Shocking Sentences

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Harsh recidivist sentencing penalties, like three-strikes laws, have been criticized heavily among both academics and practitioners on a number of different grounds. Most arguments focus on how sentences arising from these penalties are disproportionate—that there is no sensible relationship between the wrong committed and the sentence imposed. Those critiques are valid, but there's another important problem with recidivist sentencing penalties that has been overlooked: They lead to sentences that are totally unexpected—indeed, shocking—to the defendants who face them. Many recidivist sentencing penalties cause large leaps in sentencing exposure that amount to exponential growth when compared with a defendant's prior sentences.

We can better understand the problem of shocking sentences (and how to solve it) by understanding the psychological phenomenon that likely causes it: the exponential growth bias. Across a number of domains, people making quantitative decisions tend to presume linear growth will occur, even in light of evidence that the growth is exponential. I argue that this phenomenon happens in sentencing as well, and it explains—at least in part—why defendants don't anticipate these types of sentences.

Understanding the psychological underpinning of shocking sentences helps us understand why they are harmful: They undermine due process and predictability in the law, they limit potential deterrence, and they're out of line with everyday intuitions about sentencing. Flatly, they're bad sentencing policy, and we should reduce them or eliminate them outright. But even if eliminating shocking sentences is politically untenable, there may be ways to reduce the effect of the exponential growth bias. Applying lessons learned from the psychological literature, I suggest

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ways to provide increased notice of recidivist sentencing provisions aimed to make them less shocking.

INTRODUCTION

In the early 2000s, Tommie Ireland was addicted to drugs and gambling.[1] Like many others, his addictions led him to crime. First, he was involved in an altercation with police officers, pointing a gun at them and fleeing.[2] Because he was still young, he received a probation sentence under the Holmes Youthful Trainee Act—a Michigan statute that permits lenient sentences for young defendants.[3] Two years later, he was selling drugs to support his habit. It wasn't long before he was caught. First, he was convicted in 2007 of selling marijuana and was sentenced to two years of probation and nine days in jail.[4] Selling cocaine was next, and in 2010 Ireland was convicted and sentenced to one year of probation.[5] He was convicted of the same crime again several years later, and again received two years' probation.[6] In all, he served only nine days of jail time across all three sentences. And though Ireland received relatively light sentences for all three convictions, the statutes he was convicted under allowed for much harsher penalties—up to 4 years for the marijuana conviction and 20 years for the narcotics.[7]

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1. *See* Gov't's Sent'g Mem. at 9–10, United States v. Ireland, No. 17-cr-20203 (E.D. Mich. Nov. 30, 2017); Def.'s Sent'g Mem. at 3, *Ireland*, No. 17-cr-20203.

2. Gov't's Sent'g Mem., *supra* note 1, at 9.

3. *Id.* at 9–10; *see* MICH. COMP. LAWS §§ 762.111–14. If the probation is successfully completed, the statute also allows the court to dismiss the charges. *Id.* at § 762.114.

4. Register of Actions, Case No. 07-009377-01-FH, THIRD JUDICIAL CIRCUIT OF MICHIGAN, https://cmspublic.3rdcc.org/CaseDetail.aspx?CaseID=191031.

5. Register of Actions, Case No. 10-003087-01-FH, THIRD JUDICIAL CIRCUIT OF MICHIGAN, https://cmspublic.3rdcc.org/CaseDetail.aspx?CaseID=1198204.

6. Register of Actions, Case No. 16-010021-01-FH, THIRD JUDICIAL CIRCUIT OF MICHIGAN, https://cmspublic.3rdcc.org/CaseDetail.aspx?CaseID=3563508.

7. MICH. COMP. LAWS § 333.7401(2)(a)(iv) (providing that distribution of a narcotic that is "less than 50 grams" is "a felony punishable by imprisonment for not more than 20 years or

Ireland didn't stop selling drugs and was eventually caught up in a federal investigation.[8] As in his prior state cases, Ireland sold relatively small quantities of cocaine.[9] He was charged with several counts of distribution, and also with unlawful possession of a firearm.[10] But this time, Ireland's sentencing experience was very different. Based on the quantity of drugs that Ireland sold and his possession of a gun, he had a baseline Sentencing Guideline range of 51 to 63 months' incarceration—more than twice the length of time that Ireland had served on *probation* for his past convictions, let alone in prison.[11]

But his total exposure was much worse. Under the Guidelines, when a defendant commits a drug crime or a "crime of violence" after having sustained at least two prior drug or violent felonies, he is considered a "career offender," and subject to a sentencing range several magnitudes higher.[12] For Ireland, this translated to a range of 188–235 months (just over 15 years to 19.5 years).[13] As the government noted in its sentencing memorandum, this was an increase of more than 300% over Ireland's Guideline range without the career offender enhancement (which itself was still nearly 300% longer than Ireland's longest probation term to date).[14] In the end, Ireland was fortunate relative to many others in his position: The government recommended a well-below-guidelines sentence, based in part on the disparity between the career offender range, Ireland's Guideline range without that provision,

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a fine of not more than $25,000.00, or both"); *id.* § 333.7401(2)(d)(iii) (providing that distribution of "less than 5 kilograms" of marijuana is "a felony punishable . . . by imprisonment for not more than 4 years or a fine of not more than $20,000.00, or both").

8. Shawn Ley & Derick Hutchinson, *Detroit Man Busted for Drug Operation Outside Historic Downtown Hotel: Federal Indictment Describes 18 Separate Drug Transactions*, CLICK ON DETROIT (Aug. 9, 2017, 6:14 PM), https://www.clickondetroit.com/news/2017/08/09/detroit-man-busted-for-drug-operation-outside-historic-downtown-hotel/ [https://perma.cc/5QLV-A3BT]. Though the article describes other drug transactions, Ireland's conduct was part of the same investigation conducted by the Bureau of Alcohol, Tobacco, Firearms, and Explosives. *See id.* (describing how the arrest was "all part of larger gang activity downtown").

9. Gov't's Sent'g Mem., *supra* note 1, at 2–3, 6–7. Unbeknownst to Ireland, he was actually selling cocaine to an undercover ATF agent. *Id.*

10. Indictment at 1–3, United States v. Ireland, No. 17-cr-20203 (E.D. Mich. Nov. 30, 2017).

11. Gov't's Sent'g Mem., *supra* note 1, at 10; *see supra* notes 4–6 and accompanying text. Ireland's Guideline range was made up of two things: a base offense level and a criminal history category. Gov't's Sent'g Mem., *supra* note 1, at 9–10; *see also* U.S. SENT'G GUIDELINES MANUAL § 1B1.1(a) (U.S. SENT'G COMM'N 2021). His base offense level was likely derived from § 2D.1—the chapter describing drug offenses—and § 2K2.1—the chapter describing drug offenses. His criminal history category—III—was derived from his prior convictions and sentences. U.S. SENT'G GUIDELINES MANUAL ch. 4 (U.S. SENT'G COMM'N 2021). Importantly, the guideline range is only the "starting point and the initial benchmark" for the judge's sentence following the Supreme Court's landmark decision in *United States v. Booker*, 543 U.S. 220 (2005), which held that the mandatory guideline scheme was unconstitutional. Gall v. United States, 552 U.S. 38, 49–50 (2007).

12. U.S. SENT'G GUIDELINES MANUAL § 4B1.1 (U.S. SENT'G COMM'N 2021).

13. Gov't's Sent'g Mem., *supra* note 1, at 2–3, 6–7.

14. *Id.* at 10; *see supra* notes 4–6.

and Ireland's prior light sentences.[15] And because a Career Offender Guideline range is merely advisory following *United States v. Booker*,[16] the judge used his discretion to sentence Ireland to only 60 months in prison.[17] Had Ireland instead been sentenced under one of a number of statutory recidivist sentencing schemes (rather than the advisory Guideline scheme he was sentenced under), his sentence would likely have been several times longer.[18]

Recidivist sentencing penalties, like the one Ireland was subject to, have been criticized heavily in the academic literature on a number of different grounds. Many arguments focus on how these sentences are disproportionate—that there is no sensible relationship between the wrong committed and the sentence.[19] Proportionality arguments are at the center of legal challenges to recidivist sentencing penalties as well. Most famously, in *Ewing v. California*, Gary Ewing faced a 25-year-to-life prison sentence for stealing three golf clubs under California's three-strikes law.[20] Ewing challenged the sentence as disproportionate, in violation of the Eighth Amendment, because the offense was so minor relative to the penalty, though he was ultimately unsuccessful.[21] Applied to Tommie Ireland's case, the argument would go something like this: While Ireland's offense was undoubtedly serious, offenses that would be considered by many as much more serious—such as violent assault, robbery, or even homicide—can be met with sentences less than 17.5 years (the midpoint of Ireland's guideline range).[22] And indeed, Ireland's similar

15. Gov't's Sent'g Mem., *supra* note 1, at 10 n.1. In full disclosure, I was the line prosecutor responsible for handling Ireland's case. *Id.* at 13.

16. 543 U.S. at 220.

17. Judgment at 2, United States v. Ireland, No. 17-cr-20203 (E.D. Mich. Dec. 5, 2017). Since *Booker*, sentencing judges have been able to consider the broad factors laid out in 18 U.S.C. § 3553(a) to determine whether to sentence outside of the guideline range. 543 U.S. at 245. Ireland was also later successful in further reducing his sentence based on compassionate release in the wake of the COVID-19 pandemic. Ord. Granting Mot. to Modify Sentence, United States v. Ireland, No. 17-cr-20203 (E.D. Mich. Jul. 20, 2020); *see also* 18 U.S.C. § 3582(c)(2) (outlining criteria for "[m]odification of an [i]mposed [t]erm of [i]mprisonment").

18. For example, under the Armed Career Criminal Act, a defendant who commits a firearm offence under 18 U.S.C. § 922(g)—such as being a felon in possession of a firearm (as Ireland was here)—is subject to a 15-year mandatory minimum sentence (with a maximum of life) if he has three prior convictions for a "violent felony" or a "serious drug offense." 18 U.S.C. § 924(e). If Ireland's first drug conviction had been for a cocaine sale under the same statute as his second and third convictions, he could have been prosecuted under that statute and sentenced to the 15-year mandatory minimum. *See id.* § 924(e)(2)(A)(i) (defining a "serious drug offense" as one "involving manufacturing, distributing, or possessing with intent to manufacture or distribute" a controlled substance, "for which a maximum term of imprisonment of ten years or more is prescribed by law").

19. *See, e.g.*, Donna H. Lee*, Resuscitating Proportionality in Noncapital Criminal Sentencing*, 40 ARIZ. ST. L.J. 527, 527 (2008) (defining proportionality); Rachel E. Barkow, *Categorical Mistakes: The Flawed Framework of the Armed Career Criminal Act and Mandatory Minimum Sentencing*, 133 HARV. L. REV. 200, 201 (2019) ("Thousands of individuals received punishments disproportionate to their offenses because they were treated on par with the worst offenders Congress had in mind when passing its laws.").

20. 538 U.S. 11, 15–19 (2003).

21. *Id.* at 28–31.

22. *See, e.g.*, MICH. COMP. LAWS ANN. § 750.88 (West 1931) (punishing "assault with

prior offenses resulted in much shorter sentences than a Guideline sentence would have been in his federal case.[23]

Scholars have made other arguments against harsh recidivist sentencing penalties that are not so grounded in proportionality analysis. Some argue that these types of sentences are simply ineffective: They don't meet consequentialist goals of punishment, like deterrence, and are a waste of resources.[24] Others argue that recidivist sentencing penalties do not fit with the goals of retributivism,[25] lead to disparate outcomes across race and economic status,[26] or are difficult to apply in a principled way.[27]

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intent to rob" when using "violent force" with "not more than 15 years" in prison); MICH. COMP. LAWS ANN. § 750.321 (West 1931) (same penalty for manslaughter).

23. *See supra* notes 4–6 and accompanying text; MICH. COMP. LAWS § 333.7401 (2017).

24. *See, e.g.*, Guha Krishnamurthi, *Against the Recidivist Premium*, 98 TUL. L. REV. 411, 466 (2024) ("[W]e must have robust empirical evidence that [a recidivist penalty will provide specific deterrence, general deterrence, or incapacitation] . . . . But that evidence is lacking, and [indeed,] the available evidence suggests that the recidivist premium is either ineffectual in obtaining these benefits or is in fact criminogenic and counterproductive."); Jennifer Lee Barrow, *Recidivism Reformation: Eliminating Drug Predicates*, 135 HARV. L. REV. F. 418, 433–34 (2022) (noting costs of overincarceration). More generally, the criminology literature suggests that increases in sentence length do relatively little to deter crime as compared to increases in the likelihood of being caught and punished at all. *See, e.g.*, MICHAEL TONRY, SENTENCING FRAGMENTS: PENAL REFORM IN AMERICA, 1975–2025 31 (2016); Lee Kovarsky, *Suffering Before Execution*, 109 VA. L. REV. 1429, 1473 (2023).

25. *See, e.g.*, Krishnamurthi, *supra* note 24, at 429 ("None of [the] retributivist theories justifies the imposition of [the] recidivist premiums as implemented by our criminal justice system.").

26. *See, e.g.*, Barkow, *supra* note 19, at 201 ("Prosecutors have not uniformly sought mandatory minimum sentences, which has led to greater disparities, particularly on the basis of race."); Barrow, *supra* note 24, at 431 ("The ACCA disproportionately affects people of color. Only 24.0% of all people released from federal custody between 2009 and 2011 were Black, but more than half (53.2%) of the people sentenced under the ACCA and released during the same time period were Black. Moreover, in fiscal year 2016, Black people convicted under the ACCA received longer average sentences than any other racial group—averaging 185 months, compared to 178 months for White people, 173 months for Hispanic people, and 147 months for people of 'Other Race.'"); Sarah French Russell, *Rethinking Recidivist Enhancements: The Role of Prior Drug Convictions in Federal Sentencing*, 43 U.C. DAVIS L. REV. 1135, 1139 (2010) ("[T]here is clear evidence that enhancements based on prior drug convictions exacerbate racial disparities in the criminal justice system.").

27. *See, e.g.*, Barkow, *supra* note 19, at 207 ("The ACCA cases last Term show how this regime puts the federal courts in general and the Supreme Court in particular in the almost impossible position of trying to make the ACCA a coherent punishment regime, given the irrational and poorly researched foundation on which it rests."); Sheldon A. Evans, *Punishing Criminals for Their Conduct: A Return to Reason for the Armed Career Criminal Act*, 70 OKLA. L. REV. 623, 627 (2018) (criticizing federal approach to three-strikes sentencing law and favoring conduct-based approach to defining prior violent conduct because of its "simple application while achieving uniformity"); Barrow, *supra* note 24, at 433 (noting "a lack of uniformity"); Stephen R. Sady, *The Armed Career Criminal Act—What's Wrong with "Three Strikes, You're Out"?*, 7 FED. SENT'G. REP. 69, 70 (1994) ("The over-inclusiveness of the Armed Career Criminal Act has given rise to significant arbitrariness in deciding who ends up suffering under warehouse sentencing.").

All of these concerns are well-grounded. But there's another problem with recidivist sentencing penalties that has gone entirely undiscussed in the literature: These provisions lead to sentences that are vastly out of touch with what a defendant (or an outside observer) would anticipate the sentence is likely to be. In a word, they're shocking.[28] Before Tommie Ireland was charged federally, he almost certainly knew that his criminal history would play a part in any future drug charge, whether state or federal. He probably knew that his next sentence would likely be higher than his prior probation sentence. But he never would have expected that, following several probation and short jail sentences, his next crime—while similar in nature to his past ones—would expose him to a sentence in excess of 15 years.[29]

It's perhaps intuitive to think that someone in Ireland's position would be shocked by his sentence. But we can better understand the problem (and how to solve it) by understanding the psychological phenomenon that likely causes it: the exponential growth bias. The basic idea is straightforward: When people forecast future quantitative events—like the number of months in Ireland's federal sentence—they tend to presume that the future events will proceed in a linear fashion relative to past events (like Ireland's prior sentences), rather than exponentially.[30] The exponential growth bias is robust across a number of different domains. When individuals are asked to forecast the number of COVID-19 cases or deaths over a period of time, they vastly underestimate later cases or deaths, presuming linearity when in fact the increase is exponential (at least for a time).[31] Similar errors occur in financial decisions too. When asked how much money will be in a retirement savings account after a period of years, given a set monthly contribution and a 10% rate of return, individuals greatly underestimate the amount of money in the account over time, ignoring the exponential growth that results from compounding interest.[32]

Though research on the exponential growth bias has primarily focused on nonlegal contexts, the bias has serious implications for many areas of law.[33] Legal regimes and administrative policymaking fail to account for the bias where it has pernicious consequences, such as in misforecasting of the COVID-19 pandemic or incorrect modeling of some global warming processes that follow exponential growth.[34] In criminal law, many jurisdictions' sentencing procedures build in

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28. "Unpredictable" or "surprising" might also be appropriate terms here, but I think "shocking" better captures the unique dismay associated with a surprising criminal sentence, especially one that is vastly longer than what many individuals would anticipate.

29. Before entering academia, I spent about six years working as an Assistant United States Attorney, prosecuting a variety of federal cases. Part of the inspiration for this Article was a number of conversations I had with defense attorneys who expressed how surprised their clients were at the extent of their exposure in the criminal system based on their criminal history.

30. Doron Teichman & Eyal Zamir, *Exponential Growth Bias and the Law: Why Do We Save Too Little, Borrow Too Much, and Fail to React on Time to Deadly Pandemics and Climate Change?*, 75 VAND. L. REV. 1345, 1347 (2022).

31. *See infra* notes 154–167 and accompanying text.

32. *E.g.*, Craig R.M. McKenzie & Michael J. Liersch, *Misunderstanding Savings Growth: Implications for Retirement Savings Behavior*, 48 J. MKTG. RSCH. S1, S3–S4 (2011).

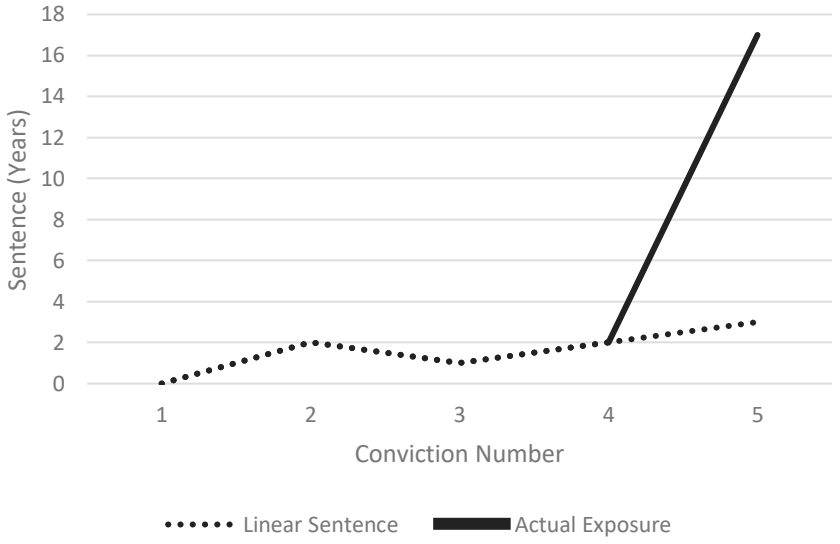
33. *See generally* Teichman & Zamir, *supra* note 30, at 1345–46 (describing contexts where exponential growth bias is relevant to law).

34. *See infra* notes 154–167 and accompanying text.

exponential (or greater-than-exponential) growth across repeat criminal convictions. The end result is disturbing: Defendants being sentenced likely vastly underestimate their potential criminal culpability, even if they carefully consider their prior sentences and the growth of the sentences they have incurred so far.[35]

A visual representation of Ireland's sentences helps demonstrate the issue. In the figure below, the dotted line for Ireland's first four convictions are the terms of probation he received for those convictions, ranging from 0 to 2 years. The point at the end of the dotted line—representing Ireland's federal conviction—is in the range of what Ireland might have expected his sentence to be if he presumed linear growth in his sentences over time. The solid line, in contrast, is the midpoint of Ireland's Guideline range for his federal sentence—around 17 years. The exponential growth bias implies that most people in Ireland's situation would have anticipated a sentence around the dotted line rather than the solid one—even if he roughly understood the sentencing process and even if his prior sentences had shown clear growth over time.[36]

Figure 1: Ireland's Sentencing Exposure



Sentences like these raise a number of serious policy concerns, separate from what scholars have identified so far.[37] As I argue in this Article, we ought to have a sentencing system that provides for graduated sentences in line with individuals' intuitions about linear growth.[38] Such a sentencing scheme better aligns with

35. *See infra* Part I.
36. *See infra* Part II.
37. *See supra* notes 19–27 and accompanying text.
38. *See, e.g.*, Weems v. United States, 217 U.S. 349, 367 (1910) ("[I]t is a precept of justice that punishment for crime should be graduated and proportioned to [the] offense.").

retributive justifications for punishment and would more adequately provide due process for defendants. And it would likely benefit consequentialist goals of sentencing as well: Individuals who would never expect shocking sentences relative to their past ones will not be deterred by those potential sentences.[39] And if we do not modify substantive sentencing rules to bring them more closely in line with what individuals anticipate are likely sentences, we should, at a minimum, implement measures to reduce the effects of the exponential growth bias, such as more serious notice requirements that provide individuals clear and repetitive information about their potential serious exposure under recidivist sentencing penalties.[40]

This Article proceeds in three Parts. In Part I, I describe the framework of statutes and regulations that give rise to shocking sentences, in both the federal system and various state systems. Nonlinear growth is built into many forms of recidivist sentencing penalties, whether through routine criminal history scores or mandatory enhancements written into substantive statutes. And in some cases, the sudden leap in exposure can be particularly sharp, as in the case of three-strikes statutes like the Armed Career Criminal Act or California's three-strikes law. These sources of shocking sentences are applied regularly, affecting tens of thousands of defendants every year. And, critically, the sentencing literature to date has not appreciated the extent to which nonlinear growth affects everyday sentences. Indeed, all federal criminal sentences involve the use of a criminal history calculation that increases nonlinearly, potentially leading to many shocking sentences.[41]

In Part II, I outline the nature of the exponential growth bias that causes shocking sentences. While many kinds of quantitative change—both naturally occurring and designed by humans—follow nonlinear patterns like exponential growth, humans are not adept at recognizing and anticipating that nonlinear growth. I describe the psychological mechanisms of the bias and explain the research demonstrating its robustness, in domains stretching from prediction of disease to financial decision-making. I also discuss ways that researchers have tried to counteract the bias.

In Part III, I turn to the normative. I argue that, because the exponential growth bias makes individuals unlikely to anticipate many potential sentences enhanced by recidivist sentencing penalties, we should reconsider regimes that lead to these shocking sentences. I explain that shocking sentence regimes are unjustified by both retributive and consequentialist theories of punishment, and they fail on moral and policy grounds. Moreover, shocking sentences seriously undermine due process, which is especially critical in our expansive modern criminal architecture. When individuals can be punished for an enormous array of conduct, it's critical that the punishment at least be psychologically intuitive to those facing punishment. Last, I suggest ways that—if we're not able to scrap shocking sentences altogether—we might be able to at least reduce the shock through debiasing measures.

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39. *See infra* notes 244–246 and accompanying text.
40. *See infra* Part III.B.
41. *See infra* notes 60–62 and accompanying text.

I. SHOCKING SENTENCING REGIMES

Before we can understand why some sentences are shocking (and why that might be problematic from a moral and policy perspective), there is an antecedent question to address: Where do shocking sentences come from? There are a variety of potential sources, both statutory and non-statutory. In this Part, I outline the legal framework that can give rise to shocking sentences and explore how common these sorts of sentences are.

A. Recidivist Sentencing and Nonlinear Growth

While sentencing schemes vary greatly across jurisdictions, there is one feature that is nearly universal, both in the United States and elsewhere: the imposition of harsher penalties on individuals who have committed crimes in the past—often termed the "recidivist sentencing premium."[42] The idea is simple: If two individuals commit identical crimes but one has committed other crimes in the past, the repeat offender's current crime represents a more culpable violation of the social contract—society had already told him to stop his actions, and yet he chose to offend again (or so the argument goes).[43] It's worth noting here that this surface-level appeal becomes increasingly difficult to sustain when examined in depth—there is little empirical evidence to indicate that recidivist sentencing schemes provide substantial deterrent value,[44] and the penalties are difficult to square with retributive conceptions of moral desert.[45] I'll revisit these challenges in Part III, but for now, let's set them aside and focus on how recidivist sentencing penalties generate shocking sentences.

When deciding how to structure a recidivist sentencing scheme, a jurisdiction must decide how the potential penalties for a crime will increase as an individual's number and severity of prior convictions increase. This kind of decision is not unique to sentencing. Any time a policymaker sets a quantitative scale that varies with the change in some other variable (in this case, the number and type of a person's prior

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42. RICHARD S. FRASE & JULIAN V. ROBERTS, PAYING FOR THE PAST: THE CASE AGAINST PRIOR RECORD SENTENCING ENHANCEMENTS 1 n.2 (2019) (describing the premium and noting that "almost all countries" apply it, with Western Australia as the lone outlier).

43. *See, e.g.*, Mirko Bagaric, *The Punishment Should Fit the Crime—Not the Prior Convictions of the Person That Committed the Crime: An Argument for Less Impact Being Accorded to Previous Convictions in Sentencing*, 51 SAN DIEGO L. REV. 343, 345–46 (2014) ("Punishing recidivists more harshly than first-time offenders is intuitively appealing. Most people, including lawyers and judges, share the view that repeat offenders deserve additional punishment."); Russell, *supra* note 26, at 1149 ("Enhancing sentences for recidivists is an ancient concept."). Indeed, the intuitive appeal has been captured empirically—surveys of the public in both the United States and abroad show substantial agreement that a defendant's criminal history should factor into sentencing. *See, e.g.*, FRASE & ROBERTS, *supra* note 42, at 2 n.5; JULIAN V. ROBERTS, PUNISHING PERSISTENT OFFENDERS: EXPLORING COMMUNITY AND OFFENDER PERSPECTIVES 163–84 (2008) (collecting studies indicating that the general public tends to believe that criminal history should be considered at sentencing).

44. *See, e.g.*, FRASE & ROBERTS, *supra* note 42, at 72–83; Krishnamurthi, *supra* note 24, at 436–43.

45. *See, e.g.*, FRASE & ROBERTS, *supra* note 42, at 11, 26–28; Krishnamurthi, *supra* note 24, at 416–34.

convictions), the policymaker must decide both the rate at which the scale will change (for example, how many months of increased imprisonment correspond with an additional prior conviction) as well as the *function* of the change.

Quantitative growth (or reduction) over time can take a variety of forms. One common type of growth is *linear*. In a linear system, growth occurs at the same rate for each unit change in time.[46] For example, a longleaf pine tree grows about two feet per year, on average, and the rate remains roughly the same year after year.[47] Linear growth can be represented in its simplest form by the equation $f(x) = ax + b$, where a is the unit of change for each given time point, and b is the starting value.[48] So, in our tree example, if the tree started in year zero at two feet tall, the height of the tree in year x would be $2x + 2$.[49] In year 1, the tree would be 4 feet tall; in year 2, it would be 6 feet; 8 feet in year 3, and so on. Graphically, linear growth appears as a straight line.

Exponential growth—unlike linear growth—occurs when the rate of change is proportional to the quantity itself, represented in its simplest form by the equation $f(x) = a^x$.[50] If our hypothetical tree started at two feet and doubled in size every year, then its height in year x would be 2^x, producing annual heights of 2 feet, then 4, then 8, 16, 32, and so on. Graphically, exponential growth appears as a curve with an increasing slope over time. And, while it may seem intuitively obvious that linear growth occurs commonly, exponential growth does too. It occurs in natural settings—most commonly in biological growth like cell division, disease spread, or animal populations[51]—and also in artificial settings, like compounding interest[52] or increases in computing power.[53]

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46. *See* Teichman & Zamir, *supra* note 30, at 1350–51.

47. *See* Marjan Kluepfel & Bob Polomski, *Pine*, CLEMSON COOP. EXTENSION (Nov. 2006), https://dc.statelibrary.sc.gov/server/api/core/bitstreams/d665a0d6-d947-424a-8def-f701bf581ae5/content [https://perma.cc/B59R-MQC6].

48. *See id.*

49. Sometimes, of course, the starting point is not zero, and a non-zero starting point is represented in the equation as b in the formula $f(x) = ax + b$. So if our hypothetical tree started at four feet tall, our equation for the height of the tree in year x would be $2x + 4$.

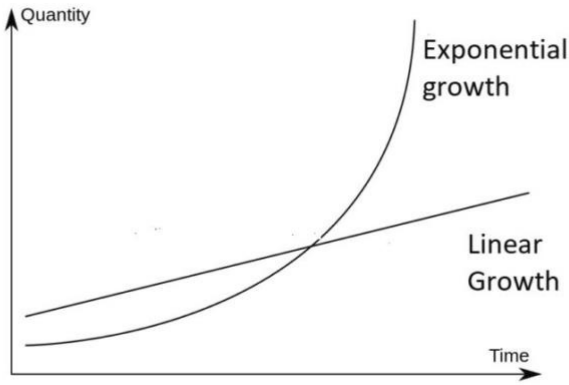
50. *See* Teichman & Zamir, *supra* note 30, at 1351.

51. *See, e.g.*, *infra* notes 141–167 and accompanying text.

52. *See infra* notes 168–182 and accompanying text.

53. The phenomenon was first identified in 1965, when Gordon E. Moore identified that producers of semiconductors had been "doubling the density of components per integrated circuit at regular intervals." Robert R. Schaller, *Moore's Law: Past, Present, and Future*, IEEE SPECTRUM, June 1997, at 53. It is worth noting here that, while I often discuss exponential change in contrast to linear change, there are many other growth/reduction functions beyond linear or exponential growth, such as logistic, logarithmic, or cubic growth. *See* Teichman & Zamir, *supra* note 30, at 1351–52. Many recidivist sentencing schemes, as we will see, have growth curves that are neither linear nor exponential, but follow a nonlinear pattern somewhere between the two.

Figure 2: Linear and Exponential Growth[54]



Generally, recidivist sentencing schemes follow patterns of nonlinear growth (though their growth cannot always be characterized as exactly exponential, either). Take, for example, the basic structure of the U.S. Sentencing Guidelines.[55] The Guidelines provide federal judges with an advisory "starting point" in determining how to sentence an individual defendant.[56] Each defendant's Guideline range is made up of two things: (1) an offense level, which is primarily determined by the statute of conviction and the characteristics of the offense itself,[57] and (2) the defendant's criminal history score, which is calculated by identifying the number of prior convictions a defendant has, scoring them by levels of severity, and translating that score into a category.[58] The offense level, in theory, provides proportional

54. *The World's Population Hasn't Grown Exponentially for at Least Half a Century*, UNION OF CONCERNED SCIENTISTS: THE EQUATION (Apr. 9, 2018, 11:54 AM), https://blog.ucsusa.org/doug-boucher/world-population-growth-exponential/ [https://perma.cc/Q89X-6SG2].

55. U.S. SENT'G GUIDELINES MANUAL (U.S. SENT'G COMM'N 2021).

56. Gall v. United States, 552 U.S. 38, 49–50 (2007); *see also* United States v. Booker, 543 U.S. 220, 245 (2005) (revising the Guidelines and making them "effectively advisory").

57. U.S. SENT'G GUIDELINES MANUAL ch. 2–3 (U.S. SENT'G COMM'N 2021).

58. *Id.* §§ 4A1.1–2 (providing "points" for prior convictions of various severities, which are then totaled to place each defendant in a criminal history "category," which affects the final Guideline range). There are other ways—beyond the routine criminal history category calculated in §§ 4A1.1–2—that the Guidelines account for recidivism. In some circumstances, the substantive Guidelines themselves provide for an enhanced offense level based on an individual's prior criminal history. *See, e.g.*, *id.* § 2K2.1(a) (providing for difference base offense levels if the defendant previously sustained convictions for a "crime of violence" or a "controlled substance offense"). In others, the Guidelines provide for a more drastic increase in both the offense level and criminal history category, such as under the Career Offender provision. *See infra* notes 121–125 and accompanying text; U.S. SENT'G GUIDELINES MANUAL § 4B1.1 (U.S. SENT'G COMM'N 2021).

punishment based on the severity of the offense, while the criminal history category adjusts based on a person's recidivist history.

Figure 3: U.S. Sentencing Guidelines Sentencing Table

SENTENCING TABLE
(in months of imprisonment)

	Offense Level	Criminal History Category (Criminal History Points) I (0 or 1)	II (2 or 3)	III (4, 5, 6)	IV (7, 8, 9)	V (10, 11, 12)	VI (13 or more)
Zone A	1	0–6	0–6	0–6	0–6	0–6	0–6
	2	0–6	0–6	0–6	0–6	0–6	1–7
	3	0–6	0–6	0–6	0–6	2–8	3–9
	4	0–6	0–6	0–6	2–8	4–10	6–12
	5	0–6	0–6	1–7	4–10	6–12	9–15
	6	0–6	1–7	2–8	6–12	9–15	12–18
	7	0–6	2–8	4–10	8–14	12–18	15–21
	8	0–6	4–10	6–12	10–16	15–21	18–24
Zone B	9	4–10	6–12	8–14	12–18	18–24	21–27
	10	6–12	8–14	10–16	15–21	21–27	24–30
	11	8–14	10–16	12–18	18–24	24–30	27–33
Zone C	12	10–16	12–18	15–21	21–27	27–33	30–37
	13	12–18	15–21	18–24	24–30	30–37	33–41
Zone D	14	15–21	18–24	21–27	27–33	33–41	37–46
	15	18–24	21–27	24–30	30–37	37–46	41–51
	16	21–27	24–30	27–33	33–41	41–51	46–57
	17	24–30	27–33	30–37	37–46	46–57	51–63
	18	27–33	30–37	33–41	41–51	51–63	57–71
	19	30–37	33–41	37–46	46–57	57–71	63–78
	20	33–41	37–46	41–51	51–63	63–78	70–87
	21	37–46	41–51	46–57	57–71	70–87	77–96
	22	41–51	46–57	51–63	63–78	77–96	84–105
	23	46–57	51–63	57–71	70–87	84–105	92–115
	24	51–63	57–71	63–78	77–96	92–115	100–125
	25	57–71	63–78	70–87	84–105	100–125	110–137
	26	63–78	70–87	78–97	92–115	110–137	120–150
	27	70–87	78–97	87–108	100–125	120–150	130–162
	28	78–97	87–108	97–121	110–137	130–162	140–175
	29	87–108	97–121	108–135	121–151	140–175	151–188
	30	97–121	108–135	121–151	135–168	151–188	168–210
	31	108–135	121–151	135–168	151–188	168–210	188–235
	32	121–151	135–168	151–188	168–210	188–235	210–262
	33	135–168	151–188	168–210	188–235	210–262	235–293
	34	151–188	168–210	188–235	210–262	235–293	262–327
	35	168–210	188–235	210–262	235–293	262–327	292–365
	36	188–235	210–262	235–293	262–327	292–365	324–405
	37	210–262	235–293	262–327	292–365	324–405	360–life
	38	235–293	262–327	292–365	324–405	360–life	360–life
	39	262–327	292–365	324–405	360–life	360–life	360–life
	40	292–365	324–405	360–life	360–life	360–life	360–life
	41	324–405	360–life	360–life	360–life	360–life	360–life
	42	360–life	360–life	360–life	360–life	360–life	360–life
	43	life	life	life	life	life	life

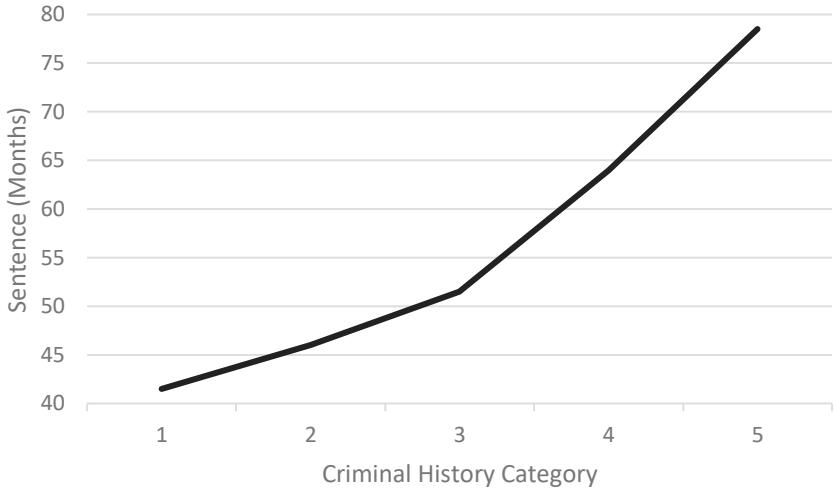
A simple example helps demonstrate the Guidelines' nonlinear approach. Imagine Mark—an 18-year-old with no criminal history—is caught in possession of 100 grams of heroin and charged with possession with intent to distribute a controlled substance.[59] Presuming there are no other aggravating circumstances and Mark pleads guilty rather than going to trial, Mark's offense will give rise to an offense level of 21, with a criminal history category of I, and a sentencing guideline range of 37–46 months' incarceration (with a midpoint of 41.5 months).[60]

Now say Mark commits the exact same offense several more times. With some possible variation based on the amount of time he served on his prior convictions, Mark's sentencing exposure as his criminal history increases would look like the following:

59. *See* 21 U.S.C. § 841(a)(1). This offense is one of the most commonly charged federal criminal offenses. *See Offenses*, FED. BUREAU OF PRISONS (Aug. 31, 2024), https://www.bop.gov/about/statistics/statistics_inmate_offenses.jsp [https://perma.cc/76BU-D3ZJ] (outlining that, as of 2023, over 44% of federal prisoners were incarcerated due to a drug offense). It's also worth noting here that this quantity of drugs could trigger an enhancement that requires a mandatory five-year sentence. *See* 21 U.S.C. § 841(b)(1)(B). But prosecutors do not always charge the mandatory minimum. Under the Obama administration, the Department of Justice took the position that "draconian mandatory minimums that may be better suited to violent traffickers or kingpins," and famously implemented a "[s]mart on [c]rime" strategy where individuals trafficking drugs were only charged with mandatory minimum penalties if certain criteria were met. Eric H. Holder, *Smart on Crime I*, 63 U.S. ATT'YS BULL. 1, 1 (2015), https://www.justice.gov/sites/default/files/usao/pages/attachments/2015/02/10/usab6301.pdf [https://perma.cc/ZS22-QHP7].

60. U.S. SENT'G GUIDELINES MANUAL § 2D1.1(c)(8) (U.S. SENT'G COMM'N 2021) (providing for base offense level of 24 for "at least 100 G but less than 400 G of Heroin"). While the Guideline provides for a base offense level of 24, Mark's guilty plea would generally result in a three-level reduction for "acceptance of responsibility." *See id.* § 3E1.1 (providing for two-level reduction, plus additional one-level reduction upon motion of the government in cases where the base offense level is 16 or greater).

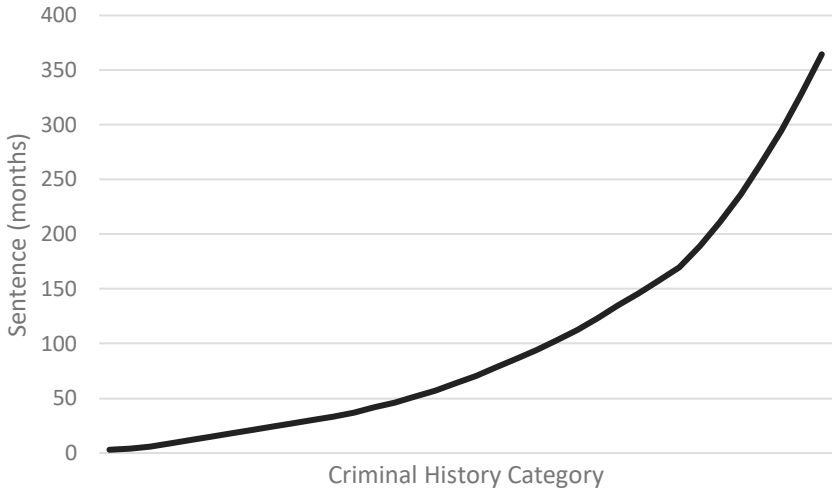
Figure 4: Mark's Hypothetical Sentencing Exposure



The increase is not linear. If it were, we would expect his exposure at conviction five to be just 59.5 months.[61] Instead, the actual midpoint of Mark's Guideline range at criminal history category five is 78.5 months—a difference of nearly two years, and a 31% increase. The remainder of the Guidelines follow a similar pattern—if you calculate the midpoint of the Guideline range for each possible offense level and criminal history category, you wind up with the below figure:

61. We arrive at this number by taking the midpoint of the guideline range for an offense level of 21 and criminal history category of I, which is 41.5 (the midpoint of 37–46 months), and subtracting it from the midpoint of the guideline range for an offense level of 21 and criminal history category of I, which is 46. *See* U.S. SENT'G GUIDELINES MANUAL ch.5, pt.A (U.S. SENT'G COMM'N 2021) (sentencing table). With a difference of 4.5 months between the two, we can see that, if the sentence increased linearly with each increase in criminal history category, the sentence would be equivalent to $4.5(x) + 37$, where x represents the criminal history category. At category V, the equation would be $4.5(5) + 37 = 59.5$. It is worth noting that the jump from criminal history category V to VI does not follow quite as steep of a slope. *See id.*

Figure 5: Sentencing Guideline Midpoint at Each Possible Offense Level and Criminal History Category



While this growth is not perfectly exponential, it is far steeper than linear, resulting not only in greater sentencing exposure with each increase in criminal history, but also greater *rates* of increase with each step up in criminal history.[62]

The basic structure of the U.S. Sentencing Guidelines likely leads to a large number of shocking sentences among the tens of thousands of federal defendants sentenced each year. But some other recidivist sentencing schemes are even more extreme—they provide even more sudden, unexpected leaps in sentencing exposure, more akin to true exponential growth that is masked by relatively low prior sentences. In the remainder of this Part, I describe the two primary sources of those schemes—(1) statutory mandatory penalties and (2) non-statutory special provisions—and discuss their prevalence in sentencing.[63]

B. Statutory Sources of Shocking Sentences

All criminal provisions provide for statutory penalties—they must articulate a maximum possible sentence,[64] and sometimes include a mandatory minimum sentence for particular substantive offenses.[65] Within those statutory boundaries, the

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62. Some state guideline systems are similarly nonlinear. For example, in North Carolina, with each increase in criminal history category, the sentencing range increases by 15%. In Minnesota, there are more fixed increases, but those increases have "larger increments at higher severity levels." FRASE & ROBERTS, *supra* note 42, at 7–8.

63. *See, e.g.*, *id.* at 3 (describing forms of recidivist penalty schemes, including statutory sources and non-statutory sources, such as sentencing guidelines).

64. *See, e.g.*, 18 U.S.C. § 924(a) (providing for a fine or imprisonment of "not *more* than five years" for violation of common federal firearm offenses under 18 U.S.C. § 922 (emphasis added)); *see also* Apprendi v. New Jersey, 530 U.S. 466, 490 (2000).

65. 18 U.S.C. § 924(c)(1)(A)(i) (providing for imprisonment of "not *less* than 5 years"

sentencing judge typically has discretion to determine the sentence, though that discretion is often constrained by a plea agreement negotiated between the parties. Some states further define the potential punishments through sentencing guidelines like the federal system described above.[66]

But many states also have a separate statutory mechanism that causes shocking sentences: statutory mandatory minimums that trigger when the defendant has certain prior qualifying convictions.[67] While these types of provisions differ across states, they tend to share certain common features: (1) they apply to broad categories of offenses (such as "violent" or "serious" felonies), rather than specific narrow substantive areas,[68] (2) they sweep in a wide array of prior criminal convictions,[69] and (3) they trigger very substantial increases in potential incarceration that are extremely unlikely to be linear when considered with a defendant's prior sentences.[70]

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for the crime of carrying a firearm "during and in relation to any crime of violence or drug trafficking crime" (emphasis added)).

66. *See, e.g.*, ALA. SENT'G COMM'N, PRESUMPTIVE AND VOLUNTARY SENTENCING STANDARDS MANUAL (2019), https://sentencingcommission.alacourt.gov/media/1089/2019-presumptive-manual.pdf [https://perma.cc/LUR6-8P2T]; FLA. DEP'T OF CORR. & OFF. OF THE STATE CTS. ADMIN., FLORIDA CRIMINAL PUNISHMENT CODE SCORESHEET MANUAL (2018), https://www.flcourts.gov/content/download/2007063/file/cpc_manual.pdf [https://perma.cc/TR4L-QH33]; MARYLAND SENT'G GUIDELINES MANUAL (MD. STATE COMM'N ON CRIM. SENT'G POL'Y 2024), https://msccsp.org/Files/Guidelines/MSGM/guidelinesmanual.pdf [https://perma.cc/EQ3X-89KP]; MICH. JUD. INST., STATE OF MICHIGAN SENTENCING GUIDELINES MANUAL (2021), https://www.courts.michigan.gov/49c7d9/siteassets/offices/mji/felony-sentencing-online-resources/2021-mi-sentencing-guidelines-manual.pdf [https://perma.cc/382A-X98R]; MINN. SENT'G GUIDELINES COMM'N, MINNESOTA SENTENCING GUIDELINES AND COMMENTARY (2023), https://mn.gov/sentencing-guidelines/assets/1August2023MinnSentencingGuidelinesCommentary_tcm30-586295.pdf [https://perma.cc/6Z7A-ZMSW]. Guideline systems can provide for the types of shocking sentences that are our topic here. *See supra* notes 55–61 and accompanying text (describing how general federal sentencing guidelines produce nonlinear growth in sentences with growth in criminal history).

67. *See, e.g.*, GA. CODE. ANN. § 17-10-7(a) (2023) (requiring the maximum sentence for a particular felony if the offender has a prior felony conviction); IDAHO CODE § 19-2514 (2023) (providing for an additional penalty of five years to life imprisonment after a third felony conviction); N.C. GEN. STAT. §§ 14-7.1, -7.6 (2023) (providing that an offender who has committed a third felony may be charged with and punished for the status offense of being a "habitual felon").

68. *See, e.g.*, N.Y. PENAL LAW § 70.08(1)(a) (Consol. 2023) (creating heightened penalties for those convicted of "a violent felony offense" or "predatory sexual assault"); 42 PA. CONS. STAT. § 9714(a)(1) (2023) (providing a mandatory sentence for repeat offenders convicted of "a crime of violence"); S.C. CODE ANN. § 17-25-45 (2023) (defining "serious" and "most serious" offenses for which mandatory penalties are imposed on repeat offenders).

69. *See, e.g.*, COLO. REV. STAT § 18-1.3-801 (2023) (defining the prior convictions needed to be a "habitual criminal" as two prior convictions of "[a]ny class 1 or 2 felony or level 1 drug felony" or "[a]ny class 3 felony that is a crime of violence"); CONN. GEN. STAT § 53a-40 (2023) (including, among other triggering prior convictions, "manslaughter, arson, kidnapping, robbery in the first or second degree, assault in the first degree, home invasion, [and] burglary in the first degree").

70. *See, e.g.*, 730 ILL. COMP. STAT. 5/5-4.5-95(a)(5) (2023) ("Anyone who is adjudged an

The most well-described form of these recidivist penalties are statutes colloquially referred to as "three-strikes" laws.[71] In response to rising violent crime rates in the early 1990s, a number of jurisdictions began enacting statutes requiring lengthy mandatory minimum sentences for individuals convicted of multiple serious offenses.[72] Washington was first in 1993, requiring mandatory life sentences without parole for those convicted of the "most serious offenses."[73] In the following several years, more than 20 states, as well as the federal government,[74] enacted similar laws.[75] While each state's statute applies slightly different criteria to the sorts of prior offenses that qualify as a "strike," many seek to cabin the enhancement to certain violent or serious drug felonies.[76]

The paradigmatic statute—and one of the statutes most likely to generate shocking sentences—is California's.[77] As with other three-strikes statutes, its statute's primary animating force was violent crime.[78] In California's case—as in many other areas of criminal justice policy—anecdotal incidents, rather than data, contributed heavily to its enactment.[79] In October 1993, 12-year-old Polly Klaas was

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habitual criminal shall be sentenced to a term of natural life imprisonment."); MISS. CODE ANN. § 99-19-83 (2023) (requiring a sentence of life imprisonment without the possibility of parole, probation, "or any other form of early release from actual physical custody"); MASS. GEN. LAWS ch. 279, § 25 (2012) (requiring the maximum sentence for the charged felony when there is a habitual offender).

71. The term is too narrow to fully capture the types of statutes of interest here, as some states have statutes that substantially increase the mandatory minimum penalty after just a second offense, not a third one. *Compare, e.g.*, N.M. STAT. ANN. § 31-18-23(A) (2011) (providing for enhanced imprisonment upon conviction of a third violent felony), *with* HAW. REV. STAT. § 706-606.5(1) (2022) (providing for enhanced periods of imprisonment for persons with one prior conviction), *and* LA. STAT. ANN. § 15:529.1 (2018) (same).

72. *See* PRISON POL'Y INITIATIVE, "THREE STRIKES" LAWS: FIVE YEARS LATER 2 (1998), https://static.prisonpolicy.org/scans/sp/3strikes.pdf [https://perma.cc/D8NA-QBJP]; Anthony Nagorski, *Arguments Against the Use of Recidivist Statutes That Contain Mandatory Minimum Sentences*, 5 U. ST. THOMAS J.L. & PUB. POL'Y 214, 217 (2010); Robert Clinton Peck, Ewing v. California*: Upholding California's Three Strikes Law*, 32 PEPP. L. REV. 191, 192 (2004); *see also* Ewing v. California, 538 U.S. 11, 15 (2003) ("Between 1993 and 1995, 24 States and the Federal Government enacted three strikes laws. Though the three strikes laws vary from State to State, they share a common goal of protecting the public safety by providing lengthy prison terms for habitual felons." (citation omitted)).

73. Nagorski, *supra* note 72, at 217; *see also* PRISON POL'Y INITIATIVE, *supra* note 72, at 2.

74. *See* 18 U.S.C. § 924(e).

75. *See id.*

76. *See, e.g.*, KAN. STAT. ANN. § 21-6626 (2011) (providing for enhanced penalties for "habitual sex offenders" convicted of enumerated sexually violent crimes); MD. CODE ANN., CRIM. LAW § 14-101(d) (LexisNexis 2023) (establishing a three-strike penalty only for crimes of violence); UTAH CODE ANN. § 76-3-203.5 (LexisNexis 2023) (defining a "habitual violent offender" to be a person convicted of two previous violent felonies).

77. CAL. PENAL CODE § 667 (West 2023).

78. *See* FRANKLIN E. ZIMRING, GORDON HAWKINS & SAM KAMIN, PUNISHMENT AND DEMOCRACY: THREE STRIKES AND YOU'RE OUT IN CALIFORNIA 6 (2001).

79. *See id.* at 5. Many scholars have noted how single incidents of violent crime can push criminal justice policy in ways contrary to what data suggest is the correct approach. This is

abducted from her home outside San Francisco, sexually assaulted, and killed.[80] Her abductor had been convicted of two prior violent felonies and had recently been paroled at the time of the incident.[81] The abduction received substantial media attention, with the governor speaking about tough-on-crime legislation at Klaas's funeral.[82] It also combined with a political atmosphere that was ripe to seize on the incident, with a struggling Republican governor soon up for reelection and eager to appear tough on crime and a Democratic state legislature unwilling to cede that ground.[83] The statute passed in November 1994 with little controversy.[84]

As originally passed, the statute provided for two major recidivist enhancements. First, if a defendant had a prior conviction for a "serious" or "violent" felony and committed *any* new felony (a so-called second strike), his punishment would double what it otherwise would be.[85] If a defendant had *two* prior convictions for a "serious" or "violent" felony and committed any new felony (a so-called third strike), the defendant was subject to a mandatory 25-year-to-life sentence.[86] This regime resulted in hugely disproportionate sentences, the most notable of which involved Gary Ewing, who received a 25-year-to-life prison sentence for stealing three golf clubs (a sentence that was upheld as proportionate by the United States Supreme Court).[87] The law was amended in 2012 to at least partially reduce those sorts of disproportionate enhancements, requiring the instant offense (the "third strike") to *also* be a "serious" or "violent" felony to qualify for the 25-to-life enhancement.[88]

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sometimes referred to as the "Willie Horton effect," named after the backlash faced by Democratic presidential nominee Michael Dukakis when William Horton, a convicted murderer serving a life sentence, committed various violent crimes while on furlough from prison through a program that Dukakis supported. *See* JEFF BELLIN, MASS INCARCERATION NATION: HOW THE UNITED STATES BECAME ADDICTED TO PRISONS AND JAILS AND HOW IT CAN RECOVER 43 (2023).

80. ZIMRING ET AL., *supra* note 78, at 5.

81. *Id.*

82. *Id.* at 6.

83. *See id.* at 5–6. A second incident involving the murder of an 18-year-old woman also helped spur passage of the law. *See* BELLIN, *supra* note 79, at 39–40.

84. ZIMRING ET AL., *supra* note 78, at 6.

85. CAL. PENAL CODE § 667(d)(1), (e)(1) (West 1994); ZIMRING ET AL., *supra* note 78, at 7–9 & tbl.1.1. The statute also contains a provision allowing for a five-year consecutive sentence added on in any case where the defendant commits a serious/violent felony and has a prior conviction for one as well. CAL. PENAL CODE § 667(a)(1) (West 2022).

86. CAL. PENAL CODE § 667(d)(1), (e)(2)(A) (West 1994); ZIMRING ET AL., *supra* note 78, at 7–9 & tbl.1.1.

87. Ewing v. California, 538 U.S. 11, 15–19 (2003).

88. CAL. PENAL CODE § 667(e)(2)(C) (West 2012) ("If a defendant has two or more prior serious and/or violent felony convictions . . . that have been pled and proved, and the current offense is *not* a serious or violent felony . . . the defendant shall be sentenced [as if there were only two strikes] . . . ." (emphasis added)); *see also* J. RICHARD COUZENS & TRICIA A. BIGELOW, THE AMENDMENT OF THE THREE STRIKES SENTENCING LAW 5 (2017), https://www.courts.ca.gov/documents/Three-Strikes-Amendment-Couzens-Bigelow.pdf [https://perma.cc/2PN2-CLH2] ("While the original version of the law applied to any new felony committed with two or more prior strikes, the new law requires the new felony to be a serious or violent felony with two or more prior strikes to qualify for the 25 year-to-life sentence as a third strike offender." (emphasis omitted)).

It's easy to see how this scheme might operate in terms of nonlinear growth, even where the substance of the offense does not change. Imagine Mark, who has no prior criminal history, is convicted for stealing a television set from a house—felony burglary—and sentenced to two years' prison.[89] Five years later, he steals another television set from a house. Because burglary is a "serious felony,"[90] it qualifies for enhanced punishment under the three-strikes law. Here, on Mark's second strike, his penalty will at least be doubled, resulting in at least a four-year sentence.[91] Then, eight years after that, Mark steals a third television set from a house. His crime is identical to the others, but this time, his sentence will be the full 25-to-life sentence required by the three-strikes law.[92] His sentences—2, then 4, then 25 years—are even steeper than exponential growth.

The California three-strikes law is also notable in the extent of its reach and impact. While many states' three-strikes laws are relatively unused, California's is applied strikingly often.[93] By 1998—four years after the statute's enactment—California had more than 40,000 three-strikes convictions.[94] While the rate of enhancements has decreased since then,[95] "several hundred thousand prison terms have been lengthened since the introduction of Three Strikes."[96] And, as of 2022, more than a quarter of California's prisoners were subject to a double sentence under the statute, and nearly 8% were subject to a full three-strikes enhancement.[97]

Many other states have schemes similar to California's that result in shocking sentences.[98] Georgia, for example, has a statute requiring that anyone who has been convicted of one serious violent felony and is convicted of a second is subject to a mandatory life sentence.[99] And the statute covers nonviolent felonies as well—anyone who commits *any* felony, after having been convicted of three prior felonies (of any kind), must be sentenced to the maximum statutory term for the new offense.[100] So, for example, a drug dealer selling small quantities of cocaine would be subject to a mandatory five-year sentence for his first offense and ten-year mandatory minimum sentences for his second and third offenses.[101] If the same

89. *See* CAL. PENAL CODE §§ 459–61 (West 2022) (defining felony burglary of an "inhabited dwelling house" as a first-degree felony, punishable by two, four, or six years).

90. *Id.* § 1192.7(c)(1) (listing "any burglary of the first degree" as a "serious felony").

91. *See id.* § 667(e)(1).

92. *See id.* § 667(e)(2)(A).

93. *See* ZIMRING ET AL., *supra* note 78, at 19–21 & fig.2.2.

94. *Id.* at 20–21 fig.2.2.

95. *See* MIA BIRD, OMAIR GILL, JOHANNA LACOE, MOLLY PICKARD, STEVEN RAPHAEL & ALISSA SKOG, COMM. ON REVISION OF THE PENAL CODE, THREE STRIKES IN CALIFORNIA 15 fig.5 (2022), https://www.capolicylab.org/wp-content/uploads/2022/08/Three-Strikes-in-California.pdf [https://perma.cc/K982-JCZG].

96. *Id.* at 11.

97. *Id.* at 12 fig.2.

98. *See e.g.*, GA. CODE ANN. 17-10-7(a) (2023); IDAHO CODE § 19-2514 (2023); N.C. GEN. STAT. § 14-7.1, -7.6 (2023).

99. GA. CODE ANN. § 17-10-7(b)(2) (2020).

100. *Id.* § 17-10-7(c).

101. *Id.* § 16-13-30(b), (d) (providing that "it is unlawful for any person to manufacture, deliver, distribute, dispense, administer, sell, or possess with intent to distribute any controlled substance" and that any violation of that provision "shall be punished by imprisonment for not

person committed the same offense a fourth time, Georgia's repeat-offender provision would require a 40-year sentence—the maximum term under the controlled substance provisions—which represents an exponential growth in sentences over time. And while that statute is not applied as often as California's, it still has substantial impact: Five years after its enactment, nearly 2000 people had already been sentenced under it.[102]

Likewise, federal law contains a three-strikes enhancement, albeit a narrower one. The Armed Career Criminal Act (ACCA) provides for a mandatory minimum sentence of 15 years for any defendant who is convicted of certain common gun crimes (such as being a felon in possession of a gun) after sustaining three or more prior convictions "for a violent felony or a serious drug offense."[103] As with the state statutes, the scheme allows for rapid increases in punishment as compared with prior sentences. A defendant could, for example, be convicted of relatively minor state drug distribution charges, have served non-custodial or very short sentences on those, and then face a mandatory 15-year sentence for a federal ACCA conviction. The ACCA is also notorious for its opacity—there is no enumerated list of the offenses that qualify as "violent" or a "serious drug offense," and so defendants are often unaware of whether they qualify for the enhancement until after substantial litigation.[104] Nevertheless, the statute has significant reach: In recent years, between 5–10% of all convictions for being a felon in possession of a firearm included enhancements under the statute, accounting for between 250 and 600 convictions per year.[105]

Finally, it's worth noting that there are many recidivist sentencing penalties, both federally and in the states, that are contained *within* substantive criminal statutes, rather than through a broadly applicable strike scheme, and these provisions can also lead to shocking sentences. A good example is in the federal drug code. Federally, distribution of (or possession with the intent to distribute) small quantities of controlled substances does not carry a mandatory minimum sentence.[106] But when a person distributes more than a certain quantity—such as more than 100 grams of

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less than five years nor more than 30 years" on the first offense, and "not less than ten years nor more than 40 years or life imprisonment" on subsequent offenses); *see also id.* § 16-13-26(1)(D) (2020) (identifying cocaine as a schedule II controlled substance).

102. PRISON POL'Y INITIATIVE, *supra* note 72, at 5.

103. 18 U.S.C. § 924(e); *see also id.* § 922(g) (outlining various gun offenses to which the ACCA can apply).

104. *See, e.g.*, Descamps v. United States, 570 U.S. 254, 257–58 (2013) (describing the "categorical approach" and "modified categorical approach" to determining whether prior convictions qualify as ACCA predicates); Sheldon A. Evans, *Categorical Nonuniformity*, 120 COLUM. L. REV. 1771, 1773–76 (2020) (describing convoluted nature of the test and unpredictability of results).

105. U.S. SENT'G COMM'N, FEDERAL ARMED CAREER CRIMINALS: PREVALENCE, PATTERNS, AND PATHWAYS 18–20 & figs.1–2 (2021), https://www.ussc.gov/sites/default/files/pdf/research-and-publications/research-publications/2021/20210303_ACCA-Report.pdf [https://perma.cc/B2JQ-PE6N].

106. 21 U.S.C. § 841(b)(1)(C) (providing for a "term of imprisonment of not more than 20 years," but no mandatory minimum sentence, for distribution of controlled substances in schedule I or II that do not reach certain quantity thresholds).

heroin—a five-year mandatory minimum sentence kicks in.[107] That mandatory minimum is independent of the defendant's criminal history.[108] But if the defendant has a prior conviction for a "serious drug felony" or a "serious violent felony," the mandatory minimum sentence doubles to 10 years.[109] To trigger that enhanced sentence, the prosecutor must file what is called an "851 enhancement," under 21 U.S.C. § 851.[110]

That regime can easily result in shocking sentences. Think back to Tommie Ireland. Suppose he distributed 105 grams of cocaine. In Michigan, where he was selling drugs, selling 105 grams of cocaine is punishable by up to 20 years in prison but has no mandatory minimum sentence.[111] Ireland could easily have sustained two state convictions under that statute and received a probation term for the first and, say, a one-year sentence for the second. Then, if he committed the exact same offense and was prosecuted federally, he would be subject to a 10-year mandatory minimum sentence—10 times the longest one he received for his prior identical conduct.

As with three-strikes enhancements, § 851 enhancements are potentially broad. In 2016, more than 30% of all federal drug defendants—6153 individuals—were eligible for a § 851 enhancement.[112] That number is relatively consistent across years: in 2012, it was about 28%; in 2014, about 32%.[113] In those years, the government only sought the enhancement in a fraction of those cases where the defendant was eligible,[114] but all of those years were ones in which the government had a policy in place that limited the impact of § 851 enhancements.[115] When prosecutors are less benevolent, the statutory scheme permits them to impose shocking sentences in a large proportion of drug cases.

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107. *Id.* § 841(b)(1)(B) (providing for penalty of "a term of imprisonment which may not be less than 5 years and not more than 40 years").

108. *See id.*

109. *Id.* ("If any person commits such a violation after a prior conviction for a serious drug felony or serious violent felony has become final, such person shall be sentenced to a term of imprisonment which may not be less than 10 years and not more than life imprisonment . . . .").

110. *Id.* § 851 ("No person who stands convicted of an offense under this part shall be sentenced to increased punishment by reason of one or more prior convictions, unless before trial, or before entry of a plea of guilty, the United States attorney files an information with the court (and serves a copy of such information on the person or counsel for the person) stating in writing the previous convictions to be relied upon.").

111. MICH. COMP. LAWS § 333.7401(2)(a)(iii) (2017) (providing that the potential penalty for possession with intent to distribute "50 grams or more, but less than 450 grams" is "imprisonment for not more than 20 years" with no mandatory minimum).

112. U.S. SENT'G COMM'N, APPLICATION AND IMPACT OF 21 U.S.C. § 851: ENHANCED PENALTIES FOR FEDERAL DRUG TRAFFICKING OFFENDERS 18 (2018), https://www.ussc.gov/sites/default/files/pdf/research-and-publications/research-publications/2018/20180712_851-Mand-Min.pdf [https://perma.cc/XSX6-2AXR].

113. Office of the Inspector General, *Review of the Department's Implementation of Prosecution and Sentencing Reform Principles Under the Smart on Crime Initiative*, 30 FED. SENT'G REP. 16, 27 (2017).

114. *Id.*; U.S. SENT'G COMM'N, *supra* note 112, at 18.

115. *See supra* note 59 and accompanying text.

And these schemes are not limited to the federal government; states have them too. Georgia's statute largely mirrors the federal one—it provides for a five-year mandatory minimum sentence for the distribution of some controlled substances, and "[u]pon conviction of a second or subsequent offense," that mandatory minimum doubles to ten years.[116] On its face, the statute provides for a potentially shocking sentence to any repeat drug distribution offender.

These types of substantive shocking sentences also go beyond the drug context. One particularly notable recidivist federal enhancement is for carrying a firearm "during and in relation to any crime of violence or drug trafficking crime."[117] For a first offense, the mandatory minimum is 5 years; for a second, it is 25 years—paradigmatic exponential growth of punishment.[118]

C. Non-Statutory Sources of Shocking Sentences

While statutory mandatory minimums likely result in many shocking sentences, non-statutory schemes can lead to them too—predominantly through sentencing guidelines. We have already examined one source: the criminal history category in the generally applicable United States Sentencing Guidelines.[119] As we have seen, sentencing exposure grows roughly exponentially as one's criminal history category grows. While those increases may not be as sudden as some of the statutory enhancements we've explored, it's still likely that individuals will underestimate them, as we will see in Part II. And they have greater reach than the statutory schemes discussed above; in the federal system, the Guidelines apply to every single criminal case, so every repeat offender who is sentenced under the guidelines is exposed to that nearly exponential growth in his sentence. That exposure is not limited to federal cases—some states have similar structures. As of this writing, 17 states and the District of Columbia have sentencing guideline systems.[120]

In addition to generally applicable criminal history scores, other more unique recidivist sentencing penalties within guideline structures can also lead to shocking sentences. One is the penalty that led to Tommie Ireland's shocking sentence: the career offender provision of the U.S. Sentencing Guidelines.[121] That provision sharply increases the Guideline range of any defendant convicted of a "crime of violence" or "controlled substance offense" who was previously convicted of two of those types of offenses.[122] As we saw with Ireland's case, the guideline can result in sentencing ranges several times higher than they would have been without

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116. GA. CODE ANN. § 16-13-30(d) (2010).

117. 18 U.S.C. § 924(c)(1)(A).

118. *Id.* § 924(c)(1)(C)(i).

119. *See supra* notes 55–62 and accompanying text.

120. *See Sentencing Guidelines Resource Center: In-Depth Jurisdiction Profiles*, ROBINA INST. OF CRIM. L. & CRIM. JUST., https://robinainstitute.umn.edu/publications/sentencing-guidelines-resource-center-depth-jurisdiction-profiles [https://perma.cc/CJV8-TQD7].

121. *See* U.S. SENT'G GUIDELINES MANUAL § 4B1.1 (U.S. SENT'G COMM'N 2023); *see also supra* notes 12–18 and accompanying text (describing application of career offender guidelines).

122. U.S. SENT'G GUIDELINES MANUAL § 4B1.1(a) (U.S. SENT'G COMM'N 2023).

application of the guideline, resulting in exponential growth of sentences.[123] And, like the mandatory-minimum sentences discussed above, the career offender provision affects a substantial number of cases: In 2022, it applied in over 2% of all cases—representing more than 1300 defendants.[124] Between 2006 and 2014, it was over 3% of all cases annually, representing more than 2000 defendants each year.[125]

Though career offender provisions are the starkest example of shocking sentences from sentencing guidelines, there are others as well. In the federal system, application of the ACCA not only triggers a 15-year mandatory minimum sentence, it also drastically raises the defendant's guideline range, further exacerbating the exponential growth of the sentence.[126] And, like criminal statutory schemes, the Guidelines include recidivist enhancements within some substantive sections as well. For example, in the commonly applied guideline for most firearms offenses, the defendant's offense level is drastically raised if the defendant has one or more prior convictions for a crime of violence or a controlled substance offense, which can result in a doubling or more of the Guideline range.[127] Other provisions have similar enhancements.[128]

In sum, there are many schemes that can produce shocking sentences, and they reach a large number of criminal cases. Notably, though, we lack information on the exact scope of shocking sentences that these provisions produce. While we have data about how often defendants are sentenced under these schemes and we sometimes have coarse data about some of their criminal history, we don't have data about the specific terms that individual defendants served prior to receiving a recidivist sentencing enhancement. How often is it the case that a three-strikes defendant in California has had relatively short prior sentences before receiving a 25-year mandatory minimum? How often are defendants in a situation similar to Tommie Ireland's?

Currently, no publicly available data provide a clear answer to those questions. Some data at least provide a small bit of insight—for example, the United States

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123. *See supra* notes 13–14 and accompanying text.

124. U.S. SENT'G COMM'N, QUICKFACTS: CAREER OFFENDERS 1 (2022), https://www.ussc.gov/sites/default/files/pdf/research-and-publications/quick-facts/Career_Offenders_FY22.pdf [https://perma.cc/W6EG-CRJY].

125. U.S. SENT'G COMM'N, REPORT TO THE CONGRESS: CAREER OFFENDER SENTENCING ENHANCEMENTS 18 (2016), https://www.ussc.gov/sites/default/files/pdf/news/congressional-testimony-and-reports/criminal-history/201607_RtC-Career-Offenders.pdf [https://perma.cc/GS6J-U34B]. Several state guideline systems have similar provisions; *see, e.g.*, MARYLAND SENT'G GUIDELINES MANUAL § 10.4 (MD. STATE COMM'N ON CRIM. SENT'G POL'Y 2024), https://msccsp.org/Files/Guidelines/MSGM/guidelinesmanual.pdf [https://perma.cc/EQ3X-89KP] (describing "Subsequent Offender Sentence Enhancements"); WASHINGTON STATE ADULT SENT'G GUIDELINES MANUAL 58–59 (STATE OF WASH. CASELOAD FORECAST COUNCIL 2022), https://cfc.wa.gov/sites/default/files/Publications/Adult_Sentencing_Manual_2022.pdf [https://perma.cc/LYW7-2UJ9] (describing enhancements for "persistent offenders").

126. *See* U.S. SENT'G GUIDELINES MANUAL § 4B1.4 (U.S. SENT'G COMM'N 2023) (raising offense level and criminal history category for defendants "subject to an enhanced sentence under the provisions of 18 U.S.C. § 924(e)").

127. *See id.* § 2K2.1(a)(2), (4)(A).

128. *E.g.*, *id.*, §§ 2H4.2(b), 2K1.3(a).

Sentencing Commission publishes reports regarding the criminal history category of defendants sentenced under the ACCA, which provides a coarse indication of how many prior convictions they sustained before application of the ACCA.[129] But those categories do not indicate the actual amount of time served in those prior sentences, so it is impossible to determine whether the ACCA-enhanced sentence represents nonlinear growth compared to prior sentences. Nor is that prior-sentence length information contained in the Sentencing Commission's data files that are made publicly available.[130] This is an important area for future work—and one that could be easily done if data are made available. The exact length of prior sentences of federal defendants are calculated and included in each defendant's presentence report. With a waiver to access those data in a limited fashion, we could learn more about whether these sentences are truly exponential, at least in the federal system.

* * *

We've learned several things in this Part. Recidivist sentencing schemes are a universal feature of criminal justice policy throughout the United States, and those schemes routinely provide for nonlinear increases in exposure as criminal history increases. As a result, defendants with criminal history may face sentences many times greater than their prior sentences, even if their offense is no more serious than their past offenses. In the next Part, we turn to a question: Will individuals appropriately *anticipate* their future exposure when it increases in this type of nonlinear way? As we will see, the psychological literature predicts that they will not.

II. THE PSYCHOLOGY BEHIND SHOCKING SENTENCES

A. Understanding Exponential Growth Bias

Recall the early days of the COVID-19 pandemic, in March 2020. At the time, the disease was still very new in the United States—Chinese officials had identified a novel coronavirus as the source of an outbreak of disease in early January, the United States reported its first case on January 20 and its 15th by February 13.[131] Suppose it's about one month later—March 16—and you are an epidemiologist at the Centers for Disease Control.[132] You have been tasked with forecasting the likely

129. *See* U.S. SENT'G COMM'N, *supra* note 105, at 24 tbl.3.

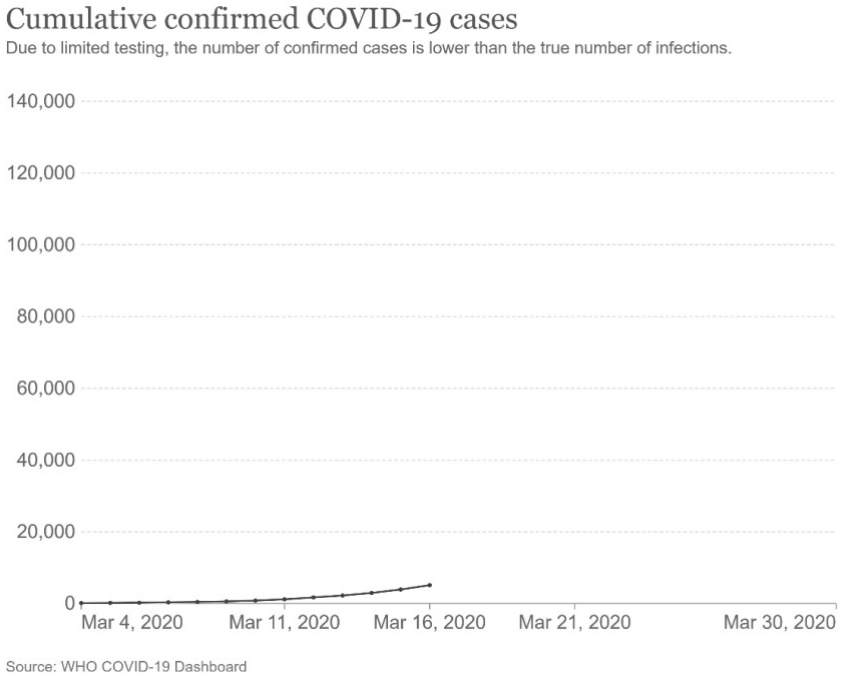
130. *See Commission Datafiles*, U.S. SENT'G COMM'N, https://www.ussc.gov/research/datafiles/commission-datafiles [https://perma.cc/97G9-YBNG]. The Individual Offender Datafiles contain information about each defendant's criminal history. *See* U.S. SENT'G COMM'N, VARIABLE CODEBOOK FOR INDIVIDUAL OFFENDERS 24–25 (2023), https://www.ussc.gov/sites/default/files/pdf/research-and-publications/datafiles/USSC_Public_Release_Codebook_FY99_FY22.pdf [https://perma.cc/NF44-LKXN] (describing coding categories relating to criminal history).

131. *CDC Museum COVID-19 Timeline*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/museum/timeline/covid19.html [https://perma.cc/6XRR-3MHN].

132. The Centers for Disease Control is "the nation's leading science-based, data-driven, service organization that protects the public's health." *About CDC*, CTRS. FOR DISEASE

number of total U.S. cases by late March—a critical job, as policy-makers were then considering a number of potential interventions, depending on the size and speed of the pandemic's growth.[133] On March 16, the United States had a total of 5148 confirmed cases, and the graphical depiction of the past 15 days' increase in cases looked like this[134]:

Figure 6: COVID-19 Cases in Early March 2020



CONTROL & PREVENTION, https://www.cdc.gov/about/cdc/index.html [https://perma.cc/E7SM-RB2U].

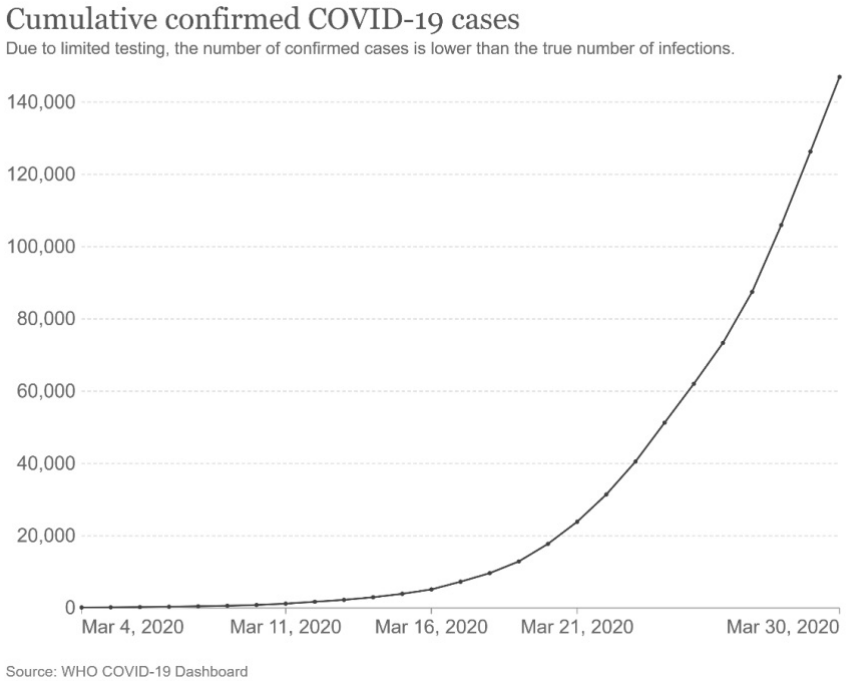
133. Numerous measures were taken worldwide to reduce the spread of COVID-19, including "travel bans and restrictions, schools and workplace closures, isolating infected persons, quarantine of exposed persons, social distancing and cancellation of mass gathering events." Imen Ayouni, Jiheen Maatoug, Wafa Dhouib, Nawel Zammit, Sihem Ben Fredj, Rim Ghammam & Hassen Ghannem, *Effective Public Health Measures to Mitigate the Spread of COVID-19: A Systematic Review*, 21 BMC PUB. HEALTH 1, 2 (2021).

134. All of the data for this example were gathered from the World Health Organization's COVID-19 dashboard. *WHO COVID-19 Dashboard*, WORLD HEALTH ORG., https://data.who.int/dashboards/covid19/cases [https://perma.cc/M5TA-7FXX]. Those data were aggregated into these figures by the data aggregation website Our World in Data, which collects and graphically depicts various large data sets related to scaled world problems, such as poverty, inequality, climate change, and disease. Max Roser, *About*, OUR WORLD IN DATA, https://ourworldindata.org/about [https://perma.cc/H3PL-VPTY]. The site's COVID-19 section graphically presents a 7-day rolling average of COVID-19 cases across various time periods. Edouard Mathieu et al., *Coronavirus (COVID-19) Cases*, OUR WORLD IN DATA, https://ourworldindata.org/covid-cases [https://perma.cc/72JK-KNXS].

Based solely on the figure, what would you predict would be the number of total cases at the end of the figure, on March 30? A natural response to the problem might be to attempt to intuitively draw the line in the figure out to the end. Given that the growth in cases leading up to the 16th was relatively modest, with a mostly flat slope, you might make a guess on the low end of the scale shown here—perhaps somewhere between 20,000 and 40,000 cases.

As it turns out, this is the response of the vast majority of people who try to intuitively forecast a growth over time of some quantitative measure, like the number of cases of a disease.[135] As you may have surmised, however, that guess is a gross underestimation of the actual number—which is 146,982 cases—depicted in the below figure[136]:

Figure 7: COVID-19 Cases in March 2020



135. *See infra* Part II.B.

136. Mathieu et al., *supra* note 134. If you underestimated the correct number, you are not alone. Key policy-makers in the United States likewise underestimated the growth of COVID-19, leading them to delay measures that could have slowed the spread of the disease, such as implementing social distancing measures or encouraging the use of masks in public. This underestimation was likely, at least in part, because they failed to grasp the exponential growth pattern of the disease. *See* Teichman & Zamir, *supra* note 30, at 1362 n.81 (citing Howard Kunreuther & Paul Slovic, *Learning from the COVID-19 Pandemic to Address Climate Change*, 1 MGMT. & BUS. REV. 92, 93 (2021) ("One of the reasons that the general public and key decision makers largely ignored the coronavirus in January and February is that they failed to appreciate the looming menace of its exponential growth.")).

Why do people underestimate the actual number of cases? The answer lies in the nature of growth that naturally occurs in the spread of new diseases (as well as many other phenomena). Most diseases—including COVID-19—don't spread via transmission in a linear fashion; instead, they spread exponentially, at least in their early stages.[137] People systematically underestimate exponential growth—and instead presume relatively linear growth—across a variety of contexts, a phenomenon that scholars refer to as "exponential growth bias."[138] As we will see, exponential growth bias leads individuals to miscalculate future growth in predicting diseases, make poor decisions in arranging their finances, and, very likely, underestimate their future criminal sentences.

Why do humans generally underestimate nonlinear growth? Psychologically, the phenomenon is relatively undertheorized. Some have proposed that the mathematical principles involved in calculating exponential growth are more difficult than in calculating linear growth, and so we tend to default toward linear growth.[139] Relatedly, nearly all of our complex thinking involves heuristic shortcuts, and shortcuts involving more straightforward, linear reasoning may be more readily used than complex heuristics.[140] It's also possible that we more regularly experience linear change than exponential change in our day-to-day lives, leading us to presume linearity in predicting future events.

Regardless of the psychological mechanisms involved, the exponential growth bias is a robust cognitive bias that occurs across a number of different contexts. A full review of the exponential growth bias would be expansive and is beyond the scope of our purposes here. But understanding some of the contexts in which the bias often occurs helps us understand how the bias likely contributes to defendants' surprise at their sentencing exposure under recidivist statutes. In the next subpart, I

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137. Richard Stevens, Rafael Perera, Carl Heneghan, Richard Hobbs & Jason Oke, *Exponential Growth: What It Is, Why It Matters, and How to Spot It*, CTR. FOR EVIDENCE-BASED MED., https://www.cebm.net/covid-19/exponential-growth-what-it-is-why-it-matters-and-how-to-spot-it/ [https://perma.cc/3XFK-93LE]. During later stages of disease growth, "when the cases become a sizeable fraction of the total population, so that the susceptible population is significantly smaller, growth will be slower than exponential." *Id.*

138. *See infra* Part II.B. In some ways, "exponential growth bias" is an imperfect term, as many studies indicate that the bias is a presumption *toward* linearity, which can bias individuals against recognizing not only exponential growth, but other types of nonlinear growth as well. *See infra* Part II.B. As a result, some authors have framed the exponential growth bias instead as a linearity bias. *See, e.g.*, László Duma, *The Groundless Use of Linearity in Daily Thinking and Decision-Making*, 29 PERIODICA POLYTECHNICA SOC. & MGMT. SCIS. 125, 125 (2021) (describing the bias as "omnipotent linearity"); Dirk De Bock, Daam Van Reeth, Janne Minne & Wim Van Dooren, *Students' Overreliance on Linearity in Economic Thinking: An Exploratory Study at the Tertiary Level*, 16 INT'L. REV. ECON. EDUC. 111, 112 (2014) (describing the bias as an "overreliance on linearity").

139. *See, e.g.*, William A. Wagenaar & Sabato D. Sagaria, *Misperception of Exponential Growth*, 18 PERCEPTION & PSYCHOPHYSICS 416, 422 (1975); Teichman & Zamir, *supra* note 30, at 1355–56.

140. *See, e.g.*, Amos Tversky & Daniel Kahneman, *Availability: A Heuristic for Judging Frequency and Probability*, 5 COGNITIVE PSYCH. 207, 207 (1973) ("We propose that when faced with the difficult task of judging probability or frequency, people employ a limited number of heuristics which reduce these judgments to simpler ones.").

briefly describe research demonstrating that the exponential growth bias is pervasive in three domains: environmental science, health and disease forecasting, and finance.

B. Exponential Growth Bias Across Domains

Forecasting future events from past ones is central to environmental decision-making. At the time of this writing, the Earth reached its hottest summer on record, following multiple years of record high temperatures.[141] Predicting future changes—both in the inputs that give rise to climate change (like carbon emissions) and the results of those inputs (like temperature change)—requires assessing prior data. Those assessments ultimately drive policy decisions. Are those assessments colored by exponential growth bias?

The answer is likely yes. Indeed, one of the first studies of the exponential growth bias identified the problem in an environmental context. In 1975, William Wagenaar and Sabato Sagaria presented participants with a "pollution index" analogous to carbon emissions.[142] In a first experiment, the authors presented the participants with five years of exponential growth in the pollution index, starting with 3 in year one, followed by 7 in year two, then 20, 55, and 148 in subsequent years.[143] The experimenters asked the participants to estimate the index in year 10, and also to estimate when the index would surpass 25,000.[144] Mathematically, the growth would reach exactly 25,000 in year 10 if it continued at the same rate.[145] But the subjects vastly underestimated that growth—two-thirds of them gave estimates of the year-10 value that were *10% or less* of the correct answer.[146] And about half estimated that the growth would not reach 25,000 until the year 2000—in other words, they underestimated the growth by a factor of more than 20 years.[147]

Perhaps one might think that the problem lies in the *mode* of presentation—that subjects presented with numbers on a page will struggle with extrapolating growth forward, but might do better if the numbers were visualized. Unfortunately, the problem is not that simple. Wagenaar and Sagaria presented the same numbers and questions graphically to a second group and found that participants' underestimates of the growth were even *more* severe.[148] As the authors put it, in the context of exponential growth bias, "a picture is not worth a thousand words!"[149]

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141. *E.g.*, Pamela Falk, *Earth Just Had Its Hottest Summer on Record, U.N. Says, Warning "Climate Breakdown Has Begun"*, CBS NEWS (Sept. 7, 2023, 11:48 AM), https://www.cbsnews.com/news/hottest-summer-on-record-2023-un-says-climate-change-global-warming-data/ [https://perma.cc/8CEV-NEYD]. For a helpful figure depicting year-over-year changes in global temperature, see *Global Temperature*, NASA, https://climate.nasa.gov/vital-signs/global-temperature/ [https://perma.cc/6F4N-KEXN].

142. Wagenaar & Sagaria, *supra* note 139, at 416.

143. *Id.*

144. *Id.*

145. *Id.* at 416–17.

146. *Id.*

147. *Id.* at 417.

148. *Id.* at 420–21. This kind of graphical presentation was intended as a *debiasing* measure, a concept explored further. *See infra* notes 183–202 and accompanying text.

149. Wagenaar & Sagaria, *supra* note 139, at 421.

Nor was particularized knowledge or expertise a saving grace. In a third experiment, participants attended a 75-minute lecture in which they learned about exponential growth and even heard the results of the initial experiment.[150] They then performed the graphical task that the second group did.[151] While they showed some improvement, they still showed greater underestimation than the first group, who were not instructed on exponential growth.[152] Finally, the researchers performed the graphical task with conservation experts—who may have some prior experience with exponential growth of pollution—but there was no difference in result from the nonexpert subjects.[153]

Exponential growth bias is also pervasive in another area of existential threat to human life: disease forecasting. As noted above, diseases spread among humans in nonlinear ways, often approximating exponential growth in the early stages of spread.[154] When individuals are tasked with forecasting this growth, however, they tend to erroneously predict linear growth, vastly underestimating future cases. In one straightforward study, experimenters asked participants in March 2020—during the early days of the COVID-19 pandemic—to simply estimate the number of cases over the prior five days.[155] The participants' average estimates were remarkably similar to the correct number of cases—in fact, their average estimate for the first day was higher than the true number of cases. But—falling prey to the exponential growth bias—the participants predicted linear growth from there, resulting in an average prediction that was well below the true number of cases by day five.[156] The experimenters also tested an intervention strategy: They instructed the participants on the rate of the virus's growth, telling them to "keep in mind that many people forget . . . the speed by which the corona virus spreads" and that "[i]n reality . . . the number of corona patients doubles and keeps doubling every three days."[157] The intervention had at least some effect: Participants who received the instruction predicted growth that was slightly closer to exponential than in the control condition.[158] But their prediction still substantially underestimated the total growth; indeed, their average prediction of the number of cases on the final day was *less* than that of the control group, who received no instructions about exponential growth.[159]

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150. *Id.*

151. *Id.*

152. *Id.* at 421–22.

153. *Id.* at 422. I note that there are several other studies examining the exponential growth bias in the general environmental context, though they are fewer than studies in the disease-forecasting and financial contexts. *See, e.g.*, Willem A. Wagenaar & Han Timmers, *The Pond-and-Duckweed Problem; Three Experiments on the Misperception of Exponential Growth*, 43 ACTA PSYCHOLOGICA 239 (1979); John Vandermeer, *How Populations Grow: The Exponential and Logistic Equations,* 3 NATURE EDUC. KNOWLEDGE 15 (2010).

154. *See supra* note 137 and accompanying text.

155. Joris Lammers, Jan Crusius & Anne Gast, *Correcting Misperceptions of Exponential Coronavirus Growth Increases Support for Social Distancing*, 117 PROC. NAT'L ACAD. SCIS. 16264, 16265 (2020).

156. *Id.*

157. *Id.*

158. *Id.* at 16265–66.

159. *Id.*

Other studies have reached similar results using slightly different methods. In one design similar to the Wagenaar and Sagaria environmental study, experimenters presented participants with the number of COVID-19 cases from an unnamed country on days 0, 5, and 10 (338, 1312, and 4661 cases, respectively) and asked them to predict the number of cases on day 35.[160] As with other studies, the participants predicted case numbers in line with what would result from linear growth: just over 33,000 cases.[161] That prediction was less than 10% of the actual number of cases resulting from exponential growth—about 556,000 cases.[162]

The experimenters also tried several interventions to alleviate the bias. In one, the experimenters instructed participants to predict the number of cases in smaller steps: Rather than just predicting the result on day 35, they also predicted the result on days 15, 20, 25, and 30.[163] Like the interventions discussed above, the strategy helped only a bit: The participants predicted an average of 118,844 cases—still less than 25% of the correct value.[164] In a third group, they gave an even more direct training: After participants predicted the number of cases on each of days 15, 20, 25, and 30, the experimenters showed them the correct value of each day as well as the participant's corresponding prediction error.[165] That treatment was substantially more successful than the others discussed above, largely eliminating the bias.[166] Other studies have

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160. Ritwik Banerjee & Priyama Majumdar, *Exponential Growth Bias in the Prediction of COVID-19 Spread and Economic Expectation*, 90 ECONOMICA 653, 656–57 (2023). The unnamed country was the United States. *Id.*

161. *Id.* at 662, 663 fig.1.

162. *Id.* Studies examining the exponential growth bias in the context of disease forecasting have exploded in popularity following the COVID-19 pandemic, though there were studies in the field before it. *See, e.g.*, Ritwik Banerjee, Joydeep Bhattacharya & Priyama Majumdar, *Exponential-Growth Prediction Bias and Compliance with Safety Measures Related to COVID-19*, 268 SOC. SCI. & MED. 113473 (2021); Siv Hilde Berg, Daniel Adrian Lungu, Kolbørn Brønnick, Stig Harthug & Jo Røislien, *Exponential Growth Bias of Infectious Diseases: Protocol for a Systematic Review*, 11 JMIR RSCH. PROTOCOLS E37441 (2022); Gerardo Chowell & Cécile Viboud, *Is It Growing Exponentially Fast? – Impact of Assuming Exponential Growth for Characterizing and Forecasting Epidemics with Initial Near-Exponential Growth Dynamics*, 1 INFECTIOUS DISEASE MODELING 71 (2016); Florian Hutzler, Fabio Richlan, Michael Christian Leitner, Sarah Schuster, Mario Braun & Stefan Hawelka, *Anticipating Trajectories of Exponential Growth*, 8 ROYAL SOC'Y OPEN SCI. 1 (2021); Joris Lammers et al., *supra* note 155, at 16264; Gerda Ana Melnik-Leroy, Linas Aidokas, Gintautas Dzemyda, Giedrė Dzemydaitė, Virginijus Marcinkevičius, Vytautas Tiešis & Ana Usovaitė, *Is My Visualization Better Than Yours? Analyzing Factors Modulating Exponential Growth Bias in Graphs*, 14 FRONTIERS PSYCH. 1 (2023); Christina Pagel & Christian A. Yates, *Role of Mathematical Modelling in Future Pandemic Response Policy*, 378 BMJ 1 (2022); Martin Schonger & Daniela Sele, *How to Better Communicate the Exponential Growth of Infectious Diseases*, 15 PLOS ONE 1 (2020); Martin Schonger & Daniela Sele, *Intuition and Exponential Growth: Bias and the Roles of Parameterization and Complexity*, 68 MATH SEMESTERBER 221 (2021); Daniel Villanova, *Linear Biases and Pandemic Communications*, 42 MED. DECISION MAKING 765 (2022).

163. Banerjee & Majumdar, *supra* note 160, at 657.

164. *Id.* at 662.

165. *Id.* at 658.

166. *Id.* at 662, 663 fig.1. In some ways, this intervention simplifies the task in an artificial way, making it difficult to draw comparisons with other debiasing methods. There are

similarly demonstrated pervasive exponential growth bias among participants attempting to forecast disease growth, with mixed results when trying to debias through interventions.[167]

Global warming and COVID-19 are two cases of *naturally occurring* exponential or nonlinear growth. But recidivist sentencing structures provide for nonlinear growth that is determined by *human decisions*, not natural forces. Does that difference affect whether individuals fall prey to the exponential growth bias?

The answer appears to be no: The exponential growth bias is robust in non-naturally occurring exponential growth as well. The most well-documented example is in the area where everyday people likely have the most experience with exponential growth: financial decisions involving compounding interest.[168] When a person deposits money in a bank account that accrues compounding interest, the balance of that account grows exponentially, rather than linearly.[169] But when individuals are asked to estimate the returns in an account that accrues compounding interest, they tend to incorrectly predict linear growth, just like we saw in the environmental and COVID-19 contexts.[170] In one experiment, Craig McKenzie and Michael Liersch told participants to imagine that they deposited $400 every month into a savings account that returns a 10% rate of interest.[171] The participants were asked to calculate how much money would be in the account after 10, 20, 30, and 40 years, respectively.[172] The participants were also split into two groups.[173] In one condition, the participants were asked to "provide [their] thoughtful best guess" as

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relatively few real-world prediction scenarios where individuals will be given direct and immediate feedback, and then have to make an immediate follow-up prediction that is only one unit of time in the future.

167. *See, e.g.*, Sebastian Jäckle & Felix Ettensperger, *Boosting the Understanding and Approval of Anti-Corona Measures–Reducing Exponential Growth Bias and Its Effects Through Educational Nudges*, 27 SWISS POL. SCI. REV. 809, 813–17 (2021) (finding exponential growth bias in COVID-19 context, with moderate reductions in bias when participants were given educational "nudges" regarding exponential growth).

168. I discuss one study in this domain below, but there are many others. *See, e.g.*, Matthew R. Levy & Joshua Tasoff, *Exponential-Growth Bias in Experimental Consumption Decisions*, 87 ECONOMICA 52 (2020); Matthew R. Levy & Joshua Tasoff, *Exponential-Growth Bias and Overconfidence*, 58 J. ECON. PSYCH. 1 (2017); Matthew Levy & Joshua Tasoff, *Exponential-Growth Bias and Lifecycle Consumption*, 14 J. EUR. ECON. ASS'N 545 (2016); Victor Stango & Jonathan Zinman, *Exponential Growth Bias and Household Finance*, 64 J. FIN. 2807 (2009); Bryan Foltice & Thomas Langer, *Exponential Growth Bias Matters: Evidence and Implications for Financial Decision Making of College Students in the U.S.A.*, 19 J. BEHAV. & EXPERIMENTAL FIN. 56 (2018); Victor Stango & Jonathan Zinman, *Fuzzy Math, Disclosure Regulation, and Market Outcomes: Evidence from Truth-in-Lending Reform*, 24 REV. FIN. STUD. 506 (2011); Matthew R. Levy & Joshua Tasoff, *Misunderestimation: Exponential-Growth Bias and Time-Varying Returns*, 36 ECON. BULL. 29 (2016).

169. *E.g.*, McKenzie & Liersch, *supra* note 32, at S3–S4.

170. *E.g.*, *id.* at S2.

171. *Id.* at S3. The authors varied whether the deposit amount was $200 or $400, and whether the interest rate was 5% or 10%. Neither the amount nor the rate materially affected the result. *Id.* at S3–4.

172. *Id.*

173. *Id.*

to the correct values, but not to "formally calculate . . . answers . . . by using a calculator or . . . scratch paper."[174] In the second condition, by contrast, the participants were provided a calculator and were asked to "calculate [their] answers using a calculator or using . . . scratch paper."[175]

Strikingly, both groups predicted linear growth of the savings account, rather than the correct exponential growth.[176] The correct amounts, with annual compounding interest, are roughly $75,000 after 10 years, $275,000 after 20 years, $800,000 after 30 years, and $2.2 million after 40 years.[177] But participants' median predicted values, in both groups, were much lower: about $52,000 after 10 years, $105,000 after 20, $158,000 after 30, and $211,000 after 40.[178] Thus, participants underestimated the correct value of the account after 40 years by more than 90%.[179] And importantly, the error did not arise out of the difficulty of calculations. Both the "estimate" and "calculation" groups made the same error: They calculated the growth as a linear one by adding up the number of years of $400 contributions and increasing that number by 10%, rather than accounting for the compounding interest that results in exponential growth.[180] The authors also found that this effect caused participants to vastly underestimate how long it would take to "catch up" if they waited to save for retirement.[181] That effect was reduced, however, in conditions where the authors showed participants graphical depictions demonstrating the effects of exponential growth on savings accounts over time.[182] In other words, making the participants aware of the effects of exponential growth encouraged them to realize the importance of investing early.

C. Debiasing and Individual Effects

That last point leads to an important theme: Across all three domains discussed here,[183] we have seen various attempts at *debiasing*—that is, eliminating or reducing

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174. *Id.* at S3.

175. *Id.*

176. *Id.* at S4 ("Participants' median responses increase linearly over time, whereas the correct responses increase exponentially.").

177. *See id.* at S4.

178. *Id.*

179. *Id.*

180. *Id.*

181. *Id.* at S5–6, S10 ("[P]articipants vastly underestimated retirement savings growth and the cost of waiting to save.").

182. *Id.* at S6–8, S11–12.

183. It is worth noting here that there are, of course, other domains in which the exponential growth bias has been demonstrated. *See, e.g.*, Simon Kemp, *Perception of Changes in the Cost of Living*, 5 J. ECON. PSYCH. 313 (1984) (examining exponential growth bias in the context of inflation and rising cost of living); Richard P. Larrick & Jack B. Soll, *The MPG Illusion*, 320 SCI. 1593 (2008) (demonstrating exponential growth bias in participants' interpretation of fuel efficiency); Hunt Allcott, *The Welfare Effects of Misperceived Product Costs: Data and Calibrations from the Automobile Market*, 5 AM. ECON. J.: ECON. POL'Y 30 (2013) (same context); Wim Van Dooren, Dirk De Bock, An Hessels, Dirk Janssens & Lieven Verschaffel, *Remedying Secondary School Students' Illusion of Linearity: A Teaching Experiment Aiming at Conceptual Change*, 14 LEARNING & INSTRUCTION 485 (2004) (exponential growth bias in

the effect of the exponential growth bias.[184] The literature regarding the effectiveness of these debiasing efforts is mixed, but promising. Debiasing measures can be grouped into roughly four categories. First are what I call *chunking* techniques. Recall our COVID-19 hypothetical above, in which you were asked to predict the number of cases 15 days beyond what the graph depicted. Would you be any more accurate in your prediction on the final day if you were asked to also first predict the number of cases after 3, 6, 9, and 12 days? The idea of debiasing via chunking is that individuals are more likely to see and predict nonlinear growth when they make predictions in smaller chunks. We saw this method used in one of the COVID-19 prediction studies discussed above[185] and in the McKenzie & Liersch retirement-savings study with some success.[186]

Closely related to chunking is debiasing in the form of *feedback*. Feedback adds to the concept of chunking by not only asking the participant to make predictions in smaller chunks, but also by providing her with feedback as to the accuracy of her prediction at each interval. In one study, for example, experimenters told participants that they would be predicting the next number in a series based only on the prior number they had seen.[187] The series grew exponentially, and the experimenters divided the growth into 100 separate chunks, asking participants to predict the value at each interval.[188] After each prediction, the experimenters provided feedback, telling participants the correct value at each interval, as well as how far off the participant's prediction was.[189] Based on this feedback, the participants were highly accurate in their predictions.[190] And critically, when the experimenters reduced the helpfulness of the feedback—by not presenting feedback from the immediately prior interval—participants' accuracy was significantly reduced.[191] This result is in line with other studies finding some benefits of providing feedback in reducing exponential growth bias.[192] But feedback is not a panacea: As others have noted, in most real-world conditions where we might want to limit the exponential growth bias, it's simply not possible to provide trial-by-trial feedback on predictions.[193] Instead, we often need to make early predictions of events far into the future to be able to appropriately plan responses—for example, planning COVID-19 related

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math problem-solving).

184. *See supra* notes 148–153, 163–167, 181–182 and accompanying text.

185. *See supra* notes 163–164 and accompanying text.

186. *See supra* note 173 and accompanying text.

187. Andrew J. Mackinnon & Alexander J. Wearing, *Feedback and the Forecasting of Exponential Change*, 76 ACTA PSYCHOLOGICA 177, 180–81 (1991).

188. *Id.* The exponential growth rate was 6%. *Id.* at 180.

189. *Id.* at 180–81.

190. *Id.* at 182.

191. *Id.* at 185–87.

192. *See, e.g.*, Wagenaar & Sagaria, *supra* note 139, at 421–22 (showing some benefit from feedback combined with education about exponential growth); Gideon Keren, *Cultural Differences in the Misperception of Exponential Growth*, 34 PERCEPTION & PSYCHOPHYSICS 289 (1983) (finding that Israeli participants were less prone to the exponential growth bias than Canadian participants, potentially due to Israelis' experiences with inflation amounting to regular feedback).

193. *See, e.g.*, Teichman & Zamir, *supra* note 30, at 1359.

school closures weeks in advance, in anticipation of exponentially increasing case numbers.

Two other forms of debiasing are likely less effective, but potentially more realistically usable, than feedback. First, a number of experiments have employed the use of calculation or visual aids to assist decisionmakers. In some cases, these aids have proven at least somewhat useful. For example, in one study, participants were asked to predict virus growth, and were shown graphs of the virus's exponential growth from days 1–20, and asked to predict the number of cases on day 30.[194] In an attempt to reduce exponential growth bias, the experimenters took two measures: First, they modified the scale of the graphs to make the exponential growth easier to visualize, and second, they transformed the scale to a logarithmic one, making the exponential growth appear linear.[195] Both measures significantly reduced the extent of the exponential growth bias, but participants still predicted values less than half of the correct ones.[196] In other words, aids provided some assistance, but the effect of the bias remained strong.[197] In some other studies, aids did not show any benefit at all. As we saw in the McKenzie and Liersch retirement-savings study, providing participants with calculators did not reduce the exponential growth bias in any meaningful way.[198]

Last, some experimenters have tried to reduce the bias through *direct education* about exponential growth. For example, in one condition, McKenzie and Liersch explicitly highlighted the extent to which exponential growth would increase retirement savings and presented targeted questions designed to draw readers' attention to those graphs.[199] When they did so, the participants were significantly more likely to correctly understand exponential growth and save early to take advantage of the later gains of exponential growth.[200] Other studies have found similar results,[201] though at least one meta-analysis found that the benefits of

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194. Hutzler et al., *supra* note 162, at 3–4.

195. *Id.* The effect of the logarithmic transfer was such that all the participants would have to do to accurately predict exponential growth would be to continue the straight line in a visually linear fashion. *See id.* at 4 fig.2.

196. *Id.* at 4–5.

197. Other studies have found similar results. *See, e.g.*, Gopi Shah Goda, Matthew Levy, Colleen Flaherty Manchester, Aaron Sojourner & Joshua Tasoff, *Predicting Retirement Savings Using Survey Measures of Exponential-Growth Bias and Present Bias*, 57 ECON. INQUIRY 1636, 1641 (2019) (permitting the use of tools during experiment but reporting no benefit of using them).

198. McKenzie & Liersch, *supra* note 32, at S4. For additional discussion, see Teichman & Zamir, *supra* note 30, at 1358.

199. McKenzie & Liersch, *supra* note 32, at S6–S7.

200. *Id.* at S7.

201. *See, e.g.*, Changcheng Song, *Financial Illiteracy and Pension Contributions: A Field Experiment on Compound Interest in China*, 33 REV. FIN. STUD. 916 (2020) (financial education reduced bias in Chinese participants); Bryan Foltice, *How to Decrease the Amortization Bias: Experience vs. Rules*, 43 J. FIN. EDUC. 273 (2017) (similar among business students). *But see* Wagenaar & Sagaria, *supra* note 139, at 421–22 (demonstrating limited benefit from education about exponential growth).

providing direct education about exponential growth bias may not last for later decisions.[202]

One final point about the empirical research is worth noting. There is some research, though mixed, as to whether specialized expertise in a given area affects individuals' susceptibility to the exponential growth bias, as well as whether broader individual characteristics—such as socioeconomic status, age, or education level—correlate with susceptibility to the bias. Both warrant a brief mention, as they may apply to the sentencing context.

First, on expertise: We have already seen one study where expertise in the subject matter at issue did little to counteract exponential growth bias. In Wagenaar and Sagaria's 1975 climate change study, neither providing participants with 75 minutes of training about exponential growth nor using conservation experts as participants eliminated the bias, though providing training did slightly reduce its effect.[203] In other contexts, technical expertise reduced the impact of the exponential growth bias—for example, in one study, participants were asked to estimate economic growth, which occurs exponentially.[204] All tended to underestimate the exponential growth, but "experts made [significantly] better estimations than laypeople."[205] Some other experiments have found some small benefits from expertise,[206] but the message to be gleaned from such studies is that, while expertise in an area may slightly reduce the effects of exponential growth bias, it is unlikely to eliminate the bias entirely, and may have no effect at all in some domains.

Second, some studies have examined whether more general demographic or personality categories correlate with the exponential growth bias. For the most part, these studies have found relatively minimal effects. In one study, experimenters demonstrated that individuals' tendency to exhibit exponential growth bias correlates with individuals' real-world retirement-savings decisions, controlling for various demographic factors.[207] Most had no significant relationship with the tendency to exhibit exponential growth bias, including financial literacy, general education, gender, and race.[208] There were some demographic predictors of the bias, however; most notably, individuals with higher IQ measures and who attained advanced

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202. *See, e.g.*, Jack B. Soll, Ralph L. Keeney & Richard P. Larrick, *Consumer Misunderstanding of Credit Card Use, Payments, and Debt: Causes and Solutions*, 32 J. PUB. POL'Y & MKTG. 66 (2013).

203. *See supra* notes 150–153 and accompanying text.

204. Fabian Christandl & Detlef Fetchenhauer, *How Laypeople and Experts Misperceive the Effect of Economic Growth*, 30 J. ECON. PSYCH. 381, 381–82 (2009).

205. *Id.* at 385–88.

206. *See, e.g.*, Gabriel Recchia, Alexandra L. J. Freeman & David Spiegelhalter, *How Well Did Experts and Laypeople Forecast the Size of the COVID-19 Pandemic?*, 16 PLOS ONE 1, 3–4 (2021) (experts underestimated the exponential growth of COVID-19, but less than laypeople).

207. Goda et al., *supra* note 197, at 1638.

208. *Id.* online app. tbl.B.3. American Indian ethnicity was slightly associated with a greater tendency toward the exponential growth bias, but the difference was significant only at the $p > .1$ level, not the .05 level. At least one other study has shown a gender effect, with women exhibiting a greater exponential growth bias than men. *See* Christandl & Fetchenhauer, *supra* note 204, at 385–88.

education (measured by having a BA or BS degree) were less susceptible to the bias.[209]

D. Connecting the Exponential Growth Bias to Sentencing

What does all of this research tell us about the exponential growth bias in the context of shocking sentences? Several things. First, like laypeople in all of the domains described above, individuals who are considering their potential future criminal exposure are likely to vastly underestimate that exposure in systems where recidivist sentencing penalties lead to nonlinear increases in sentences based on criminal history. And, as we have seen, virtually all U.S. sentencing systems have schemes that increase sentences for repeat offenders at a rate faster than linearly, whether through nonlinear guideline systems[210] or statutory mandatory minimums.[211]

This underestimation likely operates on two levels. First, if individuals recognize that their criminal history will have any impact at all on their subsequent sentences, they are likely to presume linearity in the absence of any prior information. As we have seen in the studies described above, humans tend to simply presume that growth will be relatively linear, as a set baseline. Second, even if individuals examine their prior sentences and those sentences have grown exponentially, they still are not likely to appreciate that exponential growth, and will underestimate their future sentences. Just as participants in the Wagenaar and Sagaria experiment reviewed prior carbon emissions that were growing exponentially and failed to predict continued exponential growth, individuals who are aware of their prior sentences and use them to predict future sentences are unlikely to appreciate the growth of those sentences and will thus underpredict their future sentences.

At this point, one might naturally wonder, "Aren't all of these exponential growth bias studies in domains *other* than sentencing? How can we be so sure that the exponential growth bias applies to the sentencing context at all?" True enough, there are no studies of the exponential growth bias specifically examining sentencing increases resulting from recidivism. And running experiments in the sentencing context would be a worthwhile scientific contribution. But I think we can be reasonably confident that the exponential growth bias operates in this context, just as in the other contexts we have seen, for several reasons. First, the exponential growth bias has been robustly demonstrated across multiple domains, which gives some certainty that the bias is not specific to certain contexts or substantive areas of information. In other words, we can be confident that there is nothing special about, for example, prediction of carbon emissions, that makes individuals particularly susceptible to the bias there. Instead, the bias is consistent across the domains that we have seen and has consistently replicated in new contexts.

Second, and relatedly, there is no material difference between the domains in which the exponential growth bias has been demonstrated and criminal sentencing. Each involves a quantitative measure that increases over time in a nonlinear way,

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209. Goda et al., *supra* note 197, at 1638.
210. *See supra* Part I.C.
211. *See supra* Part I.B.

and the reason the bias appears to occur is because of a difficulty in projecting quantitative growth generally, not a difficulty in assessing anything substantive about what the growth represents. In other words, there is no particular *reason* to believe that a person would fail to recognize exponential growth in carbon emissions but would recognize it in sentencing. The literature on exponential growth bias in financial contexts is especially compelling here—those contexts are ones where people are relatively familiar with exponential growth (through the concepts of compounding interest, growth in the stock market, etc.) and *still* the bias persists in those domains. There is nothing substantive about sentencing that should make it any different.[212]

Third, there is substantial evidence that a number of broadly generalizable psychological phenomena apply in legal contexts, just as they do in other contexts. There are many examples of this, but one notable one is the anchoring effect: When individuals are asked to make a difficult numerical judgment, their decision is influenced by a reference point or "anchor," even when the anchor is completely irrelevant to the task at hand.[213] The anchoring effect is extremely robust—it has been repeatedly replicated in numerous contexts.[214] And it has also been demonstrated in legal contexts: Plaintiffs' damage requests serve as a powerful anchor,[215] prosecutors' sentencing recommendations can be anchoring,[216] and anchoring plays a key role in negotiations.[217] The effect has been demonstrated in lab contexts but has also been observed in real-life legal decision-making.[218] And anchoring is not unique; other major psychological biases and heuristics, like the fundamental attribution error and the endowment effect, have been demonstrated in

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212. There is one important caveat to this: In the context of shocking sentences, the most commonly useful data point to predict is the *next* sentence. This may lead to less underprediction as potential defendants are, in some ways, naturally chunking their predictions. This may also make debiasing easier in the sentencing context. I discuss this possibility *infra* Part III.B.

213. *See, e.g.*, Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCI. 1124, 1128–30 (1974) (original study identifying phenomenon); Adrian Furnham & Hua Chu Boo, *A Literature Review of the Anchoring Effect*, 40 J. SOCIO-ECON. 35, 35 (2011) (summarizing literature); Piotr Bystranowski, Bartosz Janik, Maciej Próchnicki & Paulina Skórska, *Anchoring Effect in Legal Decision-Making: A Meta-Analysis*, 45 L. & HUM. BEHAV. 1, 2 (2021) (same).

214. Furnham & Boo, *supra* note 213, at 35–37 & tbl.1-2; Bystranowski et al., *supra* note 213, at 3–4.

215. Bystranowski et al., *supra* note 213, at 4.

216. *Id.*

217. *Id.*; *see also* Dan Orr & Chris Guthrie, *Anchoring, Information, Expertise, and Negotiation: New Insights from Meta-Analysis*, 21 OHIO ST. J. ON DISP. RESOL. 597, 597–99 (2006) (summarizing research).

218. *See, e.g.*, Shari Seidman Diamond, Mary R. Rose, Beth Murphy & John Meixner, *Damage Anchors on Real Juries*, 8 J. EMPIRICAL L. STUD. 148, 148–50 (2011) (analyzing recordings of juror deliberations in real tort cases and finding that jurors found value in plaintiffs' ad damnum damage requests, though they were less influenced by certain categories of requests and extremely large requests).

legal contexts.[219] There is little reason to think that the exponential growth bias would operate any differently than these other psychological phenomena.

One final question is also worth raising here: Are there any special characteristics of individuals potentially facing shocking sentences that might cause them to be more or less susceptible to the exponential growth bias than the populations used as participants in the studies described above? The individual-differences literature described above indicates that, if anything, individuals subject to shocking sentences are likely to be *more* susceptible to the exponential growth bias than others. As we saw—albeit in only a single study—advanced education can be predictive of a reduced susceptibility to the exponential growth bias, but justice-involved individuals are substantially less likely than average to have received advanced education.[220] What's more, there are even greater education deficits among individuals with lengthier criminal histories (as compared to first-time offenders), who are the ones more likely to be facing shocking sentences.[221] Thus, the experimental literature on the exponential growth bias might actually underestimate its effect in the sentencing context, as many of the studies described above were conducted using university students as participants. The bias in a population such as justice-involved individuals may be even greater. In sum, there is little reason to think that any demographic characteristics of individuals facing shocking sentences would make them less susceptible to the exponential growth bias; to the contrary, the opposite is likely true.

Likewise, there is probably no reason to believe that individuals facing shocking sentences have specialized knowledge that would reduce their susceptibility to the exponential growth bias in this context. As we have seen, the research has sometimes found that specialized knowledge does nothing to reduce the bias, as in the Wagenaar & Sagaria carbon emissions study, where conservation experts were no better than other participants.[222] In some other contexts—financial decision-making and disease forecasting—expertise may help reduce the bias.[223] But even if that latter finding is generalizable, there's little reason to think that individuals subject to shocking sentences have similar expertise. They are exposed to the sentencing process perhaps a handful of times in the cases in which they are involved, but likely not enough to

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219. *See, e.g.*, Daniel Kahneman, Jack L. Knetsch & Richard H. Thaler, *Experimental Tests of the Endowment Effect and the Coase Theorem*, 98 J. POL. ECON. 1325, 1339–41 (1990) (demonstrating endowment effect in negotiation context); Cassandra Flick & Kimberly Schweitzer, *Influence of the Fundamental Attribution Error on Perceptions of Blame and Negligence*, 68 EXPERIMENTAL PSYCH. 175 (2021).

220. *E.g.*, Brady Duke, *A Meta-Analysis Comparing Educational Attainment Prior to Incarceration and Recidivism Rates in Relation to Correctional Education*, 69 J. CORRECTIONAL EDUC. 44, 45–46 (2018) ("[T]he majority of literature pertaining to educational attainment rates of inmates prior to incarceration indicates they have lower educational levels than their civilian counterparts . . . .").

221. U.S. SENT'G COMM'N, EDUCATION LEVELS OF FEDERALLY SENTENCED INDIVIDUALS 12 (2023), https://www.ussc.gov/sites/default/files/pdf/research-and-publications/research-publications/2023/20231218_Education.pdf [https://perma.cc/Z26Z-XK2Y] ("Federally sentenced individuals with a higher level of educational attainment had less extensive criminal histories than those with lower levels of educational attainment . . . .").

222. *See supra* note 139 and accompanying text.

223. *See supra* notes 203–206 and accompanying text.

develop serious expertise. Instead, a criminal defense lawyer or prosecutor would be a better analogue to the experts described in the literature who might have enough specialized knowledge to reduce exponential growth bias.

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So, the case is strong that the exponential growth bias affects sentencing. This analysis naturally leads to a question. If U.S. recidivist sentencing schemes do in fact lead to individuals underestimating their criminal exposure due to exponential growth bias, is that a bad thing? In other words, is there anything *wrong* with shocking sentences? We take up this question in the next Part.[224]

III. AGAINST SHOCKING SENTENCES

As we have seen, shocking sentences are a widespread part of U.S. criminal justice. Nearly every jurisdiction imposes them, whether through statutory mandatory minimum sentences, guideline enhancement schemes, or both.[225] Indeed, they are weaved cohesively into the sentencing structure, such that recidivism is commonly punished with exponential or other nonlinear growth relative to prior sentences. And because those sentences grow in a nonlinear way, defendants are unlikely to appreciate the nature of shocking sentences before they are imposed.[226]

So, what's wrong with that? A number of things, in my view. As I argue below, imposing shocking sentences is inconsistent with the theoretical bases of penalizing recidivism in sentencing at all. There's no strong retributive rationale for shocking sentences, and the very nature of shocking sentences as unanticipated minimizes any potential deterrent effect. Moreover, imposing shocking sentences seriously

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224. Now that we have discussed both types of sentencing regimes that trigger nonlinear growth in sentences over time and the psychological reasons why these regimes likely lead to shocking sentences, there is an important question to address. Why is the focus here only on *recidivist* sentencing enhancements, and not on enhancements that relate to the characteristics of the crime itself? There are several reasons, but the primary one is that the problem simply does not appear as frequently in substantive statutes as it does in recidivist penalty enhancements—the substantive rules don't often trigger exponential growth in sentencing exposure with linear growth in offense severity. Take, for example, a federal fraud or theft crime. Under the U.S. Sentencing Guidelines, the potential penalties for the offense grow as the amount of money stolen increases, as one would expect. U.S. SENT'G GUIDELINES MANUAL § 2B1.1(b)(1) (U.S. SENT'G COMM'N 2021) (increasing offense level as quantity of theft increases). But the sentencing exposure increases relatively linearly, not exponentially—as the amount of money stolen increases, it takes an increasingly large step up in the total amount of theft to trigger an additional increase in the offense level. *See id.*; *see also id.* § 2D1.1(a)(5) (similar structure for drug offenses). In other criminal statutes, the relative increase in severity across grades of offenses is difficult to quantify. A murder statute may provide for three times the penalty of a manslaughter statute, but is murder three times more serious that manslaughter? It's difficult to find a principled way to decide. That is distinct from recidivist penalties, where an individual's criminal history is straightforward to quantify.

225. *See supra* Part I.

226. *See supra* Part II.

threatens due process, especially in an era where potential criminal liability is ever-expanding. I outline these arguments below.

A. Reconsidering Shocking Sentences Entirely

Ought we change our sentencing structures substantively to avoid potentially shocking sentences? In other words, should we eliminate, for example, substantial penalties for third-strike offenses in part because of the potential for shocking sentences? Before taking a position, we need to understand the rationales that justify any recidivist sentencing penalties in the first place. While scholars have identified a few different theories, there are two major strands that are most uniformly recognized and most potentially relevant to shocking sentences.

The first theory, arising out of retributive notions of punishment, is based on *notice*. As the argument goes, the recidivist has undergone the procedures for being convicted and sentenced, and by undergoing that process, he has been put on notice that his conduct is rejected by the community.[227] Put another way, following a first conviction, the recidivist "knows better the depth of the harm caused by the act and the societal gravity" of his criminal act.[228] Thus, the culpability for any subsequent crime is greater, and greater punishment is likewise justified from a retributive

227. *See, e.g.*, Krishnamurthi, *supra* note 24, at 429–31; FRASE & ROBERTS, *supra* note 42, at 34 (describing "enhanced culpability for offenders who, after receiving formal condemnation of their prior criminal acts, ignore society's general . . . and individualized . . . warnings, and commit further crime in open defiance of these warnings"); ROBERTS, *supra* note 43, at 37 (describing enhanced sentence because "the repeat offender, having been warned through the imposition of punishment, is disentitled to mitigation"). The U.S. Sentencing Guidelines also adopt a similar retributive theory, though they do not directly reference notice as the reason that subsequent crimes give rise to greater culpability. *See* U.S. SENT'G GUIDELINES MANUAL ch. 4 pt. A (U.S. SENT'G COMM'N 2021) ("A defendant with a record of prior criminal behavior is more culpable than a first offender and thus deserving of greater punishment."); Christopher Lewis, *The Paradox of Recidivism*, 70 EMORY L.J. 1209, 1227–28 (2021).

228. Krishnamurthi, *supra* note 24, at 443.

perspective.[229] To put it simply, the defendant *knew better* after the first conviction, and thus a greater penalty is warranted.[230]

The second main theory is that *consequentialist or utilitarian* aims of punishment, like deterrence and incapacitation, are furthered by recidivist sentencing penalties.[231]

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229. Krishnamurthi distinguishes between a notice theory of recidivist punishment and a *disobedience* theory. To him, the notice theory posits that increased punishment is warranted for the recidivist because recidivism increases the culpability for the latter crime, whereas disobedience theory posits that the very act of defying the state's instruction is its own culpable act. *Id.* at 436–42. Some others take a similar approach. *See*, *e.g.*, Lewis, *supra* note 227, at 1227–29, 1234–36; Bagaric, *supra* note 43, at 371–72. Krishnamurthi recognizes, however, that the theories sometimes blend together. Krishnamurthi, *supra* note 24, at 444 (describing one form of the notice theory as "seemingly an alternative way of stating the defiance account"). Other authors place notice theory and disobedience theory together, as I have done here. *See, e.g.*, FRASE & ROBERTS, *supra* note 42, at 34–35 (describing notice theory in terms of "defiance"); ROBERTS, *supra* note 43, at 37–39. Youngjae Lee describes a distinct (but somewhat related) approach that centers on *omissions* on the defendant's part that have led to repeat crime:

> [T]he recidivist premium stems from an omission—namely, what the repeat offenders have failed to do between the time of the previous conviction and the time of the new offense. That is, the recidivist premium is not directed at the moment a crime is committed by an offender; rather, the recidivist premium is additional punishment directed at the previous steps taken by him that enabled the later crime to be committed. . . . If the process of conviction and punishment communicates the message that what the offenders have done is wrong and they should not do it again, the process also should prompt a period of reflection on the part of offenders to determine how they ended up committing the prohibited act.

Youngjae Lee, *Multiple Offenders and the Question of Desert*, *in* SENTENCING MULTIPLE CRIMES 28–29 (Jesper Ryberg, Julian V. Roberts & Jan W. de Keijser eds., 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3062894 [https://perma.cc/RHH4-5E6J] (emphasis omitted); Youngjae Lee, *Recidivism as Omission: A Relational Account*, 87 TEX. L. REV. 571, 577 (2009) ("[W]e should think of the recidivist premium as stemming not from our enhanced understandings of repeat offenders' bad characters or allegedly defiant attitudes, but from what the repeat offenders have failed to do between the time of the previous conviction and the time of the new offense."). To Lee, going through the process of conviction and punishment triggers obligations on the part of the defendant to identify the reasons why the crime occurred, and correct problems in her life that led to them. *See id.* at 612–14. Though distinct from the purest forms of notice theory, the two theories are related: Lee's omission theory posits that the recidivist premium is justified because "once offenders are convicted of a crime, they enter into a thick relationship with the state, and that relationship gives rise to an obligation for the offenders to rearrange their lives in order to steer clear of criminal wrongdoing," essentially placing a defendant on notice (though perhaps not explicitly) that there are problems the need to be fixed. *See id.* at 621.

230. *E.g.*, Burris v. United States, No. 3:19-cr-41-MOC-DCK-1, 2022 WL 2759076, at *4 (W.D.N.C. July 14, 2022) (defendant describing his culpability in that, "[e]ven though I knew better, my involvement continued").

231. *See, e.g.*, Krishnamurthi, *supra* note 24, at 424–26; FRASE & ROBERTS, *supra* note 42, at 25–26 (noting that increases in punishment "may be based on assumed variations in

Under that theory, escalating penalties for subsequent offenses might deter individuals from committing more crimes, either when a particular individual knows his next offense might be subject to an enhanced penalty (specific deterrence) or when the public more generally knows that subsequent offenses will be punished more harshly (general deterrence).[232] Likewise, if a person who has committed a second offense is more likely to commit additional crimes than someone who has committed only a single offense, it might be sensible to punish the repeat offender more severely out of a greater need to incapacitate him, due to the increased threat of future crime that he presents.[233]

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recidivism risk and crime control benefits, without having to be justified by differences in blameworthiness"); *id.* at 41–54 (describing research and theory on recidivism risk applied to prior-record enhancements); Bagaric, *supra* note 43, at 383–85; Russell, *supra* note 26, at 1152–54; Barkow, *supra* note 19, at 219 (noting that, when the ACCA was enacted, "incapacitation appeared as the primary motivator" and "deterrence also played a key role"). The U.S. Sentencing Guidelines more explicitly adopt a consequentialist rationale, considering both deterrence and incapacitation. U.S. SENT'G GUIDELINES MANUAL Ch. 4 Pt. A (U.S. SENT'G COMM'N 2021) ("General deterrence of criminal conduct dictates that a clear message be sent to society that repeated criminal behavior will aggravate the need for punishment with each recurrence. To protect the public from further crimes of the particular defendant, the likelihood of recidivism and future criminal behavior must be considered."); Lewis, *supra* note 227, at 1218–26.

232. *See, e.g.*, Krishnamurthi, *supra* note 24, at 436–43. *But see* David A. Dana, *Rethinking the Puzzle of Escalating Penalties for Repeat Offenders*, 110 YALE L.J. 733, 737 (2001) (arguing that "[t]he economic model of optimal deterrence actually supports declining penalties based on offense history for some categories of offenses, rather than nonescalating or escalating penalties" because "holding all other variables constant, people and entities with 'records' have a higher probability of having their offenses detected than people and entities without records" (emphasis omitted)).

233. *See, e.g.*, Krishnamurthi, *supra* note 24, at 443–47. I note here that there are other theories ostensibly justifying recidivist penalties that, in my view, warrant less discussion. Under one theory—sometimes called the "bad character" theory—increased penalties are warranted for repeat offenses because the fact that a person reoffends reveals their bad character traits, such as selfishness, impulsivity, and the like. *See, e.g.*, Krishnamurthi, *supra* note 24, at 429; FRASE & ROBERTS, *supra* note 42, at 33–34 ("Character-based theories of enhanced punishment for repeat offenders are based on the idea that such offenders have shown themselves, with each additional crime, to be more and more antisocial and indifferent to the rights of others."); Youngjae Lee, *supra* note 229, at 23 ("[W]hen a person offends for the first time, we might attribute it to a temporary breakdown of self-control, but if the same person commits another offense afterward and then another, we can no longer attribute the subsequent offenses to a moment of weakness, and accordingly we may think less of him as a person. . . . [I]f that person continues to commit crimes over time we could be more confident in the judgment that the offender is a criminal with a pattern of offending over time, and not just a law-abiding citizen who slipped in a moment of weakness."). There are serious problems with the bad character theory as a defense of recidivist penalties at all—an individual tends not to control her character traits in the same way she controls her conduct, and it's not clear why we ought to punish someone for their bad character traits in the first place. *See* Krishnamurthi, *supra* note 24, at 430–31. Bad character theory also does not support the imposition of exponential sentences. If a hypothetical defendant's first conviction for drug trafficking indicates his bad character warranting greater punishment for a second conviction, do later convictions say anything further about that character trait? Is it not already established

Scholars have routinely argued that these theories do not justify the extent of recidivist penalties imposed in the United States. Indeed, recently, some scholars have argued that these arguments do not justify recidivist sentencing penalties *at all*, regardless of their severity,[234] or even that subsequent offenses should be punished *less* than first offenses.[235] But our question here is narrower: Can the theoretical bases for recidivist sentencing penalties justify the kinds of shocking sentences that we have explored here? I think the answer is no.

1. Notice

Take first the notice theory. That theory might justify some increased penalty for a second offense as compared to a first one. The process of being convicted and publicly condemned for committing an action that the state considers morally reprehensible might provide a few different types of notice. Most obviously, it might indicate to the offender that society has a special sort of rejection for the criminal conduct, and defiantly continuing to commit crimes following that notice might warrant greater retribution.[236] Second, it might provide the offender with notice that his crime caused harm (whether to individual victims of the crime, or to society more generally where there are not individual victims), and if the offender continues to offend after that notice, his culpability might be greater.[237] Third, it might provide

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by the first two convictions? Whatever minimal information later convictions do to demonstrate that bad character, under our scheme of shocking sentences, those later convictions are punished many times more harshly. Bad character theory cannot justify that increase. Krishnamurthi makes a similar point in arguing that bad character theory does not justify a recidivist penalty at all. *Id.* at 434 ("[I]f the reoffending simply reveals the same bad character trait as before, which has received some punishment, then why does it receive further punishment . . . ?"). Beyond bad character theory, there are other theories that are beyond the scope of the discussion here, as they plainly do not justify nonlinear growth in sentencing exposure for repeat offenses. *See, e.g.*, FRASE & ROBERTS, *supra* note 42, at 37–38 (describing "reserved desert" theory, under which "prior-record enhancements might be justified if the offender did not receive all of his deserved punishment in one or more prior sentencing events"); ROBERTS, *supra* note 43, at 42 (describing "preventing public demoralization" as a possible theory under which a recidivist sentencing enhancement might apply).

234. *See, e.g.*, Krishnamurthi, *supra* note 24.

235. *See* Lewis, *supra* note 227, at 1212 ("[T]he law and policy of collateral consequences, and the social conditions they engender, have left us in a situation where judges and sentencing commissions ought to do precisely the opposite of what they currently do: treat prior criminal convictions as a presumptive mitigating factor, rather than an aggravating one—imposing a recidivist sentencing discount, rather than a premium." (emphasis omitted)); *see also* Josh Bowers, *What If Nothing Works? On Crime Licenses, Recidivism, and Quality of Life*, 107 VA. L. REV. 959 (2021) (proposing system of "crime licenses" for recidivists in which enforcement for certain offenses would cease against certain recidivists).

236. *See* Krishnamurthi, *supra* note 24, at 442. Krishnamurthi rejects this rationale for recidivist penalties entirely, arguing that it punishes the *attitude* of contempt or disrespect, and retributivism rejects the punishment of attitudes. *Id.* at 436–38.

237. *Id.* at 443. Krishnamurthi is skeptical, as am I, that the process of being convicted actually provides much increased notice of this type—as he puts it, "[f]or the vast majority of crimes, people generally have a full understanding of the harms that may arise from them." *Id.* at 444.

the offender with greater notice of his own capacity for wrongdoing.[238] Presume, for a moment, that these theories provide increased culpability for a second offense. When we get to the third offense, where the defendant's sentencing exposure could become nonlinear and shocking, what new notice has that conviction provided? The notice was already given as a result of the initial conviction.

Take Ireland's case, for example. He was first convicted of selling drugs in 2007.[239] Perhaps, as a result of that conviction, he received notice—of the state's moral rejection of drug trafficking, of the potential harms to society he was causing, and of his own capacity for crime. As a result, perhaps he was more culpable the second time he was convicted, in 2010,[240] warranting some increased penalty for his recidivism. But then, when Ireland was later convicted federally and was exposed to a shocking sentence under the career offender guideline, had his notice materially changed? He had already likely received notice after the *first* conviction. Why should his sentencing exposure, based on notice theory, increase more between each successive conviction, when each one of those convictions likely provides only minimal, if any, additional notice to him? Indeed, notice theory most plausibly would favor a *plateauing* of recidivist penalties over time, as an offender would have the greatest difference in notice between his first and second convictions, and a successively smaller increase in notice after each following conviction.

There are other problems with the notice justification for shocking sentences, too. Many of the shocking sentence regimes we have discussed increase sentencing exposure when a person commits some prior offense and then commits an entirely different instant offense. For example, under the ACCA—the federal three-strikes law—a defendant can be subject to a 15-year mandatory minimum sentence for carrying a gun following three prior convictions for selling drugs.[241] How does notice theory justify that exponential increase? The defendant may have been put on notice of, for example, the state's moral disgust for selling drugs, the harms of selling drugs, or his own proclivities to selling drugs. But that notice has little to do with the later offense of carrying a gun, and surely can't justify the exponential growth in sentencing exposure for the gun crime.

Last, the notice theory is further undermined by the inherent lack of notice involved in shocking sentences. One notice-related argument for a recidivist sentencing penalty might go something like the following: "Penalties for committing crimes get much harsher as one accumulates more convictions. That fact demonstrates society's moral rejection of offending repeatedly. And, despite that demonstration of society's moral rejection, you chose to continue to offend, and thus, your culpability is greater." But this argument quickly breaks down because of the exponential growth bias: If an individual does not recognize the exponential growth in sentencing exposure resulting from repeat convictions, he is not effectively

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238. *Id.* at 445–46. As with the second type of notice, I'm skeptical that being convicted provides any special information that the defendant didn't already have as a result of committing the crime itself. When a person commits a crime, it doesn't take a conviction to show to him that he's prone to committing crimes. *See id.* at 446.

239. *See supra* text accompanying note 4.

240. *See supra* text accompanying note 5.

241. *See supra* notes 103–105 and accompanying text.

informed of that increased moral rejection, and so notice cannot justify the exponential growth in the sentence.

2. Utility

Notice does little to justify shocking sentences. What then, about consequentialist/utilitarian justifications for them? Many statutes and guidelines that generate potentially shocking sentences are ostensibly animated by a desire to deter violent crime or serial recidivism. The ACCA, for example, has the "purpose . . . to incapacitate repeat offenders who possess a firearm . . . and to deter others from criminal conduct that could lead to an ACCA sentence."[242] Likewise, one of the authors of the California three-strikes law described its purpose was to create a "behavioral sea-change" in which "those who might otherwise be disposed to a life of crime in California" decide not to offend because of the harsh potential penalty.[243]

But the very nature of the exponential growth bias cuts this rationale off at the knees. When an individual fails to anticipate future exponential growth, her actions cannot be motivated or shaped by that growth—she is entirely unaware of it. This effect has been empirically demonstrated in the exponential growth bias literature. Recall, for example, the McKenzie & Liersch study in which participants were told to imagine that they deposited $400 every month into a savings account that returns a 10% rate of interest and were asked to estimate the amount of money in the account over various periods of time.[244] Because of the exponential growth bias, the participants presumed the growth would be linear, rather than exponential. And that bias affected their decisions in the present: They elected to save less in the immediate future because "[t]hey believed that it would be much easier than it really is to make up for lost time, so the decision to put off saving appeared more attractive than it should be."[245] Individuals subject to shocking sentences likely behave in a similar pattern—they may think that their later sentences will only increase in a linear fashion if the severity of the crime is held constant, and so there is reduced incentive not to commit future offenses. Put more simply, if one doesn't affirmatively know about a potential sentence and psychologically won't anticipate it, that potential sentence will not deter.[246]

Of course, whether there would be much deterrent effect of a longer sentence, even if known by the potential defendant, is questionable. A substantial body of

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242. United States v. Titley, 770 F.3d 1357, 1359 (10th Cir. 2014); *see also* United States v. Smith, 544 F.3d 781, 785 (7th Cir. 2008) ("When it enacted the ACCA, Congress was attempting to separate out those offenders whose criminal history evidenced a high risk for recidivism and future violence; these career offenders, it concluded, exhibited a special need for an increased sentence in order to deter future violent crimes.").

243. Bill Jones, *Why the Three Strikes Law Is Working in California*, 11 STAN. L. & POL'Y REV. 23, 24 (1999).

244. *See supra* notes 169–182 and accompanying text.

245. McKenzie & Liersch, *supra* note 32, at S6; *see also id.* at S10 (describing the effect across several experiments).

246. *See, e.g.*, John C. Ball, *The Deterrence Concept in Criminology and Law*, 46 J. CRIM. L. CRIMINOLOGY & POLICE SCI. 347, 351 (1955) ("[T]he deterrent effect of a law obviously depends upon the individual's knowledge of the law and the punishment prescribed . . . .").

criminology research indicates that the likelihood of prosecution is much more impactful than the severity of the sentence in deterring crime.[247] Even further, at least one recent study has found that not prosecuting nonviolent misdemeanor offenses at all is beneficial to specific deterrence—that is, the individual defendant is more deterred from reoffending when she is *not* prosecuted than when she is.[248]

To be sure, broadly measuring the deterrent effect of sentencing laws is challenging, and one should take caution in drawing broad conclusions even when the empirical literature is relatively uniform.[249] Furthermore, my aim here is not to argue that *all* recidivist penalties are unjustified from a deterrence perspective. So let's simply presume, for a moment, that lengthier sentences have some deterrent effect. We must then ask: Do recidivist penalties *that result in exponentially growing sentences* deter particularly effectively?

The empirical literature at least implies that they do not. Take, for example, studies of the California three-strikes statute. When crime rates dropped sharply—both in California and nationally—in the mid-1990s, proponents of three-strikes laws were quick to attribute the drop to the deterrent effect of the new statutes.[250] But more nuanced study contradicts that narrative. Franklin Zimring and his colleagues disaggregated California's reduction in crime rates in the mid-to-late 1990s and examined the decreases among 2nd strike offenders—to whom the law made no material change—and third strike offenders—who were now facing a potential life sentence following passage of the new law.[251] Looking at that population, the authors found no statistical decrease in crime rates following passage of the law.[252] Other

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247. *See, e.g.*, ANDREW VON HIRSCH, ANTHONY E. BOTTOMS, ELIZABETH BURNEY & P-O. WIKSTRÖM, CRIMINAL DETERRENCE AND SENTENCE SEVERITY: AN ANALYSIS OF RECENT RESEARCH (1999).

248. AMANDA Y. AGAN, JENNIFER L. DOLEAC & ANNA HARVEY, MISDEMEANOR PROSECUTION 42 (Nat'l Bureau of Econ. Rsch., Working Paper No. 28600, 2021), https://www.nber.org/system/files/working_papers/w28600/w28600.pdf [https://perma.cc/KU2L-YXZM] (finding, contrary to conventional wisdom, that "not prosecuting marginal nonviolent misdemeanor defendants substantially reduces their subsequent criminal justice contact, or, in other words, that prosecuting marginal nonviolent misdemeanor defendants substantially increases their subsequent criminal justice contact").

249. *See, e.g.*, Raymond Paternoster, *How Much Do We Really Know About Criminal Deterrence*, 100 J. CRIM. L. & CRIMINOLOGY 765, 765 (2010) (noting that "empirical evidence leads to the conclusion that there is a marginal deterrent effect for legal sanctions, but this conclusion must be swallowed with a hefty dose of caution and skepticism; it is very difficult to state with any precision how strong a deterrent effect the criminal justice system provides").

250. *E.g.*, Jones, *supra* note 243, at 24 (noting that, in the four years following the 1993 passage of California's three-strikes law, "homicide rates dropped 51.5 percent, rape dropped by 18.7 percent, robbery dropped by 48.6 percent, assault dropped by 25.9 percent, burglary dropped by 38.3 percent, and motor vehicle theft dropped by 40.2 percent"); *see also* ZIMRING ET AL., *supra* note 78, at 85–87 (describing California officials' premature celebration of the law's deterrent effects).

251. ZIMRING ET AL., *supra* note 78, at 94–96.

252. *Id.* at 96–99. Another important context for California's crime decrease following passage of the three-strikes law is that crime rates were decreasing in other jurisdictions—including ones that did not pass any three-strikes law—during this period as well. *Id.* at 89–90.

studies of California have found similar results,[253] and the same is true for other mandatory sentencing penalties.[254] These results align with what the exponential growth bias would predict: If offenders are relatively unaware of the exponential growth of their sentences with future strikes, they will not be deterred by that growth. Moreover, empirical literature further buttresses that hypothesis: "[a] sizable literature demonstrates that ordinary citizens are largely uninformed about the operation of the justice system, the content of the criminal law, and the severity of punishments."[255]

What about incapacitation? Empirically, it's difficult to disentangle deterrence effects from incapacitation effects because reductions in crime following the passage of a recidivist sentencing penalty will appear the same whether caused by a person choosing not to commit a crime (despite his ability to do so) or by a person being prevented from committing that crime (presumably because he is incarcerated).[256] Zimring and his coauthors attempted to measure incapacitation by looking at incarceration rates in California before and after passage of the three-strikes law.[257] Finding that incarceration rates did not shift—despite large drops in crime over the same period—they concluded that there was little incapacitation benefit from the law.[258] Other data further undercut incapacitation as a rationale for recidivist sentencing provisions at a more general level: There is mixed evidence as to whether repeat offenders are arrested or convicted at higher rates than first-time offenders

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253. *See, e.g.*, Thomas B. Marvell & Carlisle E. Moody, *The Lethal Effects of Three-Strikes Laws*, 30 J. LEGAL STUD. 89, 89 (2001) (arguing three-strikes laws increase violent crime due to witness intimidation and "there is little evidence that the laws have any compensating crime reduction impact through deterrence or incapacitation"). It's important to note, however, that the studies on this issue are not uniform. *See, e.g.*, Eric Helland and Alexander Tabarrok, *Does Three Strikes Deter? A Nonparametric Estimation*, 42 J. HUM. RES. 309 (2007) (finding reduction in arrest rates among offenders following passage of the law). Studies of other jurisdictions have generally found limited deterrent effects from harsh sentencing policies, though not always in the context of potentially shocking sentences. For example, studies of New York's "broken windows" zero-tolerance policing strategy have found relatively little deterrent effect from the policy. *E.g.*, Bernard E. Harcourt & Jens Ludwig, *Broken Windows: New Evidence from New York City and a Five-City Social Experiment*, 73 U. CHI. L. REV. 271, 277 (2006) ("[O]ur examination of data . . . provide[s] no support for the idea that broken windows enforcement activities, including order-maintenance policing or other measures designed to reduce the level of social or physical disorder within a community, represent the optimal use of scarce government resources."); *see also* Michael Tonry, *Learning from the Limitations of Deterrence Research*, 37 CRIME & JUST. 279, 285–86 (2008) (collecting studies).

254. *See, e.g.*, Michael Tonry, *The Mostly Unintended Effects of Mandatory Penalties: Two Centuries of Consistent Findings*, 38 CRIME & JUST. 65, 68 (2009) ("Mandatory penalty laws have not been credibly shown to have measurable deterrent effects for any save minor crimes such as speeding or illegal parking or for short-term effects that quickly waste away.").

255. Tonry, *supra* note 253, at 286 (citing JULIAN V. ROBERTS, LORETTA J. STALANS, DAVID INDERMAUR, & MIKE HOUGH, PENAL POPULISM AND PUBLIC OPINION (2002)).

256. Helland & Tabarrok, *supra* note 253, at 310 & n.2 ("Most papers on criminal deterrence cannot distinguish deterrence from incapacitation.").

257. ZIMRING ET AL., *supra* note 78, at 91–94.

258. *Id.*

(meaning that there may not be any special need to incapacitate repeat offenders as compared with other offenders); incarceration itself may be criminogenic, causing later crime after prisoners are released; and any differences in arrest rates between repeat offenders and first-time offenders may be due to repeat offenders' increased likelihood of being caught.[259] And, setting aside the debatable points of the empirical literature, the shocking sentence provisions at issue here authorize extreme and unpredictable sentences that are magnitudes greater than a defendant's prior sentences. To justify that through incapacitation, the defendants subject to shocking sentences would need to be magnitudes more likely to commit crimes than others. Such differences are simply not present in the literature.[260]

3. Other Arguments

Even if either notice or utilitarian arguments favored shocking sentences, there are other countervailing arguments that outweigh them. Here, I briefly discuss two: due process and racial disparities.

The Constitution guarantees defendants in criminal cases a number of process-related rights, including, in certain circumstances, the right to a jury trial, the right to effective assistance of counsel, the right against self-incrimination, and the right to confront the witnesses against them.[261] Some procedural rights require that individuals be given notice about various aspects of the criminal law before being prosecuted. The bedrock principle in this category—perhaps "the first principle of American criminal law"—is the idea of legality: the notion that a person "may not be convicted and punished unless her conduct was previously defined as criminal."[262] From there comes the notion that individuals must be able to learn of that defined conduct: "Fundamental fairness of course requires that people be given notice of what to avoid."[263] Thus, statutes that are so vague as to "leave[] the public uncertain as to the conduct [they] prohibit[]" are void for vagueness and violate the Due Process Clause.[264] "These principles apply not only to statutes defining elements of crimes, but also to statutes fixing sentences," like the ACCA or California's three-strikes law.[265]

Shocking sentence provisions, as a category, do not run afoul of these basic principles. They generally give notice of the conduct required to trigger particular sentencing enhancements and the enhancements themselves, and are very likely constitutional under the Due Process Clause. But that does not make them good policy under the basic notions of fairness that the Due Process Clause is designed to protect. The purpose of the legality principle, and vagueness doctrine, is to ensure

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259. For helpful review of all these literatures, see Krishnamurthi, *supra* note 24, at 444–48.

260. *See id.*

261. U.S. CONST. amends. V, VI.

262. JOSHUA DRESSLER & STEPHEN P. GARVEY, CRIMINAL LAW CASES AND MATERIALS 95 (9th Ed. 2022) (quoting HERBERT L. PACKER, THE LIMITS OF THE CRIMINAL SANCTION 79–80 (1968)).

263. Winters v. New York, 333 U.S. 507, 524 (1948) (Frankfurter, J., dissenting).

264. City of Chicago v. Morales, 527 U.S. 41, 56 (1999).

265. Johnson v. United States, 576 U.S. 591, 596 (2015).

that people have "notice of what to avoid" so they can make moral and socially beneficial decisions.[266] We undermine those principles when individuals are psychologically unlikely to anticipate their future sentences, even if those potential sentences are laid out in a codebook, because very few everyday people are likely to know what's written in the codebook. If we take due process and fair notice seriously as a moral good, we should consider whether the undermining of due process that is inherent in shocking sentence provisions is worth it, especially in light of the weak retributive and utilitarian arguments for the provisions in the first place.

This is especially true in modern criminal law. Over the past century, our criminal architecture has become increasingly massive, handing over more and more of the critical decision-making from lawmakers to discretionary actors like police and prosecutors.[267] As the codebook becomes more unwieldy, individuals are less likely to have actual notice of what is prohibited and what the penalties will be for engaging in prohibited conduct. In these circumstances, having rules that are psychologically intuitive to those subject to punishment is especially important to protect due process. But shocking sentencing provisions are anything but psychologically intuitive.[268]

Beyond due process, racial and class disparities are another reason we should reconsider shocking sentences. Most readers of this Article are already well familiar with the enormous racial disparities that, in many ways, define the American criminal justice system. Black people are policed, prosecuted, and incarcerated at higher rates than Whites; receive worse plea deals and harsher sentences than Whites; are struck from juries at higher rates; and suffer numerous other disparities.[269] But provisions that give rise to shocking sentences cause additional racial disparities, above and beyond those already baked into the system at large. For example, a 2004 study of California's three-strikes law found that, while Black people were incarcerated at about 7.5 times the rate of Whites generally, their

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266. *Winters*, 333 U.S. at 524.

267. *See, e.g.*, William J. Stuntz, *The Pathological Politics of Criminal Law*, 100 MICH. L. REV. 505, 511 (2001); GianCarlo Canaparo, Patrick McLaughlin, Jonathan Nelson & Liya Palagashvili, *Count the Code: Quantifying Federalization of Criminal Statutes*, HERITAGE FOUND. (Jan. 7, 2022), https://www.heritage.org/crime-and-justice/report/count-the-code-quantifying-federalization-criminal-statutes [https://perma.cc/9SJF-LVKJ] (assessing federal criminal code algorithmically and concluding that "[n]ot only has the number of federal crime statutes risen dramatically in the past 50 years, but there is no single place where any citizen can go to learn them all" because "[t]he federal criminal laws are scattered pell-mell throughout the United States Code and the Code of Federal Regulations").

268. Indeed, those subject to shocking sentences may not know it even after they are arrested for and convicted of the crime that could expose them to shocking sentences. Some statutes that may give rise to shocking sentences, like the ACCA, do not specifically define the predicate offenses that trigger them. As a result, it often takes significant lawyerly expertise to determine whether a person qualifies for the enhancement, and even then, it may not be clear whether a defendant is subject to it until the conclusion of substantial litigation. *See, e.g.*, Taylor v. United States, 495 U.S. 575, 578 (1990) (determining whether California burglary statute qualifies as a predicate crime under the ACCA).

269. For an excellent collection of literature on all of these disparities, see Radly Balko, *There's Overwhelming Evidence that the Criminal Justice System is Racist. Here's the Proof*, WASH. POST (June 10, 2020), https://www.washingtonpost.com/graphics/2020/opinions/systemic-racism-police-evidence-criminal-justice-system/ [https://perma.cc/87NV-PXHX].

incarceration rate was 10 times higher for second strikes, and 13 times higher for third strikes.[270] In other words, as the extent of the recidivist sentencing penalty increased, the racial disparity increased as well. These racial disparities persist even when legally relevant considerations, such as prior record and offense severity, are controlled for.[271] The disparities likely arise out of other more standard sources of racial disparity, such as prosecutorial discretion,[272] but harsh recidivist sentencing penalties provide another avenue for those sources to operate and, because the sentences involved are so long, they result in particularly pernicious outcomes.[273] And these disparities exist across other common recidivist sentencing penalties that give rise to shocking sentences, like the ACCA.[274]

In addition to these racial disparities in the sentence itself, the exponential growth bias may be particularly pronounced for defendants in vulnerable populations, further exacerbating racial and class disparities. As I highlighted above, individuals with less education—highly correlated with lower economic status—tend to be more vulnerable to the exponential growth bias. Thus, lower income, largely minority defendants may both be subject to greater sentences when harsh recidivist penalties apply, *and* they may be less likely to foresee those penalties. With little theoretical basis that counsels in favor of shocking sentences, the fact that they produce these sorts of racial and class disparities should make us very skeptical of their use.

B. Reducing the Shock

In my view, the case is strong that we should reconsider statutes and guidelines that produce shocking sentences. But sentencing reform—like all criminal justice reform—is challenging and politically fraught.[275] So we should also think about ways to reduce the impact of shocking sentences even without substantive changes to the sentencing rules themselves. Recall that the exponential growth literature describes a number of ways to potentially reduce exponential growth bias (with

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270. SCOTT EHLERS, VINCENT SCHIRALDI & ERIC LOTKE, JUST. POL'Y INST., RACIAL DIVIDE: AN EXAMINATION OF THE IMPACT OF CALIFORNIA'S THREE STRIKES LAW ON AFRICAN-AMERICANS AND LATINOS 5, 7 (2004), https://www.prisonpolicy.org/scans/jpi/Racial_Divide.pdf [https://perma.cc/PE9F-MFYP].

271. Elsa Y. Chen, *The Liberation Hypothesis and Racial and Ethnic Disparities in the Application of California's Three Strikes Law*, 6 J. ETHNICITY CRIM. JUST. 83, 94 (2008).

272. *See id.* at 83–86.

273. Similar racial disparities occur in the federal system as well. *See, e.g.*, Barkow, *supra* note 19, at 201 ("Prosecutors have not uniformly sought mandatory minimum sentences, which has led to greater disparities, particularly on the basis of race."). Indeed, recidivist sentencing enhancements tend to lead to racial disparities as a general matter. *See, e.g.*, FRASE & ROBERTS, *supra* note 42, at 128–51 (describing disproportionate impact of recidivist guideline enhancements on minority populations).

274. *See supra* note 27.

275. *See, e.g.*, Pamela K. Lattimore, *Reflections on Criminal Justice Reform: Challenges and Opportunities*, 47 AM. J. CRIM. JUST. 1071 (2022); Katherine Beckett, *The Politics, Promise, and Peril of Criminal Justice Reform in the Context of Mass Incarceration*, 1 ANN. REV. CRIMINOLOGY 235 (2018).

varying degrees of success).[276] In the remainder of this Part, I discuss a few ways we might be able to leverage those techniques to make shocking sentences *less* shocking.

At the outset, I note one major challenge in thinking about ways to reduce the exponential growth bias in the sentencing context. All of the debiasing measures described in the exponential growth bias literature involve communicating with or providing resources to the decision-maker to be debiased—for example, separating the task into smaller chunks or providing education about the exponential growth bias. There are several actors in the criminal justice process who have opportunities to communicate with or provide information to individuals potentially subject to shocking sentences—most notably, defense attorneys, the sentencing judge in a prior case, or a probation officer or parole agent working with a person following a prior sentence. Here, I will focus on ways those actors might be able to reduce bias. But there's a problem: We have relatively little understanding about what those actors are already communicating to individuals potentially subject to shocking sentences. So far as I can identify, there is no literature describing how sentencing judges, probation officers, or parole agents communicate with individuals about potential future sentences in the event of another conviction.

We can, however, draw at least some tentative conclusions based on the lack of any statutes or rules requiring judges or probation officers to discuss potential future sentences. In the federal system, judges must follow certain procedures at sentencing, including announcing the guideline range, allowing the parties to introduce evidence, allowing the parties and any victims an opportunity to speak, and announcing the sentence.[277] Moreover, the rules require the judge to provide some information relevant to post-sentencing conduct; for example, she must advise the defendant of his right to appeal, if any.[278] But there is no requirement for the judge to provide any information about what a defendant's future sentences might be, or how the current conviction might affect the defendant's future exposure.[279] The rules also require that the defendant be provided with a presentence report, which does include a calculation of the defendant's criminal history.[280] That may provide a defendant with at least some notice of his prior convictions, but it does not indicate whether he'll be subject to a large increase in sentence for subsequent convictions under a heavy recidivist penalty like the ACCA or the career offender provision.[281] And in many state systems, the structure is less well-defined than in the federal system, so there is likely even worse notice. In short, the rules and standards do not encourage any sort of notice at sentencing that might help to reduce shocking sentences.

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276. *See supra* Part II.C.

277. FED. R. CRIM. P. 32(i), (k).

278. FED. R. CRIM. P. 32(j).

279. *See* FED. R. CRIM. P. 32.

280. *See* Presentence Investigation Report 1, 4–5, https://www.icpsr.umich.edu/summerprog/2009/nijworkshop/PSRDrugScenario.pdf [https://perma.cc/6KN7-MJAZ].

281. *See id.* The Federal Judicial Center also produces a benchbook for district judges that provides scripts to follow for various procedures, including sentencing. FED. JUD. CTR., BENCHBOOK FOR U.S. DISTRICT COURT JUDGES 125–39 (6th Ed. 2013), https://www.fjc.gov/sites/default/files/2014/Benchbook-US-District-Judges-6TH-FJC-MAR-2013.pdf [https://perma.cc/4B3H-85QH]. The portions relating to sentencing, like the rules, contain no guidance to advise defendants about their future potential criminal liability.

Can the experimental literature tell us anything about how we might effectively be able to give better notice? At least some of the debiasing measures described in the literature are naturally built into the sentencing context. First, recall the *chunking* method of debiasing: Under that method, participants are sometimes less subject to the exponential growth bias when they are asked to predict future growth in smaller segments, rather than along long periods of time.[282] In the context of shocking sentences, defendants are naturally employing the chunking technique in predicting their next likely sentence—they are primarily only attempting to discern the next item in the series, not the future sentences further downstream. Likewise, *feedback*-related debiasing measures are also built into the sentencing context. Feedback debiasing attempts to work by telling the participant about the accuracy of his growth prediction at each interval.[283] This occurs naturally in sentencing; whatever a defendant might have predicted about his sentence before it occurs, he receives feedback on that prediction when he learns the actual sentence.

Both of those debiasing methods show some promise in reducing, though not eliminating, exponential growth bias.[284] Are there other measures that we could apply to current sentencing procedure? One of the debiasing methods—the use of visual aids—does not seem useful.[285] In the sentencing context, defendants are not often calculating out their likely future exposure across several later sentences—they are just trying to predict what the next one would be. And the use of aids has provided a somewhat limited benefit even in the laboratory context where the method is a better fit.[286]

Direct education, however, seems more promising. In the experimental context, researchers can sometimes reduce the exponential growth bias simply by telling participants about it.[287] That could work in the sentencing context as well: Judges could explain during the sentencing process the nature of exponential growth in sentencing schemes based on recidivism and instruct defendants that their subsequent convictions are likely to follow that growth, rather than linear growth. But because the most important estimation for a criminal defendant to make is simply what the next sentence is likely to be, the direct education that a judge or probation officer could provide is even stronger—they could simply inform the defendant of what the potential next sentence is, given the likelihood of exponential growth or the application of future enhancements. This could be especially helpful where a specific enhancement is likely to apply: If, for example, Tommie Ireland's sentencing judge had informed him following his earlier drug trafficking convictions that a federal case would likely expose him to a guideline range of more than ten years, he would much more likely have been aware of that potential sentence.

Functionally, how might this work? It could be incorporated into rules of procedure similar to the way that other notice provisions are. Take, for example, Rule 11 of the Federal Rules of Criminal Procedure, which governs pleas. That Rule requires judges to give defendants notice that entering a guilty plea would amount to

282. *See supra* notes 183–186 and accompanying text.
283. *See supra* notes 187–193 and accompanying text.
284. *See supra* notes 183–193 and accompanying text.
285. *See supra* notes 194–198 and accompanying text.
286. *See supra* notes 194–198 and accompanying text.
287. *See supra* notes 194–198 and accompanying text.

waiving a number of important constitutional rights, such as the right to a jury trial, the right to confront the witnesses against him, and the right to be protected from self-incrimination.[288] The rules could incorporate a similar requirement of providing the defendant notice about potential future sentences during the sentencing hearing. This sort of notice requirement would be in line with the kinds of requirements that others have suggested to try to reduce the exponential growth bias in other legal contexts, such as in the sale of financial products.[289]

Additionally, the criminal justice system has one advantage in combating the exponential growth bias that some other areas do not have: It potentially allows for repeated debiasing measures because individuals in the system often have regular contact with a probation officer or parole agent following a custodial sentence (or in place of one).[290] Because of that regular contact, probation officers or parole agents might be even better situated than a judge to provide guidance about the potential exponential growth of future sentences, or the fact that a particular individual is likely to be subject to a recidivist penalty if she reoffends.[291]

CONCLUSION

The American criminal justice system is perhaps at its nadir of legitimacy, both among legal scholars and the public. The system is costly, inefficient, unfair, and unwieldy. It produces racially disparate results. It inflicts suffering in ways that are difficult to square with our foundational theories of punishment. These problems are, in many ways, endemic to the institutional structure of our criminal justice system.[292] The actors who largely control criminal justice outcomes—legislators, prosecutors, and judges—are unlikely to shrink it, even across changes in political administrations.[293] And so, unfortunately, sweeping change will likely continue to be difficult.

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288. FED. R. CRIM. P. 11(b)(1). The Federal Judicial Center Benchbook outlines how the judge should provide the defendant notice of these rights. FED. JUD. CTR., *supra* note 281, at 69–70.

289. *See, e.g.*, Teichman & Zamier, *supra* note 30, at 1350.

290. *See, e.g.*, 18 U.S.C. § 3563(b)(15) (allowing sentencing judge to set various conditions of probation, including requiring defendant to "report to a probation officer as directed by the court or the probation officer"); 18 U.S.C. § 3583 (similar authorization for supervised release).

291. At least some form of this surely already occurs. For example, California incorporates specialized parole officers who only supervise second strikers, with the purpose of "allow[ing] parole agents to more closely monitor these parolees and provide services that could assist in preventing parolees from reoffending and receiving third strike convictions." Brian Brown & Greg Jolivette, *A Primer: Three Strikes - The Impact After More Than a Decade*, LEGIS. ANALYST'S OFF. OF CAL. (Oct. 2005), https://www.lao.ca.gov/2005/3_strikes/3_strikes_102005.htm [https://perma.cc/3JEZ-QW6Q]. Presumably, those parole agents provide information to parolees about their potential third-strike sentence. Unfortunately, as described in the main text above, we lack clear data about whether and how parole agents and probation officers carry out this process, and there is no literature describing it in any systematic way.

292. *E.g.*, Stuntz, *supra* note 267, at 510.

293. *Id.*

Against that backdrop, shocking sentences stand as a stark problem. If left unchanged, exponentially growing recidivist sentencing penalties will continue to affect tens of thousands of defendants each year, and they will disproportionately ensnare the most vulnerable defendants. Because of the exponential growth bias, those defendants are unlikely to foresee their sentences. And that causes real harm. Most obviously, it harms defendants, who receive less due process and experience the suffering of not only being exposed to a lengthy sentence, but also the additional sting of that sentence being a surprise. But it also harms *supporters* of recidivist sentencing penalties, as the exponential growth bias severely limits any potential deterrent value of imposing shocking sentences. We ought to rethink this structure and seek ways both to limit shocking sentences and to reduce the bias by providing greater notice to criminal defendants about their potential future sentencing exposure.