciate the choice to resolve disputes either in more risk-averse settlement contexts or in more risk-loving trial contexts. But at least some views of justice will have difficulty explaining what such preferences have to do with achieving just outcomes.

58. One notable exception may occur in the sentencing phase of death penalty cases where defendants sometimes present evidence of "residual doubt." There is, however, probably no federal constitutional right to present such evidence. See *Oregon v. Guzek*, 546 U.S. 517, 525–27 (2006).

59. Ehud Guttel & Doron Teichman, *Criminal Sanctions in the Defense of the Innocent*, 110 MICH. L. REV. 597 (2012).

60. Talia Fisher, *Conviction Without Conviction*, 96 MINN. L. REV. 833 (2012).

61. See Henrik Lando, *The Size of the Sanction Should Depend on the Weight of the Evidence*, 1 REV. L. & ECON. 277 (2005).

B. Step 2: Craft Law to Match Theory as Closely as Possible

Once we have an underlying normative theory, we need to translate the theory into actual law. Our laws should conform as closely as possible to our theories, subject to practical considerations that sometimes warrant deviating from our theoretical ideals.

1. Bumpy Needs

Sometimes we apply a theory to a context that only realistically permits a small set of possible legal outcomes. That is, we have bumpy needs. Assuming, for example, that we cannot divide up and share chambers of a human heart, we wouldn't want laws granting 75 percent of a heart to one person and 25 percent to another. Similarly, as noted, cases must be heard in either federal or state court, child custody determinations cannot always be made along a smooth gradient, and people cannot (in any easy or familiar way) be partially eligible for the presidency. Even in criminal law, some punishments, like the death penalty, are not smoothly administered. You cannot be a little bit executed.⁶²

Fully developed theories would not present these issues. No fully developed theory of organ distribution would recommend dividing a lifesaving organ into two useless pieces. But some theories—a general theory of distributive justice, perhaps—might be posed at a high level of generality, applying to goods that are generally divisible. When theories are framed in such continuous ways that cannot be practically accommodated in the real world, then we must round the theory to fit our bumpy needs.

In such cases, deviations between theory and law create no real costs. Sure, we may give a donor heart to the person with a 75 percent claim to it relative to the person with a 25 percent claim. But so long as we are forced to do so by the world, the legal result does not deviate from our best theory in a way that causes error. In such cases, I say, the law is rounding to the nearest possible outcome. But it is not creating rounding error. It is rounding exactly as

62. In *Roper v. Simmons*, 543 U.S. 551 (2005), the Supreme Court held that people who are under eighteen years old at the time they offend are ineligible for capital punishment. At least at first, the rule seems extraordinarily bumpy: those who murder on their eighteenth birthday can potentially be executed while those who murder the day before cannot. A small change in maturity can have a big effect on punishment severity.

However, if we assume that current methods of punishment are the only ones available, then we arguably have only bumpy options. Our extreme punishments consist of life imprisonment without parole (LWOP) followed by capital punishment. Taking available punishments as given, there exists a precise point where a slight change in culpability would indeed translate into a dramatic change in punishment eligibility (though it is implausible that merely turning eighteen could appropriately mark the spot). Of course, we could certainly make our needs less bumpy by creating additional kinds of punishments between LWOP and death. Unconstrained by constitutional and other principles, there are forms of execution that deliberately inflict pain or suffering. See *Baze v. Rees*, 553 U.S. 35, 48 (2008). Even if such forms of punishment are inappropriate, they illustrate that it is conceptually possible to make punishment severity levels span a wider range.

it should—exactly as any sensible theory would recommend in cases in which continuous outputs are unavailable.

2. *Trading Off Accuracy with Other Goals*

In other contexts, however, the law may deviate from our normative theory for weaker, practical reasons. Consider a popular website that aggregates movie reviews.⁶³ Each review is converted into a binary variable: the reviewer either liked the film or not. The website then calculates the percentage of positive reviews relative to the total number of reviews. If 60 percent of reviews are positive, the film is deemed “fresh”; otherwise it is deemed “rotten.”

The website usefully distills complicated information into a final, binary recommendation. But if this were the only measurement reported, it would hide lots of relevant information. When converting individual reviews into an overall positive or negative determination, it would ignore whether a reviewer absolutely loved a film or just found it mildly pleasing (and the same for hating versus mildly disliking). Then, when it determined the percentage of favorable reviewers, it would draw an arbitrary cut-off at 60 percent, even though there is little difference between movies that receive 61 percent positive reviews and those that only receive 59 percent positive reviews.

There are, of course, advantages and disadvantages to this approach. For site visitors looking for a quick verdict about a film, the bumpy approach may simply and adequately satisfy their needs. But the convenience has a trade-off in terms of lost information: one might watch some movies that more detailed investigation would have cautioned against and miss some movies that more detailed investigation would have recommended.

In fact, the website does report smoother metrics as well, and, when it comes to movies, the stakes are not especially high. But when legal systems destroy morally relevant information, as bumpy tort and criminal laws seem to do, there are much more serious risks of harm. No one can plausibly deny that both culpability and dangerousness are morally relevant. So the loss of such information should be avoided absent good justification.

Once we know how much information we’re losing, we can weigh that loss against purported benefits. For example, a bumpy law that loses some morally relevant information might be warranted by gains in administrability, financial costs, allocations of discretion, and so on. Indeed, from a societal perspective, such efficiencies are themselves morally relevant.

Unfortunately, theories often say little about how to compare substantive normative goals with other real-world values. For example, how do we weigh the cost of prison sentences that are longer or shorter than justice requires against the desire to reduce discretion among judges or against the goal of

63. ROTTEN TOMATOES, <http://www.rottentomatoes.com> (last visited Feb. 28, 2014).

reducing trial costs? Ideally, normative theories would take these real-world concerns into account directly. A theory is incomplete if it cannot tell us at least in principle how to weigh real-world considerations against theoretical virtues. When theory gives insufficient guidance, we must either pick a better, more complete theory, or engage in some kind of rough, intuitive balancing.

C. Step 3: If Necessary, Rely on Generalizations

Absent a detailed normative theory that takes real-world considerations into account or absent empirical data enabling us to assess these considerations, we cannot say with certainty whether some law instantiating a theory makes significant rounding error. I offer some generalizations about the choice between smooth and bumpy laws that may help us decide when we lack more complete information.

1. Considerations Generally Favoring Smooth Laws

Generally speaking, smooth laws create better incentive schemes, treat similar cases similarly, and better preserve morally relevant information. They also seem to be growing in popularity.

a. Incentives

Smooth laws often promote better incentive schemes than do bumpy laws because smooth laws are less subject to strategic behaviors that subvert legislative goals. For example, if we ignore most of the federal tax code and look only at the relationship between adjusted gross income and total personal income tax liability, we see a relatively smooth relationship. We provide for higher *rates* of tax in higher income brackets, but the rates only apply to income within the relevant bracket. So the relationship between income and total tax burden varies smoothly (though nonlinearly because of progressively higher tax rates).⁶⁴ These rates may distort our behavior to some extent: some people may choose to work less as the government takes a progressively larger share of their earnings. But the disincentives to work are somewhat gradual, at least relative to a system where increasing tax rates are applied not at the margins but to total adjusted gross income. If increasing tax rates applied to total adjusted gross income, those likely to make just enough income to push

64. The relationship between adjusted gross income and taxes owed satisfies my description of a smooth relationship. There is, however, a bumpy relationship between income and marginal tax rate. A person's marginal tax rate increases in a stepwise fashion as adjusted gross income crosses certain thresholds. Such bumpiness may have distortive effects or may otherwise be theoretically unsound. We could eliminate these brackets (and still retain progressivity) by using a smoother formula. See Matthew C. Klein, *A Tax Reform You Probably Haven't Heard Of*, BETWEEN THE BALANCE SHEETS (Sept. 27, 2011), <http://betweenthebalancesheets.wordpress.com/2011/09/27/a-tax-reform-you-probably-havent-heard-of>.

themselves into a higher tax bracket would have strong incentives to reduce their income to stay in the lower bracket.

Compare the relative smoothness of the federal personal income tax to New York State's so-called "mansion" tax. The mansion tax requires home buyers to pay an additional 1 percent tax on home purchases of \$1 million or more.⁶⁵ This tax is bumpy over an important range of values. There is no mansion tax liability on the purchase of a home worth just under \$1 million, but once a home reaches the \$1 million level, a \$10,000 tax (1 percent of \$1 million) suddenly kicks in. A small change in the relative luxuriousness of a property can dramatically change the tax liability incurred when purchased. As a result, people have incentives to: (1) buy homes valued just under the threshold, (2) refrain from improving homes that might become subject to the threshold, and (3) covertly transfer assets between buyers and sellers to avoid making homes subject to the tax. Thus, the mansion tax may distort prices and behavior in a variety of ways.

Presumably the mansion tax is meant to implement some theory about the just distribution of resources by increasing the progressivity of taxes. Yet there are probably no good theoretical grounds for treating people radically differently based on whether their homes are worth just above or just below \$1 million. About the only thing to be said in favor of the bumpy approach is that it is slightly easier to calculate than a smooth version that is phased in more gradually. But the benefits of a simpler calculation may not justify the bumpy harms of distorting home purchasing and renovation decisions and the risks of incentivizing tax evasion.

b. Treating Similar Cases Similarly

Smooth jurisprudence has an elegant fit between inputs and outputs. Cases that vary only slightly along a pertinent dimension have outputs that vary only slightly. By contrast, bumpy jurisprudence takes some situations in which inputs vary substantially along a pertinent dimension and treats them identically and takes other situations where they vary slightly and creates sharp discontinuities.

Imagine two people who caused accidents. One observed a reasonable level of caution, while the other was just slightly less cautious. The reasonably careful person would owe no damages for negligence, but the one who was just slightly less cautious might owe millions of dollars. Though the differences in their conduct seem almost trivial, our bumpy negligence doctrine creates a sharp discontinuity in how we treat them.

A staunch defender of a bumpy doctrine of negligence could argue that the two drivers are not similar. One was negligent, and the other was not. But even though they may be placed into two different categories, it is not obvious

65. N.Y. TAX LAW § 1402-a(a) (McKinney 2008).

why they ought to be treated so radically differently. Yet such radically different treatment of similarly situated people is a common feature of bumpy laws.

c. Preserving Morally Relevant Information

As noted, we cannot decide which laws preserve morally relevant information without settling on a particular theory. I obviously cannot resolve all such debates here. I have hinted, however, at how many phenomena that implicate criminal justice and corrective justice seem naturally suited to smooth relationships. So though I cannot prove it here definitively, I suggest that, as a general matter, smooth laws tend to better preserve morally relevant information than do bumpy laws.

d. Historical Trend

While I do not offer a detailed analysis of the law's relative smoothness over time, there are hints that the law is growing progressively smoother. The clearest example is the transition from contributory to comparative negligence. Under principles of contributory negligence, if a plaintiff's negligence is even partly responsible for his injury, his action fails: any amount of contributory negligence is a complete bar to recovery.⁶⁶ The rule operates in a very bumpy fashion. If a defendant's negligence causes millions of dollars' worth of injuries to an entirely non-negligent plaintiff, the plaintiff can recover the full amount. If, however, the plaintiff's own negligence contributes just a bit to his injury, he recovers nothing.

Almost all U.S. jurisdictions have switched from contributory negligence to a smoother, comparative approach. Many jurisdictions have adopted a "pure" version of comparative negligence that compares the extent of the plaintiff's contribution to his injury relative to the defendant's contribution. If the plaintiff wins, the defendant pays only that percentage of the total damage award attributable to his own negligence. So if the pertinent legal input is the amount of plaintiff negligence relative to defendant negligence, then comparative negligence is clearly smoother than contributory negligence.⁶⁷

The shift toward comparative negligence can be seen as part of a broader trend toward smoother tort law.⁶⁸ For example, when multiple tortfeasors are

66. RESTATEMENT (FIRST) OF TORTS § 467 (1934). The Second Restatement has a similar provision with an exception "where the defendant has the last clear chance" to avoid the harm. RESTATEMENT (SECOND) OF TORTS § 467 (1965); *see id.* §§ 479–80.

67. Other jurisdictions use a modified comparative negligence standard. For example, some jurisdictions apply comparative negligence principles until the plaintiff's responsibility for an accident is at or above the defendant's level. W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS § 67, at 473 (5th ed. 1984). At that point, the plaintiff's negligence becomes a complete bar to recovery. *Id.* Modified comparative negligence is clearly less smooth than the pure form.

68. The doctrine of assumption of risk, a close cousin of contributory negligence, has also largely faded from use in the United States. Like contributory negligence, assumption of risk generally

held jointly and severally liable, a negligent tortfeasor charged more than his pro rata share can generally now seek contribution from other tortfeasors in amounts that correspond to their percentage of responsibility for the injury caused.⁶⁹ Similarly, the recent development of market-share liability⁷⁰ and loss-of-a-chance principles⁷¹ seems to reflect an increasingly smooth relationship between tortfeasors' negligence and their liability.⁷²

In criminal law, we have new kinds of liability that arguably forge closer ties between levels of culpability or dangerousness and corresponding punishments. For example, there was no general doctrine of attempt in early English law.⁷³ Now, we generally punish attempters with shorter sentences than completers,⁷⁴ which in the minds of most people, more smoothly pegs punishment to offenders' conduct.

We have also constructed thousands of new crimes. At the turn of the twentieth century, there were dozens of federal criminal statutes.⁷⁵ By some estimates, there are now roughly 4,500 federal crimes.⁷⁶ While it is no excuse for overcriminalization, to the extent these statutes punish appropriately, the proliferation of statutes may tie punishment more closely to culpability or dangerousness. In some aspects of conduct, there may be so many statutes to choose from that the discrete variable governing offense selection starts to

operates in an all-or-nothing fashion. See Kenneth W. Simons, *Reflections on Assumption of Risk*, 50 UCLA L. REV. 481, 484–94 (2002). Assumption of risk can be understood as a consent doctrine, and I am agnostic as to whether consent ought to be understood as a smooth or bumpy phenomenon.

69. UNIF. CONTRIBUTION AMONG TORTFEASORS ACT § 7 (amended 1955), 12 U.L.A. 194 (2008); see also RESTATEMENT (THIRD) OF TORTS: APPOINTMENT OF LIAB. § 23 cmt. 1 (allowing intentional tortfeasors to seek contribution).

70. See, e.g., Allen Rostron, *Beyond Market Share Liability: A Theory of Proportional Share Liability for Nonfungible Products*, 52 UCLA L. REV. 151, 152–53 (2004) (describing market share liability as “a theory under which a plaintiff unable to identify the manufacturer of the particular product that caused his injury can recover on a proportional basis from each of the manufacturers that might have supplied the product”).

71. Under traditional principles, a patient who would have had a 30 percent chance of survival but for a physician's negligence cannot recover for the lost chance because he cannot show his survival was more likely than not. Joseph H. King, Jr., *Causation, Valuation, and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences*, 90 YALE L.J. 1353, 1363–64 (1981). Even if he had a greater than 50 percent chance of surviving, his recovery would “not be discounted by the chance that the loss might have occurred even absent the tort.” See *id.* at 1365. Some courts now allow recovery even when the lost chance of survival is less than 50 percent. See, e.g., *Herskovits v. Grp. Health Coop.*, 664 P.2d 474 (Wash. 1983); BARRY R. FURROW ET AL., *HEALTH LAW* § 6–7(b), at 307 (2d ed. 2000) (“The amount of damages available to the plaintiff in lost chance cases is generally equal to the percent of a chance lost as a result of the physician's negligence, multiplied by the total amount of damages that would be awarded.”).

72. Alternatively, they may reflect smoothing of the relationship between liability and level of certainty of factual causation. I am agnostic about smoothing such uncertainty. See *supra* Part III.A.5.

73. Jerome Hall, *Criminal Attempt—A Study of Foundations of Criminal Liability*, 49 YALE L.J. 789, 791, 793 (1940).

74. See SANFORD H. KADISH ET AL., *CRIMINAL LAW AND ITS PROCESSES: CASES AND MATERIALS* 607–10 (8th ed. 2007).

75. Fields & Emshwiller, *supra* note 8.

76. *Id.*

seem almost continuous. Of course, a trend toward smoother law is no proof that we are on the right track. But it points to aspects of the law that have grown smoother and could presumably be made smoother still.

2. Considerations Generally Favoring Bumpy Laws

By contrast, bumpy laws are generally cheaper and easier to administer than smooth laws. And sometimes, we have no choice but to pick a nearby discrete outcome. In such cases, bumpy laws round without creating rounding error.

a. Cost and Administrability

One of the best reasons to choose bumpy laws is that they are often cheaper and easier to administer than smooth laws. Bumpy laws require us to decide whether some input was higher or lower than a pertinent threshold, while smooth laws require a much more precise estimate of the value of the input itself. For example, it is much easier to decide whether a plaintiff was contributorily negligent (that is, negligent at all) than to assess the extent of a plaintiff's negligence relative to the defendant's.

Of course, even when bumpy laws are cheaper or more administrable, we need to consider the errors induced when our laws deviate from our best theories. In the criminal context, bumpy laws may lead us to round a prison sentence up several years longer than it ought to be and the additional time will be quite costly to the prisoner and society. Similarly, if we round a sentence down below what it should be, people might commit crimes they otherwise would not. In such cases, rounding may incur the substantial costs of permitting preventable crimes. In short, when deciding how to structure the law, we must often compare the various costs of administering smooth laws to the various harms of bumpy rounding errors. Without a theory that tells us whether the law should be smooth or bumpy, however, we cannot even begin to determine what aspects of our legal practices constitute error, acceptable or otherwise.

b. Bumpy Needs and Law Governing Law

As noted, we have bumpy needs when, for all practical purposes, we are forced to choose between a limited set of legal options. Such bumpy needs tend to arise in areas of the law that govern the operation of other aspects of law. We want evidence to be admissible, inadmissible, or admissible for some purposes. The choices are discrete rather than continuous. In civil procedure, we typically want a motion to be filed by a certain deadline and not partially filed over a period of weeks. In constitutional law, we expect a law to be constitutional, unconstitutional, or constitutional in some respects, but again the results are limited to a few discrete options. When we have bumpy needs, bumpy laws create no rounding error.

3. Context-Dependent Considerations

It is possible that, as a matter of human psychology, people perceive smooth laws and bumpy laws differently in ways that ought to be taken into consideration. In addition, since laws often result from political compromises among competing theories, it is no surprise that legal input-output relationships will often have hybrid smooth and bumpy features.

a. Human Psychology

In a famous psychology experiment, when Israeli day-care centers introduced a monetary penalty for parents who arrived late to pick up their children, the number of late pickups actually increased.⁷⁷ The researchers suggest that the penalty changed parents' perceptions: parents no longer thought they were taking advantage of teachers when they paid the price for a late pickup.⁷⁸

The fine that was introduced was bumpy. Parents less than ten minutes late owed nothing, while parents more than ten minutes late owed ten shekels.⁷⁹ Perhaps a smooth fine would have had the same effect. But a smooth fine might have seemed *even more* like a price than the bumpy fine did, since the cost of violation would increase with the duration of the violation. If so, smooth regulation may have a slight advantage when we want to send out a pricing message but a slight disadvantage when we want to convey a more absolute prohibition.

Smooth and bumpy penalties may also differ in their memorability. A bumpy \$100 fine for driving above sixty-five miles per hour may be easier to remember than a relatively smooth fine of \$10 per mile-per-hour driven above the limit. Or perhaps it is the other way around. Either approach gives notice of the pertinent penalty, but there may still be consistent differences in memorability that could favor one form of regulation over another.⁸⁰

Assuming there are consistent differences in how people respond to smooth and bumpy laws, they must be considered along with all the other pertinent factors to determine which kind of rule best serves the theory justifying the law. So even if a bumpy fine better promoted compliance than a smooth one, we would still have to consider whether the implementation of the bumpy fine would produce better or worse outcomes when the fine was actually imposed.

77. Uri Gneezy & Aldo Rustichini, *A Fine Is a Price*, 29 J. LEGAL STUD. 1 (2000).

78. *Id.* at 13–14.

79. *Id.* at 14.

80. Concerns about the memorability of a law might also justify signaling one message to help people obey the law and another message to judges who actually decide cases. See Meir Dan-Cohen, *Decision Rules and Conduct Rules: On Acoustic Separation in Criminal Law*, 97 HARV. L. REV. 625, 627–30 (1984) (distinguishing “conduct rules” addressed primarily to the public to guide behavior and “decision rules” addressed primarily to judges to decide individual cases).

b. Political Compromise

Most bodies of law reflect compromises among people who support different theories.⁸¹ Smooth decision making has to be tied fairly closely to some particular theory, but since lawmaking is often a compromise among many theoretical views, courts and legislators may end up with somewhat bumpy rules that hide a law's underlying motivations and operative principles.

Suppose one political constituency believes the personhood rights of a fetus should smoothly relate to its cognitive abilities. As fetal cognition gradually develops, the fetus slowly accumulates weightier personhood rights. Another constituency believes there should be a bumpy relationship between cognitive abilities and fetal personhood rights. According to this group, a fetus should have no personhood rights whatsoever until it crosses some critical threshold of cognitive development at which point it should receive personhood rights with maximum weight.

The compromise that would likely emerge would be neither perfectly smooth nor completely bumpy. Indeed, the amalgamation of the many such theories of fetal personhood rights may lead to something like our own constitutional law of abortion which draws a few critical places in the course of pregnancy when the rights and interests of fetuses, mothers, and the state change. Prior to viability, a woman has a right to abortion with limited state interference.⁸² Upon viability, the state can prohibit abortion, so long as it makes exceptions when the mother's life or health is endangered.⁸³ Upon the moment of birth, the fetus instantaneously transforms into a person with full constitutional rights.⁸⁴ While this body of law is not as bumpy as some constituencies would prefer, the result is surely not as smooth as others would prefer. Hence, compromises between smooth and bumpy theories will likely lead to laws that are bumpy to some degree or another.⁸⁵

D. Summary

The best relationship between a legal input and output depends on the context. Sometimes we need discrete outcomes, but often we do not. Smooth jurisprudence generally provides better incentive schemes, treats similar cases similarly, preserves morally relevant information, and reduces errors created by outputs that are divergent and limited in number. There is also a historical trend

81. See Cass R. Sunstein, *Incompletely Theorized Agreements*, 108 HARV. L. REV. 1733, 1735–36 (1995).

82. *Planned Parenthood v. Casey*, 505 U.S. 833, 846 (1992).

83. *Id.*

84. U.S. CONST. amend. V (“No person shall be . . . deprived of life, liberty, or property, without due process of law . . .”).

85. In principle, compromises between smooth laws could lead to a law that is bumpy, while compromises between bumpy laws could lead to a law that is smooth. Nevertheless, I speculate that political compromise is more likely to promote bumpy laws rather than smooth ones.

toward smoother jurisprudence. Bumpy jurisprudence, on the other hand, is usually less costly and less difficult to administer. It works well for laws that govern other laws and is necessary when we have bumpy needs.

How should we decide between the two? We look at what our theories require and the kinds of outcomes we need. If the answer is not yet obvious, we further consider the various advantages and disadvantages of smooth and bumpy laws to resolve the matter. When we switched in most states from contributory negligence to comparative negligence, we implicitly engaged in this sort of analysis. It is the kind of analysis that often cannot be done from an armchair but requires examination of real-world costs and benefits, including, ideally, field experiments using different approaches.

CONCLUSION

Many behavioral phenomena of interest to the law are better captured by smooth rather than bumpy laws. Smooth laws frequently have clearer and stronger theoretical foundations, while bumpy laws frequently create rounding errors. Bumpy laws also put inordinate pressure on us to identify the magical and frequently mysterious point along a continuum where our legal treatment radically changes course.

Sometimes, however, we have bumpy needs for the law, and sometimes smooth solutions would be prohibitively expensive. Yet scholars have largely failed to justify the bumpiness of our laws in terms of bumpy needs or cost effectiveness. Indeed, we often have no good explanations for the law's bumpiness, other than the random path of history that has led us to where we are. Scholars must more carefully refine their theories if they believe they can justify the law's bumpiness. Along the way, we will surely find good opportunities to smooth existing law. Recent history suggests the law is growing smoother, and we are likely to find more opportunities to smooth the law when we consciously look for them.

Justice is iconically represented by a scale that balances the merits of each party. The image suggests that one side of the scale will quickly fall to the bottom, even if the merits on that side are just slightly weightier than the other. But if we ignore the difference in weight between the two sides, we often lose important, morally relevant information. Justice may be better represented as a tug of war where each party pulls on a rope with force proportional to its merits. We then look at the position of the rope to determine the relative strength of each side. When justice is so viewed, we can find solutions that better reflect the smooth features of the natural world.