

# Trial by Machine

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*This Article explores the rise of “machines” in criminal adjudication. Human witnesses now often give way to gadgets and interpretive software, juries’ complex judgments about moral blameworthiness give way to mechanical proxies for criminality, and judges’ complex judgments give way to sentencing guidelines and actuarial instruments. Although mechanization holds much promise for enhancing objectivity and accuracy in criminal justice, that promise remains unrealized because of the uneven, unsystematic manner in which mechanized justice has been developed and deployed. The current landscape of mechanized proof, liability, and punishment suffers from predictable but underscrutinized automation pathologies: hidden subjectivities and errors in “black box” processes; distorted decision making through oversimplified—and often dramatically inaccurate—proxies for blameworthiness; the compromise of values protected by human safety valves, such as dignity, equity, and mercy; and even too little mechanization where machines might be a powerful debiasing tool but where little political incentive exists for their development or deployment. For example, the state promotes the objectivity of interpretive DNA software that typically renders match statistics more inculpatory, but lionizes the subjective human judgment of its fingerprint and toolmark analysts, whose grandiose claims of identity might be diluted by such software. Likewise, the state attacks the polygraph as an unreliable lie detector at trial, where results are typically offered only by defendants, but routinely wields them in probation revocation hearings, capitalizing in that context on their cultural status as “truth machines.” The Article ultimately proposes a systems approach—“trial by cyborg”—that safeguards against automation pathologies while*

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*interrogating conspicuous absences in mechanization through “equitable surveillance” and other means.*

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#### INTRODUCTION

Referring to the “Drunk-O-Meter,” a then-recently invented gadget for proving a driver’s alcohol impairment, one legal scholar wrote in 1953 that “[t]he age-old dream of man has been the achievement of a sort of ‘slot-machine proof’ whereby a situation is fed into a device and out rolls the correct adjudication.”<sup>1</sup> In 2016, that dream has yet to be achieved, but certainly not for lack of trying. American courts and law enforcement pride themselves on embracing a number of crime-detecting gadgets touted as “truth machines”—from daguerreotype imaging to the Drunk-O-Meter to DNA. Every state has now shifted to a regime of “mechanical liability” in drunk driving cases in an effort to restrain irrational human juries ignorant of “laboratory evidence” proving the risk of even low blood alcohol concentration (BAC).<sup>2</sup> And American lawmakers have pursued mandatory minimum sentences, sentencing guidelines, and evidence based sentencing (EBS) to rein in human discretion and promote uniformity and truth in punishment. Still, there appears to be wide agreement that human judges and juries have a role to play in softening mechanization’s bluntness; that is, in acting as “circuitbreaker[s] in the State’s machinery of justice.”<sup>3</sup> Calls for robot judges and juries are typically met with derision, on grounds that machines are incapable of the individualized human judgment necessary to fully assess blameworthiness through a combination of complex fact-finding, equitable discretion, and mercy. Indeed, the polygraph is nearly universally excluded from criminal trials, often on grounds that it raises the “specter of trial by machine.”<sup>4</sup> Given the laudable goals underlying the rise of mechanized criminal adjudication and the apparent restraint by lawmakers and courts in safeguarding the complexity and “softer” values<sup>5</sup> protected by

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1. Dillard S. Gardner, *Breath-Tests for Alcohol: A Sampling Study of Mechanical Evidence*, 31 TEX. L. REV. 289, 289 (1953).

2. See COMM. ON PUB. WORKS, 90TH CONG., 1968 ALCOHOL AND HIGHWAY SAFETY REP. 122 (1968) [hereinafter 1968 REPORT].

3. *Blakely v. Washington*, 542 U.S. 296, 306 (2004).

4. *United States v. Bursten*, 560 F.2d 779, 785 (7th Cir. 1977).

5. By “softer” values, I mean those values—such as dignity, equity, mercy, and systemic legitimacy—that are deeply embedded in rhetoric that justifies the structure of our system, but the benefits of which are not easily quantified or otherwise measured. See, e.g., Richard A. Bierschbach, *Proportionality and Parole*, 160 U. PA. L. REV. 1745, 1785 (2012) (contrasting “standard” measurable penal goals, such as deterrence, with “softer values,” like “self-recognition of human worth and potential” (citation omitted)).

human intervention, it would seem that our system's approach to mechanization is balanced and working well.

Yet, as this Article argues, the rise of "mechanized" criminal adjudication has actually occurred in a highly problematic manner. The deployment of mechanized forms of proof and decision making in criminal justice has typically been dictated by law enforcement or interest groups focused on a certain type of objectivity and accuracy; that is, the reduction of "false negatives." In the criminal context, false negatives are inaccuracies in the form of undetected crime, wrongful acquittals, or overly lenient sentences. An attempt to reduce these inaccuracies by harnessing the promise of mechanization is no doubt a laudable goal. But what has emerged is an approach to mechanization that often seems haphazard, or even counterproductive, rather than systematically focused on combatting inaccuracy and bias. As the discussion below bears out, sometimes the very scope of what is "mechanical"—or whether "mechanical" should be considered an honorific or an epithet—seems dependent not on the inherent characteristics of a process, but rather on whether the "mechanical" label enhances the process's claim to public legitimacy. In particular, with the notable exception of the breath-alcohol-machine context, lawmakers and law enforcement sometimes appear blind (or even hostile) to ways in which mechanization might be harnessed to reduce false positives as well. Indeed, law enforcement actors seem to romanticize the importance of subjective human judgment precisely, and primarily, when such discretion reduces false negatives rather than false positives. Meanwhile, predictable automation pathologies in mechanical forms of proof or discretionless rule-based regimes of punishment and liability appear to be most tolerated where they reduce false negatives. Such pathologies ultimately threaten the very goals—accuracy and objectivity—underlying mechanization's rise.

The fact that the development and deployment of mechanization in criminal justice has been uneven and contingent on social and political forces should not be surprising. Rather, it conforms to a central axiom of Science and Technology Studies (STS) scholars that the development and conception of new technologies is "highly contested, contingent on particular localized circumstances, and freighted with buried presumptions about the social world in which they are deployed."<sup>6</sup> Nor should it be surprising that law enforcement institutions view mechanization primarily through the lens of reducing false negatives, of deciphering and controlling the criminal.<sup>7</sup> Nonetheless, legal scholars have not yet

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6. SHEILA JASANOFF, *SCIENCE AT THE BAR: LAW, SCIENCE, AND TECHNOLOGY IN AMERICA*, at xiv (1995).

7. See *infra* Section I.C; see generally MICHEL FOUCAULT, "SOCIETY MUST BE DEFENDED": LECTURES AT THE COLLÈGE DE FRANCE, 1975–76, at 239, 242–43, 259 (Arnold I. Davidson ed., David Macey trans., Picador 1st ed. 2003) (1997) (discussing the use of devices and surveillance as a tool of "biopower" to "discipline" individual bodies and "regulate" populations); Herbert L. Packer, *Two Models of the Criminal Process*, 113 U. PA. L. REV. 1, 9 (1964) (describing idealized "Due Process" and "Crime Control" models of criminal process and suggesting that, under the latter, "repression of criminal conduct is by far the most important function to be performed by the criminal process").

scrutinized the uneven and contingent development of mechanized criminal justice—nor the consequences of the resulting imbalance—in a comprehensive way.

Part I of this Article documents the rise of mechanized criminal adjudication and makes the case that this rise has often been unbalanced, reflecting the primary focus of those controlling or wielding mechanization on reducing false negatives. In instances where a gadget-like form of proof increases crime detection, a determinable proxy for criminality increases convictions, or an actuarial instrument increases the length of detentions, law enforcement has typically celebrated its “mechanical” virtues. On the other hand, those forms of mechanization that would mostly reduce false positives, rather than negatives, are often conspicuously avoided or shunned for being overly “mechanical.”

Take, for example, the polygraph. It does not detect lies; rather, the polygraph is a machine that measures certain physical phenomena such as skin conductance, heart rate, and systolic blood pressure, which are then interpreted by a *human* analyst as indicators of deception (or not). Indeed, deception experts at the time of the modern polygraph’s development bristled when the press referred to deception tests as “lie detector[s].”<sup>8</sup> Yet by the time the “Keeler Polygraph”<sup>9</sup>—a sellable, standardized instrument—was unveiled, it became, in the eyes of the public, a “truth machine.”<sup>10</sup> Today, the state still routinely touts the polygraph as a reliable, mechanical lie detector against defendants in postconviction parole or probation revocation proceedings (not to mention in sensitive national security matters). Yet prosecutors have often fought to exclude polygraph evidence as unreliable in criminal trials, where it is nearly always offered by a defendant as proof of innocence, rather than by the prosecution as proof of guilt.<sup>11</sup>

A similar pattern emerges with other forms of mechanization. Prosecutors and government contractors promote the enhanced objectivity and accuracy of probabilistic software for interpreting DNA mixtures in contested admissibility hearings. A number of such software programs already exist and some local law enforcement offices have even created their own.<sup>12</sup> But no urgency exists to develop such software for fingerprints, toolmarks, or similar forensic disciplines where experts are typically permitted to testify that, based on their “judgment and experience,” the defendant is, with certainty, the source of the evidence.<sup>13</sup> In the sentencing context, mandatory minimums and sentencing guidelines—which have actually increased racial disparities in sentencing and dramatically

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8. See KEN ALDER, *THE LIE DETECTORS: THE HISTORY OF AN AMERICAN OBSESSION* 80–81 (2007).

9. *Id.* at 80.

10. I borrow the term “truth machine” from GEOFFREY C. BUNN, *THE TRUTH MACHINE: A SOCIAL HISTORY OF THE LIE DETECTOR* (2012).

11. I consider and refute alternative theories to explain this discrepancy in Part I.A, *infra*.

12. See ERIN E. MURPHY, *INSIDE THE CELL: THE DARK SIDE OF FORENSIC DNA* 98–101 (2015).

13. See *infra* Section I.D.

increased sentence lengths<sup>14</sup>—have been applauded by law enforcement as an objective and rational means of reining in judicial discretion. However, recent “smart” bail reform algorithms that have dramatically reduced pretrial detention rates in some parts of the country have been met with concerns from prosecutors—not just because of cost, but rather because these methods are seen as simplistic and overly mechanical in the characteristics they take into account.<sup>15</sup>

In turn, Part II argues that there is a serious cost to this imbalanced, results-oriented approach to mechanized criminal adjudication in three respects. First, it has allowed mechanization to develop in ways that mask hidden subjectivities and error. If a machine’s deployment tends to reduce false negatives, the state has an incentive to construct it in the most compelling way possible. Labeling a deception test a “lie detector,” for example, appeals to Americans’ instrument fetishism. At the same time, where revealing a machine’s inner-workings risks instilling a “mistrust of its scientific complexity,”<sup>16</sup> its creators might have a reason to “hide the wires” under layers of steel and proprietary code. Within those processes are not only random machine errors and mistranslations of code, but the hidden assumptions of the programmers and policymakers themselves about which scientific theories are valid, what data should be considered, and what level of error is acceptable. Some processes that appear “mechanical” are actually the product of subjective human judgment—the “man behind the curtain.” For example, the polygraph and sentencing guidelines offer the veneer of uniformity in a sentencing system driven largely by prosecutors’ discretionary decision making. Moreover, many mechanical proxies for criminality, such as recent attempts to enact per se DUI marijuana laws, are either grossly oversimplified or wholly lacking a legitimate scientific basis. But where such proxies dramatically increase the likelihood of successful prosecution, and where lawmakers understandably view successful prosecution as key to addressing a pressing social problem or to responding to pressure from law enforcement, lawmakers often have little incentive to scrutinize the proxy. On the other hand, the DUI alcohol context offers a promising, if imperfect, template for a rational regime of mechanical proof and liability—perhaps not coincidentally because of the role of public health officials, outside the law enforcement community, in helping to create that regime.

Of course, any successful quest to reduce false negatives is not without substantial public benefit. An enhanced ability to identify, prosecute, and punish the guilty can be justified on all the utilitarian and retributive grounds traditionally invoked to legitimize punishment. And it is true that mechanization has also reduced false positives; the “innocence movement,” for example, could not

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14. See *infra* Section II.C.

15. See Shaila Dewan, *Judges Replacing Conjecture with Formula for Bail*, N.Y. TIMES, June 26, 2015, at A18 (discussing an algorithm that intends to help judges set bail at an appropriate amount based on the likelihood of recidivism and risk of flight).

16. Jennifer L. Mnookin & Nancy West, *Theaters of Proof: Visual Evidence and the Law in Call Northside 777*, 13 YALE J.L. & HUMAN. 329, 363 (2001).

exist without the state's embrace of forensic DNA typing. Yet, the state often tries to block defendants' attempts to use DNA methods as a tool of exoneration.<sup>17</sup> In the current landscape, the reduction in false positives from mechanization too often seems fortuitous rather than systematic.

The second reason this results-oriented deployment of mechanization is problematic is that it has compromised other important systemic values. A recent National Research Council report on mass incarceration identified the protection of citizens' "human dignity" as a core principle of a just penal system.<sup>18</sup> A good candidate for a dignity-threatening device is the state's use of the "penile plethysmograph," a machine that measures a subject's erection to detect pathological sexual desires.<sup>19</sup> Our system also purports to take seriously the need for "equity"—the extralegal consideration of case-specific information—as a way of "correcting" or "completing" justice, as well as the need for "mercy," or leniency granted simply out of grace, rather than as an appeal to justice.<sup>20</sup> The more overinclusive a rule of liability or punishment, the more important equitable discretion—as a safety valve—becomes.<sup>21</sup> Safety valves in the form of judicial discretion and jury nullification are all compromised (or at least pressured) by the authoritative nature of mechanical proof: proxy crimes, "streamlining" laws that eliminate jury trials, automatic enforcement systems, mandatory prosecution policies, and sentencing guidelines. Of course, how courts or policymakers decide which practices violate such values varies widely over time and space. But where mechanization is pursued primarily as a means of reducing inaccuracy in the form of overleniency, we would expect such values to be compromised in an underscrutinized way.

The third and final reason this contingent approach to mechanization is problematic is that it often results in too little mechanization in areas where mechanization might be a powerful debiasing tool in the direction of reducing false positives—wrongful convictions and overpunishment. Our justice system has been slow, for example, to focus our zeal for surveillance on law enforcement or on certain economically or politically empowered populations and has been slow to harness expert systems in situations where the unaided discretion of witnesses, juries, or judges already tends to favor the state.

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17. *See infra* Section I.D.

18. NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., *THE GROWTH OF INCARCERATION IN THE UNITED STATES: EXPLORING CAUSES AND CONSEQUENCES* 328 (Jeremy Travis et al. eds., 2014).

19. *See infra* Section II.B.1.

20. Martha C. Nussbaum, *Equity and Mercy*, 22 *PHIL. & PUB. AFF.* 83, 93–94 (1993) (describing Aristotle's conception of "equity" as being consistent with justice); *see also infra* Section II.B.2.

21. *See generally* FREDERICK SCHAUER, *PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE*, at xv (1991) (arguing that prescriptive rules are often "probabilistic generalizations that . . . when followed produce in particular instances decisions that are suboptimal or even plainly erroneous").

Although a grand, unified theory of mechanical justice is beyond the scope of this Article, Part III does offer a set of “biotechnic”<sup>22</sup> principles to guide a machine-era system of criminal adjudication. It begins by explaining the need to move past the existing “MABA-MABA” (men-are-better-at/machines-are-better-at) thinking<sup>23</sup> toward a “systems approach” similar to that used in medical diagnoses and space travel.<sup>24</sup> I then flesh out this “trial by cyborg” approach by suggesting how to ensure front-end regulatory and adversarial safeguards to open “black box” processes to scrutiny; systematically consider the effect of new mechanical processes on softer values; and systematically “interrogate automation’s absence” by ensuring rational and equitable deployment of mechanization.

The Article concludes with some final thoughts on artificial intelligence and the future of criminal adjudication. It may be that the rise of mechanization portends a cataclysmic shift, akin to the shift from the “accused speaks” trial to the lawyer-driven trial that John Langbein has theorized.<sup>25</sup> Even if it does not fundamentally change the structure of our criminal justice system, however, mechanization is happening and is placing significant pressure on many of the values that lie at the heart of that system. Whatever the future holds, this Article aims to put “into scholarly circulation”<sup>26</sup> both a vocabulary and a set of questions to help frame further discourse on mechanized justice.

#### I. THE UNEVEN, CONTINGENT RISE OF MECHANIZED CRIMINAL ADJUDICATION

This Part documents the rise of mechanized criminal adjudication, arguing that its rise has been uneven and unsystematic, largely contingent on the desiderata of institutions and actors that create and deploy the mechanization. Specifically, I argue that although the motivation of law enforcement, lawmakers, and interest groups who promote “truth machines,” mechanical proxies, and mechanical sentencing-regimes is often a desire for objectivity and accuracy, it is typically a desire for a particular type of accuracy: the reduction of false negatives. False negatives, in this context, would be crimes that go undetected, guilty defendants who go free, or convicted offenders who are underpunished. As support for this claim, I offer examples of gadgetry, software, and mechanical proxies that were developed or adopted by law enforcement in large part because of a perceived need to reduce such false negatives. I then offer

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22. This term is borrowed from Lewis Mumford, who used it to describe goal-centered mechanization rather than mechanization-centered goals. *See generally* LEWIS MUMFORD, *THE PENTAGON OF POWER: THE MYTH OF THE MACHINE*, VOL. II (1970).

23. *See, e.g.*, Sidney W.A. Dekker & David D. Woods, *MABA-MABA or Abracadabra? Progress on Human-Automation Co-ordination*, 4 *COGNITION, TECH. & WORK* 240 (2002).

24. *See generally* DAVID A. MINDELL, *DIGITAL APOLLO: HUMAN AND MACHINE IN SPACEFLIGHT* (2008) (describing the history of human-machine interface in space travel).

25. *See* JOHN H. LANGBEIN, *THE ORIGINS OF ADVERSARY CRIMINAL TRIAL* 48–61, 67–68, 106–10 (2003) (tracing the historical evolution of the modern lawyer-dominated model of criminal trials).

26. MARY POOVEY, *A HISTORY OF THE MODERN FACT: PROBLEMS OF KNOWLEDGE IN THE SCIENCES OF WEALTH AND SOCIETY*, at xiii (1998).

examples of uneven treatment of certain mechanical forms of proof, liability, or punishment, suggesting a tendency of law enforcement to shun mechanization when it reduces false positives rather than negatives, while romanticizing human judgment when it tends to reduce false negatives.

Although this brief discussion does not purport to be a sociolegal history of mechanized devices in criminal justice, it does occasionally draw upon the work of Science and Technology Studies (STS) scholars to suggest that the uneven development of mechanized criminal adjudication should not be surprising. Institutional dynamics and disciplinary perspectives play a critical role in determining what is or is not labeled as virtuous, authoritative, “legitimate expertise,”<sup>27</sup> or “good science.”<sup>28</sup> One would expect, then, that in the criminal justice system, the answers to the questions of what is, and is not, a “machine,” as well as which machines are legitimate sources of epistemic authority, will depend on who seeks to gain from the type of proof, liability, or punishment regime at issue.

#### A. TESTIMONY BY MACHINE

Over the past 150 years, “the importance of the human senses” has given way to the “silent testimony of instruments.”<sup>29</sup> The modern criminal trial still has its share of human witnesses, of course, but the rise of “scientific gadgets in the law of evidence”<sup>30</sup> and interpretive forensic and diagnostic software has reduced the role of both percipient and human witnesses in proving guilt. Although “[l]ive witness testimony may have been the best possible means of proving guilt in the eighteenth century,”<sup>31</sup> prosecutors now choose to rely on “mechanical” forms of proof, often labeled “truth machines” by their supporters.<sup>32</sup>

These emerging forms of proof have dramatically increased the accuracy, objectivity, precision, and capacity for knowledge in historical fact-finding. As a result of these technologies, we now have a better grasp of whether a person ran a red light, an automobile accident was the result of alcohol intoxication, or the semen in a rape kit belongs to the defendant than we did at a time when the jury’s fact-finding was often based on subjective eyewitness accounts and

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27. See JASANOFF, *supra* note 6, at xiii.

28. Eric Biber, *Which Science? Whose Science? How Scientific Disciplines Can Shape Environmental Law*, 79 U. CHI. L. REV. 471, 547 (2012); *see also id.* at 501–12 (citing to the work of STS scholars in exploring how disciplinary perspectives and normative assumptions can affect how scientific claims are made and assessed in the climate debate and other environmental contexts).

29. MIRJAN R. DAMAŠKA, *EVIDENCE LAW ADRIFT* 143 (1997).

30. See *Scientific Gadgets in the Law of Evidence*, 53 HARV. L. REV. 282 (1939) (discussing courts’ response to the rise of blood tests, breath-alcohol tests, photographs, and polygraphs, in suggesting that the law should be less enthusiastic to adopt emerging scientific technologies that have yet to be validated).

31. WILLIAM J. STUNTZ, *THE COLLAPSE OF AMERICAN CRIMINAL JUSTICE* 227 (2011).

32. See, e.g., BUNN, *supra* note 10; MICHAEL LYNCH ET AL., *TRUTH MACHINE: THE CONTENTIOUS HISTORY OF DNA FINGERPRINTING* (2008); *cf.* Mnookin & West, *supra* note 16, at 347 (referring to photography as a “machinery of truth”).

potentially questionable confessions. As this section shows, however, many “truth machines” were developed or adopted by law enforcement specifically as a means of reducing false negatives. But when development or adoption of a “truth machine” might offer a powerful means of safeguarding against false positives instead—what Donna Haraway might refer to as “illegitimate offspring . . . unfaithful to their [state-centered] origins”<sup>33</sup>—the state often resists or is disinterested.

### 1. The Polygraph

The state’s use of devices to detect, measure, or otherwise exert control over a suspect’s body is a well-studied phenomenon. During the seventeenth and eighteenth centuries, Michel Foucault spoke of a power shift from state control over life and death to “[s]tate control of the biological,”<sup>34</sup> which entailed the “emergence of techniques of power” and “devices” that “centered on the . . . individual body” and “could be used to take control over bodies.”<sup>35</sup> And as penal policy in the United States and Britain moved away from morality toward a focus on the natural causes of criminality, the “opportunities for governance—the targeting of the criminal’s body and mind by mechanisms of regulation and control”—only increased, rather than decreased.<sup>36</sup> The era that followed saw the invention of the “Phreno-physiometer,” an instrument that purported to predict criminality—in a clearly racialized and soon thoroughly debunked way—by measuring angles between the ear and eyebrow.<sup>37</sup> As support eventually waned for the idea that the “stigmata of criminality” might be physically apparent, or that criminality was necessarily a sign of abnormality rather than immoral acts of normal people, criminologists and psychologists began to question whether emotions related to deception might be measurable.<sup>38</sup>

Against this backdrop, it should not be surprising that the modern “polygraph” as a lie detector has a provenance entwined with the interests of law enforcement. One of the polygraph’s precursors was a crude instrument created by psychologist William Moulton Marston (the creator of Wonder Woman) to measure anxiety through systolic blood pressure.<sup>39</sup> But it was John Larson, a Berkeley, California police detective in the 1920s, who first published papers on

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33. Donna Haraway, *A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century*, in *THE CYBERCULTURES READER* 291, 293 (David Bell & Barbara M. Kennedy eds., 2000).

34. FOUCAULT, *supra* note 7, at 240.

35. *Id.* at 242 (noting that these “techniques of power” over the body “included all devices that were used to ensure the spatial distribution of individual bodies,” meaning their “separation, their alignment, their serialization, and their surveillance”).

36. BUNN, *supra* note 10, at 11 (citation omitted).

37. *See id.* at 13–14.

38. *See id.* at 4, 64–65. Bunn also suggests this quest should be understood in the context of attempts by criminologists in the past to decipher and tame the “female sensation,” notably the belief that women were insensitive to pain. *See id.* at 65.

39. *See* Adam B. Shniderman, *You Can’t Handle the Truth: Lies, Damn Lies, and the Exclusion of Polygraph Evidence*, 22 *ALB. L.J. SCI. & TECH.* 433, 435–37 (2012); *see generally* Jill Lepore, *On*

how an anxiety-detecting machine “could be applied to real-life crimes.”<sup>40</sup> And it was Larson’s assistant (and future rival), Leonarde Keeler, who patented and marketed the polygraph as a machine that police could use to interrogate suspects and secure convictions by calling a polygraph examiner as a witness at trial.<sup>41</sup> From its humble beginnings as a measure of physical phenomena, the polygraph “came to be constructed as a technology of truth.”<sup>42</sup>

To be sure, the Berkeley police officers who helped develop the modern polygraph “hoped that the lie detector would enable them to administer justice with machinelike fairness.”<sup>43</sup> The goal was to accurately determine whether the subject was lying. But the strength of the desire for the machine stemmed from a belief that suspects were lying and thus could be revealed as such by this newfangled mechanical means, not from a hunch that suspects were falsely accused and could be exonerated by the device. In short, the desire was motivated by a concern over a particular kind of inaccuracy seen as urgently needing a mechanical solution: guilty suspects being set free.

The government’s problem in using polygraph results as evidence of guilt at trial was that, if an examination was coerced, the results would be inadmissible in court, at least under constitutional case law as it stood in the mid-1930s.<sup>44</sup> But the polygraph’s power reached beyond the courtroom: police could legally use the threat of a polygraph, or even lie about polygraph results, to secure confessions for use in court.<sup>45</sup> Thus, the inability to rely on polygraph results at trial proved only a minor hurdle in wielding the lie detector as a guilt-detecting device.

Defendants, however, had no such constitutional restrictions on offering polygraph results as evidence of innocence. In decisions regarding the polygraph’s admissibility, criminal defendants have moved to admit results as evidence of truthfulness beginning with the seminal 1923 case, *Frye v. United States*, in which Marston himself had examined the petitioner.<sup>46</sup> But in *Frye*, and numerous future cases, prosecutors successfully fought to keep polygraphs out of trials on the belief that the results were both unreliable and that they

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*Evidence: Proving Frye as a Matter of Law, Science, and History*, 124 YALE L. J. 1092 (2015) (discussing the history of the polygraph more broadly).

40. ALDER, *supra* note 8, at 81.

41. *Id.* at 126–27, 130.

42. BUNN, *supra* note 10, at 5; *see also* Shniderman, *supra* note 39, at 437 (documenting Keeler’s role in the development of the polygraph).

43. ALDER, *supra* note 8, at 106.

44. *See, e.g.*, *Brown v. Mississippi*, 297 U.S. 278, 285 (1936) (holding that the Fourteenth Amendment’s due process prohibition on admission of an involuntary confession is applicable in state court prosecutions).

45. *See, e.g.*, *United States v. Blake*, 571 F.3d 331, 346–47 (4th Cir. 2009).

46. 293 F. 1013 (D.C. Cir. 1923). The so-called “*Frye* test” became the standard for admission of novel scientific evidence in many state courts, and nearly all federal courts, until the Supreme Court’s decision in *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993).

usurped the jury's credibility-determining role,<sup>47</sup> a pattern similar to that which has emerged with neuroimaging-based lie detection.<sup>48</sup> Even as the lie detector became "America's mechanical conscience,"<sup>49</sup> then, the polygraph became an "evidentiary pariah" in American trials.<sup>50</sup>

Despite the state's objections to admission of lie-detector evidence at trial, the polygraph was used extensively by the state as evidence of guilt in postconviction proceedings. Probation and parole departments routinely require convicted offenders to undergo polygraph examinations as a condition of treatment, particularly in sex offenses, and routinely offer polygraph-examiner testimony as evidence of an offender's deception in parole or probation revocation hearings.<sup>51</sup> The Department of Defense also heavily relies on polygraphs for background checks and other sensitive matters related to national security.<sup>52</sup> Indeed, an expert who unapologetically trained people to "beat" the polygraph, Doug Williams, recently pled guilty to federal obstruction of justice charges.<sup>53</sup>

This apparent inconsistency in law enforcement's treatment of the polygraph could be explained by a belief that the high burden of proof in a criminal trial merits a higher level of scrutiny for the device. Yet the potential jail time at

47. See, e.g., *United States v. Scheffer*, 523 U.S. 303, 307 (1998) (holding per se exclusion of polygraph evidence does not violate a defendant's Sixth Amendment right to present a defense); *United States v. Alexander*, 526 F.2d 161, 170 (8th Cir. 1975) (holding that the trial court did not err in refusing to admit polygraph results to evidence because polygraph did not "presently command general scientific acceptance and ha[d] not been shown to be sufficiently reliable"); Brief for the United States at 26–28, *Scheffer*, 523 U.S. 303 (No. 96-1133), 1997 WL 367053 (arguing that the polygraph undermines the functions performed by the judge and jury); see also Shniderman, *supra* note 39, at 469–70 (speculating that the polygraph's disfavored status might be related to "judges' efforts to aid the prosecution," given that polygraph results are generally offered by defendants).

48. Companies such as "No-Lie MRI" offer commercially available services. See Henry T. Greely, *Law and the Revolution in Neuroscience: An Early Look at the Field*, 42 AKRON L. REV. 687, 698 (2009) ("[A]t least two companies are already selling fMRI-based lie detection in the United States."). Neuroimaging-based lie detection evidence has been proffered in three American cases, all by a defendant and all excluded on reliability grounds. See William A. Woodruff, *Evidence of Lies and Rules of Evidence: The Admissibility of fMRI-Based Expert Opinion of Witness Truthfulness*, 16 N.C. J.L. & TECH. 105, 108–09 nn.4–6 (2014) (citing *United States v. Semrau*, No. 07-10074 MI/P, 2010 WL 6845092, at \*14 (W.D. Tenn. June 1, 2010); *Wilson v. Corestaff Servs., L.P.*, 900 N.Y.S.2d 639, 642 (Sup. Ct. 2010); Memorandum Opinion and Order, *Maryland v. Smith*, No. 106589C (Montgomery Cty., Cir. Ct., M.D. Oct. 3, 2012)).

49. ALDER, *supra* note 8, at xiv.

50. *Witherspoon v. Superior Court*, 183 Cal. Rptr. 615, 621 (Ct. App. 1982).

51. See, e.g., Douglas C. Maloney, Comment, *Lies, Damn Lies, and Polygraphs: The Problematic Role of Polygraphs in Postconviction Sex Offender Treatment (PCSOT)*, 84 TEMP. L. REV. 903, 907–08 (2012); DIANE PATRICK ET AL., NAT'L INST. OF JUSTICE, HOW IS THE POST-CONVICTION POLYGRAPH EXAMINATION USED IN ADULT SEX OFFENDER MANAGEMENT ACTIVITIES? 39–40 (2000); Paula Reed Ward, *Lie Detector Tests Being Used to Monitor Sex Offenders and Guide Treatment*, PITTSBURGH POST-GAZETTE (May 17, 2015, 12:00 AM), <http://www.post-gazette.com/news/state/2015/05/17/Lie-dete/stories/201505030109> [<https://perma.cc/A4FP-XFYK>] (noting that offenders can get probation revoked for failure to take a test).

52. See *Scheffer*, 523 U.S. at 318 (Kennedy, J., concurring).

53. See Drake Bennett, *Man vs. Machine: The True Story of an Ex-Cop's War on Lie Detectors*, BLOOMBERG BUS. (Aug. 4, 2015), <http://www.bloomberg.com/graphics/2015-doug-williams-war-on-lie-detector/> [<https://perma.cc/FTA9-96TK>].

stake in probation or parole revocation hearings is often higher than in many trials. Moreover, if the government truly believed, as it persuaded the Supreme Court in 1998 in *United States v. Scheffer*, that the polygraph's accuracy rate is "little better than [what] could be obtained by the toss of a coin,"<sup>54</sup> one would hope they would not use it at all, much less in high-stakes circumstances.

The inconsistency might also be explained by a desire on the part of prosecutors to safeguard the jury's own role as lie-detector. But judges and parole boards in postconviction proceedings also bring complex human judgment, for whatever it is worth, to credibility determinations. Moreover, the government sometimes stipulates to admission of polygraph results, allowing the jury to be aided by the machine in such cases.<sup>55</sup> The argument that the polygraph would unduly intrude upon the jury's credibility-determining role also seems a somewhat curious one for the government to make with gusto, given how incompetent the jury is at credibility determinations.<sup>56</sup> Indeed, the jury is only the system's "lie detector" because, after it became clear that swearing an oath was not a reliable guarantor of truthful testimony, the system had little choice but to seek refuge in the conveniently inscrutable "black box" of jury deliberations to maintain the legitimacy of verdicts.<sup>57</sup> In any event, as discussed in section II.C., courts' recurring concern that the polygraph is a "trial by machine," although understandable, is one that should be revisited.

## 2. Photographic and Filmic Evidence

When the daguerreotype—the precursor to the photograph—was invented in 1839, the American public's reaction was largely to celebrate the new technology as a "machinery of truth,"<sup>58</sup> noting the potential to solve crimes. A newspaper article from that year wondered, "[w]hat will become of the poor thieves, when they shall see handed in as evidence against them their own portraits, taken by the room in which they stole, and in the very act of stealing!"<sup>59</sup>

Shortly thereafter, law enforcement in several countries began to use the photograph in earnest.<sup>60</sup> Although biometrics—the use of body measurements to study criminality and identify individuals—predated the photograph, the availability of the new photographic medium allowed an unprecedented level of scrutiny and surveillance, both of criminals and of those populations deemed potentially criminal. Using Michel Foucault's phrasing, just as technologies that

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54. *Scheffer*, 523 U.S. at 310 (citation omitted).

55. See Shniderman, *supra* note 39, at 442.

56. See George Fisher, *The Jury's Rise as Lie Detector*, 107 *YALE L.J.* 575, 578–79 (1997).

57. See *id.* at 578–79 (arguing the criminal justice system "protects its own legitimacy" by having the jury function as a "lie detector").

58. See Mnookin & West, *supra* note 16, at 347.

59. *New Discovery in the Fine Arts*, *NEW YORKER*, Apr. 13, 1839, at 49 (citation omitted).

60. See SIMON A. COLE, *SUSPECT IDENTITIES: A HISTORY OF FINGERPRINTING AND CRIMINAL IDENTIFICATION* 20 (Harvard Univ. Press 2002).

measure the body are a means of state control via the power to discipline, surveillance techniques—including biometrics—allow the state to “regulariz[e]” a “multiplicity of men” through the “technology of biopower.”<sup>61</sup> It should not be surprising, then, that beginning in the nineteenth century police departments had collected “Rogues’ galleries”—photographs of known criminals—not only to keep track of offenders and potentially identify them as culprits of new crimes, but also as the basis for anthropomorphic studies that sought to identify visible manifestations of criminality.<sup>62</sup> Alphonse Bertillon, the father of forensic biometric identification, was a police photographer who popularized both the “mugshot” and the photographing of crime scenes.<sup>63</sup>

Today, photographic and filmic evidence is a major tool of surveillance and crime detection in the United States. Cameras in cities are ubiquitous, used to capture and prosecute even low-level offenses.<sup>64</sup> Red light camera footage is used in crime detection, creating camera footage that is searchable by certain objects, faces, or license plates.<sup>65</sup> The “Avista Smart Sensor,” for example, uses “machine learning”<sup>66</sup> to analyze surveillance footage based on thousands of variables and to report to police when it believes a crime is occurring.<sup>67</sup>

And, of course, this increased capacity for detecting and solving crimes through surveillance and photographic documentation has, in many ways, been a boon to the accuracy and objectivity of fact-finding. But again, the state’s desire to increase accuracy and objectivity through use of photography, although laudable, has been primarily focused on reducing false negatives, not on reducing false positives or highlighting the misdeeds of law enforcement itself. Thus, “hot spot” surveillance and red light cameras tend to focus on high crime areas so as to maximize the likelihood of detecting crime. And although “hot spot” camera footage in high-crime areas has sometimes exonerated rather than inculpated a defendant,<sup>68</sup> episodes of exoneration are a byproduct, not a goal, of state surveillance. Moreover, camera footage from both dashboard and body

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61. FOUCAULT, *supra* note 7, at 242, 247.

62. *See, e.g.*, COLE, *supra* note 60, at 20–22.

63. *See Most-Wanted Photography*, ECONOMIST, Feb. 7, 1998, at 115.

64. *See, e.g.*, Steve Henn, *In More Cities, a Camera on Every Corner; Park and Sidewalk*, NPR (June 20, 2013, 7:07 AM), <http://www.npr.org/sections/alltechconsidered/2013/06/20/191603369/The-Business-Of-Surveillance-Cameras> [<https://perma.cc/732H-2NW4>].

65. *See, e.g.*, Memorandum from Oakland Police Dep’t to Office of the City Adm’r on Red Light Camera Enforcement Sys., City of Oakland Agenda Report, at 1 (Nov. 10, 2009) (on file with author) [hereinafter OPD Memorandum].

66. “Machine learning” refers to “computer algorithms that have the ability to ‘learn’ or improve on performance over time on some task.” Harry Surden, *Machine Learning and Law*, 89 WASH. L. REV. 87, 88 (2014).

67. *See, e.g.*, Digital Justice, *Digitisensory Technologies Avista Smart Sensors*, YOUTUBE (Sept. 14, 2012), <https://www.youtube.com/watch?v=JamGobiS5wg> [<https://perma.cc/J8T4-97VN>].

68. *See, e.g.*, Joshua Sabatini, *San Francisco’s Crime Cameras Zoom in on the Innocent*, S.F. EXAMINER (July 8, 2011), <http://www.sfexaminer.com/sanfrancisco/san-franciscos-crime-cameras-zoom-in-on-the-innocent/Content?oid=2177815> [<https://perma.cc/5DJB-SJM2>] (reporting a case in which the state dropped homicide charges against a man after “hot spot” city surveillance videos showed he was helping a disabled woman).

cameras can exonerate and inculpate defendants (and can implicate state actors in misconduct); however, it has largely been through the persistent advocacy of crime victims and defendants that police departments have begun to implement body and dashboard cameras.<sup>69</sup> Likewise, it has taken protracted litigation by defendant advocacy groups to require police departments to videotape interrogations of suspects; for example, the FBI “resisted recording confessions or interviews” until 2014.<sup>70</sup>

My claim here is neither that the focus on high-crime areas is irrational if one’s goal is to detect crimes through public surveillance, nor that the videotaping of all FBI suspect interviews is necessarily good policy. Rather, my claim is only that photographic and filmic evidence, as a form of mechanical (or, at least, apparently mechanical<sup>71</sup>) proof, has been deployed by law enforcement primarily out of a desire to reduce a particular type of inaccuracy: false negatives.

### 3. Impairment Machines

American law enforcement’s quest for a machine that measures motorists’ alcohol intoxication from their breath was, as with so many other gadgets, motivated by a concern about false negatives—about drunk drivers going undetected and unpunished. Before the 1940s, it was difficult for police to secure convictions in drunk-driving cases based solely on an officer’s subjective testimony about the driver’s impaired condition.<sup>72</sup> Before breath testing, police had tried to create a mechanical test for impairment in the form of field sobriety tests, such as reciting the alphabet backwards and standing on one leg. But these tests had a high false negative rate, with some drunken motorists passing with flying colors.<sup>73</sup> And although chemists had developed blood tests for alcohol intoxication, they were of limited use for law enforcement because they required the aid of a doctor. It would be those within the law enforcement sphere—coroners’ chemists, police consultants, and police officers moonlighting as inventors—who would develop and colorfully name the first breath-testing machines, from the “Drunk-O-Meter” in 1938 to the “Breathalyzer” in

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69. Although many police unions now endorse the use of cameras as a means of protecting police from false claims of abuse, the state itself did not initiate such efforts in the way they have initiated wide-scale public surveillance campaigns. After mobile video recorders became affordable in the 1980s, the organization “Mothers Against Drunk Driving” began buying dashboard cameras for police patrol cars, so as to make DUI prosecutions easier. See LILIAN DRAISIN, UNIV. CENT. FLA., PUB. ADMIN. DEP’T, POLICE TECHNOLOGY: AN ANALYSIS OF IN-CAR CAMERAS AND BODY WORN CAMERAS 6 (2011); INT’L ASS’N OF CHIEFS OF POLICE (IACP), THE IMPACT OF VIDEO EVIDENCE ON MODERN POLICING: RESEARCH AND BEST PRACTICES FROM THE IACP STUDY ON IN-CAR CAMERAS 5 (William Albright et al. eds., 2004).

70. Carrie Johnson, *New DOJ Policy Urges Agents To Videotape Interrogations*, NPR (May 21, 2014, 6:49 PM), <http://www.npr.org/sections/thetwo-way/2014/05/21/314616254/new-doj-policy-calls-for-videotaping-the-questioning-of-suspects> [<https://perma.cc/GK5E-XKQ3>].

71. In Section II.A, *infra*, I argue that film evidence, including videotaping of suspects, is an example of a “false machine” susceptible to human manipulation and hidden subjectivities.

72. See Andrea Roth, *The Uneasy Case for Marijuana as Chemical Impairment Under a Science-Based Jurisprudence of Dangerousness*, 103 CAL. L. REV. 841, 849–50 (2015).

73. See *id.* at 850.

1954.<sup>74</sup> From the moment of their debut, these devices were hailed as “truth machines.” In 1955, the magazine *Popular Science* excitedly observed that “[t]he hunches and walk-a-straight-line methods of old-time police work are being replaced by scientific devices to tell the cops just how drunk a driver is by analyzing a whiff of his breath.”<sup>75</sup> Since then, breath machines have surely saved thousands of lives precisely because they detect low but still dangerous blood-alcohol concentrations (BACs).

Breath-alcohol machines can also potentially exonerate a motorist accused of driving while intoxicated if the breath test shows a low or zero BAC, and some states give defendants charged with public intoxication a right to have a “chemical test” within two hours of being arrested.<sup>76</sup> Of course, police might still elect to arrest, and prosecutors elect to charge, a suspect who has a low BAC under a traditional (or non-*per se*) driving-under-the-influence (DUI) or public intoxication law.<sup>77</sup> No state has created a legal presumption of nonimpairment at low BACs, although public health officials in the 1930s suggested that states adopt one.<sup>78</sup> There may be perfectly rational reasons to prosecute someone for DUI with a low BAC, such as a delay in testing or a reason to believe the driver has little experience driving with any alcohol in his blood. But such individualized, nonmechanical determinations of impairment work only in one direction: toward prosecution. Meanwhile, for decades, requests from victims’ groups and defendants for police dashboard and body cameras to corroborate testing results in DUI cases have gone unfulfilled, until more recently.<sup>79</sup>

The episodic concessions by the state to the scientific authority of breath impairment machines even for exoneration are striking relative to the story of the polygraph. As discussed in more detail below, breath test machines have also undergone significant (though not necessarily sufficient) scrutiny in terms of their reliability, through both litigation and statutory and regulatory safeguards governing testing conditions. One potential explanation for the high level of scrutiny on breath-test machines might be the relative social privilege of DUI defendants compared to those accused of other crimes; more specifically, that alcohol tends to be the drug of choice for middle- and upper-class American whites and that DUI defendants may be more relatable than the

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74. The earliest breath-testing device was invented by a “coroner’s chemist” in Chicago. *See id.* at 853. The “Drunk-O-Meter” was invented by Dr. Rolla Harger, a biochemist and police consultant in Indianapolis, and the “Breathalyzer” was invented in 1954 by a former police officer and amateur scientist, Dr. Robert Borckenstein. *See id.* at 853, 861.

75. Joseph Dorlaque, *New Machines Get Drunks Off the Road*, POPULAR SCI. MONTHLY, Oct. 1955, at 166.

76. *See, e.g.*, IOWA CODE § 123.46(3), (4) (2011).

77. *See, e.g.*, CAL. VEH. CODE § 23152(a), (b) (West 2014).

78. *See* Roth, *supra* note 72, at 859.

79. *See supra* text accompanying note 69; *see also* Patrick Moore, *Smile . . . You’re (Probably Not) on Camera*, WINNEBAGO CTY. BAR ASS’N NEWSLETTER, Mar. 2010, at 18–19 (highlighting that defense attorneys’ requests for cameras in DUI cases had gone unheeded).

typical criminal defendant.<sup>80</sup> In any event, I will later argue that the DUI story in certain limited respects is a decent template for using science in a transparent, reliable way to improve accuracy in both fact-finding and liability.

#### 4. Forensic DNA Typing

Forensic DNA typing is, as former Attorney General John Ashcroft put it in 2002, the “truth machine of law enforcement, ensuring justice by identifying the guilty and exonerating the innocent.”<sup>81</sup> And make no mistake: DNA has a relatively impressive scientific foundation compared to forensic disciplines like toolmark and fingerprint analysis that were developed mostly within the law enforcement context.<sup>82</sup> It has unprecedented power to solve crimes<sup>83</sup> and protect the innocent.<sup>84</sup> The rhetoric of certainty surrounding DNA has led to “broad public opinion accept[ing] DNA findings as definitive.”<sup>85</sup>

DNA has been aggressively harnessed and endorsed by the state as an accurate and reliable means of detecting and successfully prosecuting crimes, as well as placing large swaths of the population under permanent genetic surveillance. But it has not been so aggressively harnessed or endorsed by the state as a means of exonerating the innocent. For example, when defendants test biological material that the state chose not to test and ask that the FBI (which operates CODIS, the national offender database) run a resulting DNA profile through CODIS to see if an alternative suspect matches, the FBI often refuses, absent a court order.<sup>86</sup> The FBI has also refused many independent researchers requesting anonymized access to CODIS to test the accuracy of the database’s reported match statistics, which have been criticized for erroneously interpreting the frequency of various genetic markers.<sup>87</sup> Many prosecutors also resisted “Innocence Protection Acts,” which allow defendants in most states to insist

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80. See, e.g., Roth, *supra* note 72, at 846–47.

81. Press Release, John Ashcroft, U.S. Att’y Gen., U.S. Dep’t of Justice, DNA Initiative (Mar. 4, 2002) (transcript available at <http://www.justice.gov/archive/ag/speeches/2002/030402newsconference dnainitiative.htm> [<https://perma.cc/88ZJ-SJA3>]).

82. See generally NAT’L RESEARCH COUNCIL OF THE NAT’L ACADS., STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (2009) (describing an inability of most disciplines to achieve independence from their law enforcement roots).

83. According to the FBI, over 210,700 investigations have been “assisted” by use of DNA offender databases. See *Combined DNA Index System (CODIS): National DNA Index (NDIS) Statistics*, U.S. FED. BUREAU OF INVESTIGATION, [www.fbi.gov/about-us/lab/biometric-analysis/codis/ndis-statistics](http://www.fbi.gov/about-us/lab/biometric-analysis/codis/ndis-statistics) [<https://perma.cc/L6GR-GH6T>] (last visited Jan. 24, 2016).

84. Since 1989, over 300 convicted defendants in the United States have been publicly exonerated through DNA testing. See INNOCENCE PROJECT, [www.innocenceproject.org](http://www.innocenceproject.org) [<https://perma.cc/ZE3U-JXRD>] (last visited Jan. 24, 2016).

85. Jay D. Aronson & Simon A. Cole, *Science and the Death Penalty: DNA, Innocence, and the Debate over Capital Punishment in the United States*, 34 LAW & SOC. INQUIRY 603, 617 (2009) (citation omitted).

86. See Andrea L. Roth & Edward J. Ungvarsky, *Data Sharing in Forensic Science: Consequences for the Legal System*, 2009 JOINT STATISTICAL MTG., AMER. STATISTICAL ASS’N 469, 473.

87. D.E. Krane et al., Letter to the Editor, *Time for DNA Disclosure*, SCI., Dec. 18, 2009, at 1631.

upon preservation or testing of biological material.<sup>88</sup> And in several cases involving questionable confessions or eyewitness identifications and where definitive DNA evidence has been offered to exclude the defendant as the possible perpetrator, prosecutors tend to resist exonerations, relying instead on strained theories of coincidence to explain away the DNA.<sup>89</sup> The best evidence that DNA's supposed infallibility is a subtly constructed truth<sup>90</sup> is how much more willing the state is to reject DNA's authority when it does not fit a narrative of guilt.

Most recently, the state has pursued a new tool to reduce false negatives in DNA analysis: probabilistic DNA mixture interpretation software. Because of advances in DNA typing methods, small amounts of DNA or partially degraded DNA from a crime scene can be detected, amplified, and tested. The downside to this new capability is that DNA mixtures have become more difficult to interpret. For example, the fact that a particular DNA marker or "allele"<sup>91</sup> is present in a defendant's DNA but absent in a DNA mixture found on a knife at the crime scene might mean that the defendant is not a contributor to the mixture. Or, it might mean that the defendant is a minor contributor, but that his DNA is in such a low quantity or has become so degraded that one or more of his alleles have "dropped out."<sup>92</sup> Such judgment calls are critically important, as they can mean the difference between reporting a match or no match between two samples.

Until recently, human analysts made these interpretive calls and used a relatively simple formula to determine the probability that a random person would have a DNA profile consistent with the alleles seen in the mixture. But the coup de grâce finally arrived in the form of the TrueAllele<sup>TM</sup> software, a "computer that interprets DNA evidence."<sup>93</sup> TrueAllele purports to remove human interpretation entirely from complex mixtures by incorporating the possibility of allelic dropout and firing off a single statistic. This "likelihood ratio" is the chance this particular mixture of alleles would appear given the competing hypotheses that a particular person is or is not a contributor to the mixture. In 2009, TrueAllele was used to convict a defendant, representing "the first time that automated computer interpretation was accepted into court as

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88. See, e.g., Nancy Marion & Marvin Zalman, *Towards a Theory of Innocence Policy Reform*, in *CONTROVERSIES IN INNOCENCE CASES IN AMERICA* 175, 184 (Sarah Lucy Cooper ed., 2014).

89. See generally Andrea Roth, *Defying DNA: Rethinking the Role of the Jury in an Age of Scientific Proof of Innocence*, 93 B.U. L. REV. 1643 (2013) (discussing several such cases).

90. See JASANOFF, *supra* note 6, at 56.

91. In forensic DNA analysis, analysts focus on locations along the subject's genetic strand that are highly variable among humans. At each location, they count how many times a particular genetic code repeats. The number of repeats is the "allele" one has at that location. See Erin Murphy, *The Art in the Science of DNA: A Layperson's Guide to the Subjectivity Inherent in Forensic DNA Typing*, 58 EMORY L.J. 489, 495 (2008).

92. See, e.g., NUFFIELD COUNCIL ON BIOETHICS, *THE FORENSIC USE OF BIOINFORMATION: ETHICAL ISSUES* 19, 23 (2007) (discussing problems with analytical techniques that employ low-quantity DNA samples).

93. See *TrueAllele Casework Process Overview Video*, at 0:04, CYBERGENETICS, May 1, 2013, <http://www.cybgen.com/systems/casework.shtml> [<https://perma.cc/6EFT-S3VX>].

evidence.”<sup>94</sup> It has been used in numerous criminal trials in the United States and United Kingdom since then,<sup>95</sup> and several other companies now have competing but similar software.<sup>96</sup>

The results of software like TrueAllele are, to be sure, potentially exonerating. For example, consider a case where some of the defendant’s alleles are not in the mixture and the manual method incorrectly assumed they had “dropped out” due to degradation or other circumstances. TrueAllele, on the other hand, may properly interpret the mixture to exclude the defendant. But software results are also potentially much more inculpatory than the old manual method because the software’s reported match statistics are typically orders of magnitude more damning than the old method.<sup>97</sup> Nearly all of the press releases on the company’s website document court decisions admitting the software in cases on behalf of the prosecution.<sup>98</sup>

At the same time, states have been slow to automate expert interpretation of pattern evidence outside the realm of DNA. Part of the reason may, of course, be cost. But part of the reason may also be the prevailing sentiment among state examiners that their experiences and judgments are superior to what a computer program could do. As one defense toolmark consultant put it, there is a “stereotype [of] the distinguished, greying individual on the stand saying, ‘my opinion is based on my many years of experience in the field.’”<sup>99</sup> Experts testify to a perfect match based on their “own inarticulate, mind’s eye judgments.”<sup>100</sup> Some in the forensic toolmark community claim that human examiners can do a better job in determining source probability because of their training and experience: “[T]he opinion of the specialist in tool marks should have more weight than the opinion of a specialist in statistics, although the second one might more easily impress the jury[,] [n]umbers always look so scientific!”<sup>101</sup>

In turn, it is the prosecution that benefits from a forensic examiner’s subjective claim of certainty about the defendant being the source of pattern evidence, rather than giving the jury a potentially less impressive estimate of the statistical significance of the match. Forensic examiners are currently allowed to tell the jury that the defendant’s gun made a mark on a bullet “to a reasonable degree of

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94. See *History*, CYBERGENETICS, <http://www.cybgen.com/company/history.shtml> [<https://perma.cc/LR D8-3YPA>] [<https://perma.cc/J295-L3Q9>] (last visited Jan. 24, 2016).

95. See, e.g., *Newsroom*, CYBERGENETICS, <http://www.cybgen.com/information/newsroom/page.shtml> (last visited Jan. 24, 2016).

96. See MURPHY, *supra* note 12, at 102.

97. See Mark William Perlin, *Inclusion Probability for DNA Mixtures Is a Subjective One-Sided Match Statistic Unrelated to Identification Information*, 6 J. PATHOLOGY INFORMATICS 59, 62 (2015).

98. See *Press Releases*, CYBERGENETICS, <http://www.cybgen.com/information/press-release/page.shtml> [<https://perma.cc/78ND-QR96>] (last visited Jan. 24, 2016).

99. Adina Schwartz, *Challenging Firearms and Toolmark Identification—Part One*, 9 THE CHAMPION 10, 14 (2008) (quoting Christophe Champod & Ian W. Evett, *A Probabilistic Approach to Fingerprint Identification Evidence*, 51 J. FORENSIC IDENTIFICATION 101, 106 (2001)).

100. *Id.* at 14.

101. See, e.g., Miguel Deschênes et al., *Statistics and Tool Marks Comparisons*, 27 AFTE J. 140, 141 (1995).

ballistic certainty” or “to the exclusion of all other firearms in the world.”<sup>102</sup> Until recently, fingerprint examiners were allowed to claim a “zero error rate” and assert, to a reasonable degree of scientific certainty, that a latent print was left by the defendant. Although defendants are able to cross-examine the state’s analysts, they are reduced to criticizing the opinion for being subjective rather than directly refuting it with more objective—and perhaps less damning—match statistics produced by probabilistic software.

#### B. VERDICT BY MACHINE

As with mechanical proof, the rise of “mechanical liability” regimes has often been linked to a desire by law enforcement or interest groups to reduce false negatives. Again, this desire is not unmoored from concerns about objectivity and accuracy; rather, it is narrowly aimed at a particular type of inaccuracy—the failure to charge or convict the morally blameworthy.

Two hundred years ago, the American criminal jury had significant leeway to engage in complex moral decision making when determining guilt. The list of common law crimes was relatively short and included only those offenses involving inherently immoral conduct. These crimes had robust *mens rea* elements that required a finding that the defendant intended harm, or at least knew harm would result, from his acts. These elements were written in colorful, imprecise phrases—“depraved heart,” “wicked,” and “wanton and willful”—that allowed jurors to grapple with overall blameworthiness, rather than some technical legal definition of intent, in determining guilt.<sup>103</sup>

In today’s courtroom, however, defendants are prosecuted not just for breaking and entering, but for simply possessing burglary tools as well.<sup>104</sup> A felon in possession of a firearm is guilty of a serious federal crime.<sup>105</sup> And per se DUI laws now criminalize the simple act of driving with a particular blood alcohol concentration or other drug level without requiring any jury finding of dangerous impairment. These inchoate crimes are not without a theory of legitimacy—they are justified on all the same grounds as attempt crimes. But they are, by nature, an overinclusive attempt to err on the side of punishment.<sup>106</sup>

In some instances, lawmakers have removed the jury entirely on grounds of efficiency. Modern offenses with highly determinable elements and no robust *mens rea* element are often prosecuted as misdemeanors or low-level felonies, such as entering a building without legal authority. Some jurisdictions have

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102. See, e.g., *United States v. Diaz*, No. CR 05-00167 WHA, 2007 WL 485967, at \*13–14 (N.D. Cal. Feb. 12, 2007); see also *Commonwealth v. Pytou Heang*, 942 N.E.2d 927, 929, 945 (Mass. 2011) (approving of toolmark expert’s use of such phrases to the jury as an acceptable “empirically based but subjective opinion[.]” of an expert).

103. See STUNTZ, *supra* note 31, at 303.

104. See, e.g., CAL. PENAL CODE § 466 (West 2008).

105. See 18 U.S.C. § 922(g)(1) (2012).

106. See 1968 REPORT, *supra* note 2, at 122.

“streamlined” their criminal code by eliminating jury trials for these offenses.<sup>107</sup> At least one scholar has called for the elimination of jury trials in DUI cases expressly citing jurors’ lenience as the concern.<sup>108</sup> And now fully automated legal regimes exist in the traffic context, removing any ability by a fact finder to exercise extralegal lenity.<sup>109</sup> Red light cameras may save lives and money, and may ultimately reflect good policy, but they definitely prioritize efficiency and err on the side of overpunishment.

Indeed, the modern expansion of proxy or rule-based liability is so extensive that some scholars have linked it to the rise in mass incarceration. As Jonathan Simon has put it:

If the common-law trial once operated like a colonial flintlock rifle, deadly if fired close enough but inaccurate and generally limited to one shot, modern U.S. criminal procedure works more like a fully automatic machine gun, with which the prosecution is able to spread a stream of fire sufficient to suppress almost any resistance.<sup>110</sup>

Perhaps the most dramatic historical example of the use of a proxy crime to suppress resistance was the Black Act of 1723. English nobility and gentry in postfeudal England found themselves in land disputes with locals, mostly poor people, who claimed rights to hunt and graze on local forested land. Some locals took to wearing disguises and hunting at night. To crack down on these nuisances, Parliament created a “crime,” punishable by death, of simply wearing a black mask in the forest while armed.<sup>111</sup>

The broadening of criminal liability based on proxies might also be seen as part of a shift in penal justifications by the state away from moral judgment and toward risk reduction. This shift might have the effect of lessening certain punishments, or delegitimizing certain forms of punishment, but it also has the effect of broadening criminal liability beyond its traditional scope. One aspect of Foucault’s “biopolitics” is the modern consolidation of state control through the “regularization” of life, including interventions intended to “improve life by eliminating accidents,” which he notes “easily take on a Statist dimension in

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107. See, e.g., Omnibus Criminal Justice Reform Amendment Act of 1994, 1 D.C. Law 10-151, 41 D.C. Reg. 2608 (reducing the statutorily-prescribed sentences for various low-level offenses from one year to 180 days so as to no longer trigger any statutory or constitutional right to a jury trial).

108. See Adam M. Gershowitz, *12 Unnecessary Men: The Case for Eliminating Jury Trials in Drunk Driving Cases*, 2011 U. ILL. L. REV. 961, 971–76 (2011) (presenting statistical evidence to support a finding that juries tend to be more lenient than judges in DUI cases).

109. See *infra* Section II.B.2.

110. Jonathan Simon, *Uncommon Law: America’s Excessive Criminal Law & Our Common-Law Origins*, 143 DAEDALUS 62, 67 (2014); see also STUNTZ, *supra* note 31, at 303.

111. See E. P. THOMPSON, *WHIGS AND HUNTERS: THE ORIGIN OF THE BLACK ACT 188–89*, 192 (1975) (“The Black Act put unprecedented legal power in the hands of men who had not a generalized, delegated interest, such as the maintenance of order, or even the maintenance of the privileges of their own class, but a direct and personal interest in the conviction of men who were a nuisance to them.”).

apparatuses such as the police.”<sup>112</sup> James Scott has also described the tendency of states to engage in “heroic simplification”—the well-intended oversimplification of a complex social problem while attempting social engineering through methods that involve measurement and ordering.<sup>113</sup> In doing so, states “isolate a single element of instrumental value” that is easily measurable and ignore more complex elements or less domesticated forms of knowledge. The more “complex and poorly understood” the process being domesticated, the more problematic the simplification becomes.<sup>114</sup>

The state’s use of such proxies in criminal law to reduce false negatives and increase efficiency also conforms to a more general pattern of simplifying legal decision making into determinable elements, with an eye toward efficiency and accuracy, but a tendency to oversimplify or entrench existing biases. In the administrative law context, agencies are now “increasingly inclined to adopt policies involving simple questions and answers that are easy to translate into code, even when strong substantive reasons favor a more nuanced approach.”<sup>115</sup> One critic of artificial-intelligence-assisted legal reasoning expressed concern that “lawmakers [might] consider making more formal and determinate previously less determinate areas of law, to allow them to be processable by computers.”<sup>116</sup> And with respect to the use of actuarial data in determining which suspects to stop and frisk or which offenders to punish harshly, scholars have warned that such “actuarial justice” models are self-perpetuating: the mere availability of statistical data tempts criminal justice actors to choose investigative techniques and punishment models that “function more smoothly with prediction” and measurement.<sup>117</sup>

#### C. PUNISHMENT BY MACHINE

Finally, the state’s pursuit of mechanical judicial decision making has been motivated by a desire to increase the uniformity and rationality of punishment, but typically in a certain direction: away from undue leniency. Before the modern movement toward determinate and uniform sentencing, judges typically had wide discretion to impose a sentence, within the statutory maximum set by

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112. FOUCAULT, *supra* note 7, at 247–50; cf. Jonathan Simon, *Driving Governmentality: Automobile Accidents, Insurance, and the Challenge to Social Order in the Inter-War Years, 1919 to 1941*, 4 CONN. INS. L.J. 521, 559–60 (1998) (exploring car accidents as a challenge to state order and governance and describing the controversial rise of speed laws).

113. See JAMES C. SCOTT, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITION HAVE FAILED 8 (1998).

114. *Id.* at 21.

115. Danielle Keats Citron, *Technological Due Process*, 85 WASH. U. L. REV. 1249, 1255 (2008) (citation omitted).

116. Harry Surden, *The Variable Determinacy Thesis*, 12 COLUM. SCI. & TECH. L. REV. 1, 89 (2011).

117. See BERNARD E. HARCOURT, AGAINST PREDICTION: PROFILING, POLICING, AND PUNISHING IN AN ACTUARIAL AGE 3 (2007); see generally Malcolm M. Feeley & Jonathan Simon, *The New Penology: Notes on the Emerging Strategy of Corrections and Its Implications*, 30 CRIMINOLOGY 449 (1992) (describing the shift from clinical and retributive judgments to probabilistic and actuarial assessments in penology).

the legislature, in accordance with traditional purposes of punishment.<sup>118</sup> Judges would impose an “indeterminate” sentence consisting of a broad temporal range, thereby delegating to parole boards the decision whether to release the offender before the full term.<sup>119</sup>

This era of discretion came to an end in the federal system in 1984, when Congress passed the Sentencing Reform Act, abolishing the federal parole system and creating a sentencing commission that promulgated mandatory guidelines for judges to follow in imposing “determinate” sentences. The guidelines amounted to a grid—a set of boxes that, with few exceptions, definitively set an offender’s sentence based on his prior record, the facts of the crime, and similarly determinable inputs. The grid was so mechanistic, in fact, that federal officials created a “non-intelligent” computer program to execute them, referred to as the Applied Sentencing System (ASSYST).<sup>120</sup> Following the Sentencing Commission’s lead, twenty-one states developed similar guidelines.<sup>121</sup> Meanwhile, mandatory minimum sentences are a fixture of federal and most state sentencing regimes, arguably reducing judges to “sentencing machines” as well.<sup>122</sup>

It is true that the pendulum in sentencing in the United States has swung slightly back toward complex judgment. This shift stems in part from the Supreme Court’s holding that mandatory guidelines are not constitutional if they establish sentencing ranges based on facts not found by the jury beyond a reasonable doubt,<sup>123</sup> and, in part, the result of a bipartisan movement toward reduced penalties and the elimination of mandatory minimum sentences for nonviolent drug offenses.<sup>124</sup> Judges, however, continue to regularly follow the guidelines.<sup>125</sup> Even when judges exercise discretion, many have augmented or

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118. See STEPHANOS BIBAS, *THE MACHINERY OF CRIMINAL JUSTICE* 25–26 (2012) (describing the rise of truth-in-sentencing laws and associated guidelines for parole boards). Although Congress has used mandatory minimum sentencing to a limited extent since the 1790s, the length, prevalence, and diversity of federal crimes carrying mandatory minimums significantly increased beginning in the mid-twentieth century. See U.S. SENT’G COMM’N, *REPORT TO THE CONGRESS: MANDATORY MINIMUM PENALTIES IN THE FEDERAL CRIMINAL JUSTICE SYSTEM* 22–31 (2011).

119. See BIBAS, *supra* note 118, at 25.

120. See generally Eric Simon et al., *ASSYST—The Design and Implementation of Computer-Assisted Sentencing*, 55 *FED. PROBATION* 46 (1991) (describing the ASSYST system and its possible use in criminal sentencing).

121. See generally NEAL B. KAUDER & BRIAN J. OSTROM, *NAT’L CTR. FOR STATE COURTS, STATE SENTENCING GUIDELINES: PROFILES AND CONTINUUM* 3 (2008) (profiling twenty-one state sentencing guideline systems).

122. See Lee Anne Fennell, *Between Monster and Machine: Rethinking the Judicial Function*, 51 *S.C. L. REV.* 183, 209 (1999).

123. See *United States v. Booker*, 543 U.S. 220, 220 (2005); *Blakely v. Washington*, 542 U.S. 296, 296 (2004).

124. For example, the Texas Public Policy Foundation’s *Right on Crime* project espouses a “conservative approach to criminal justice” that includes sentencing reform and libertarian justifications for robust indigent criminal defense. See *RIGHT ON CRIME*, <http://rightoncrime.com> [<https://perma.cc/6VCA-RT7A>] (last visited Feb. 17, 2016).

125. See, e.g., Lynn Adelman, *What the Sentencing Commission Ought to Be Doing: Reducing Mass Incarceration*, 18 *MICH. J. RACE & L.* 295, 304 (2013) (“Judges are cautious by nature, and they pay a

replaced their decision making with actuarial risk-assessment instruments, or “evidence-based sentencing” (EBS).<sup>126</sup> Under EBS, offenders receive a numerical score representing their risk of reoffending based on variables such as prior record, employment, and circumstances of the crime.

The fact that mandatory minimum sentencing was primarily intended to reduce instances of underpunishment may seem obvious. But the fact that the sentencing guidelines were intended as such may be less obvious. Under the old system, nearly half of federal offenders received probation, with any jail time suspended unless and until probation was revoked. In drafting the new guidelines, the Commission contemplated both that fewer offenders would get probation and that the new determinate sentencing ranges for offenders who did receive jail time would be no more lenient than the ultimate amount of time parole boards gave offenders in similar circumstances under the old regime. These were reasonable, if punitive, choices stemming from, in the words of Kate Stith and Judge José A. Cabranes, a “fear of judging.”<sup>127</sup> As discussed more fully in Part II, however, the Commission committed a glaring error in attempting to translate into numbers its desire to combat leniency.

Although the state has embraced mandatory minimums, sentencing guidelines, and EBS, prosecutors have been slow to warm to mechanical judicial decision making where it has reduced—rather than increased—incarceration. In 2015, an actuarial instrument for bail determinations debuted in twenty-one jurisdictions around the country, describing ten common risk factors that surfaced as the best predictors of re-offense or failure to appear based on researchers’ review of over 500,000 cases.<sup>128</sup> Significantly, the instrument chose not to rely on several factors “that judges and prosecutors normally consider relevant” to bail, including employment status, community ties, and history of drug abuse.<sup>129</sup> The instrument was not funded by law enforcement, but rather by a private foundation that believed too many low-level and moderate-level offenders were being needlessly detained before trial. One of the “initial skeptics” of the program, a North Carolina prosecutor, was pleasantly surprised to find that

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lot of attention to the Commission’s recommendations even though such attention is often unwarranted.”).

126. See generally Sonja B. Starr, *Evidence-Based Sentencing and the Scientific Rationalization of Discrimination*, 66 STAN. L. REV. 803 (2014) (describing EBS systems and critiquing them on constitutional and policy grounds).

127. KATE STITH & JOSE A. CABRANES, FEAR OF JUDGING: SENTENCING GUIDELINES IN THE FEDERAL COURTS 169 (1998).

128. The instrument was referred to as the *Public Safety Assessment* and was developed by the Laura and John Arnold Foundation, a nonprofit organization. See *Public Safety Assessment*, LAURA & JOHN ARNOLD FOUND., <http://www.arnoldfoundation.org/initiative/criminal-justice/crime-prevention/public-safety-assessment> [<https://perma.cc/N7VY-WQL4>] (last visited Jan. 24, 2016); see also LAURA & JOHN ARNOLD FOUND., DEVELOPING A NATIONAL MODEL FOR PRETRIAL RISK ASSESSMENT: RESEARCH SUMMARY (Nov. 2013), [http://www.arnoldfoundation.org/wp-content/uploads/2014/02/LJAF-research-summary\\_PSA-Court\\_4\\_1.pdf](http://www.arnoldfoundation.org/wp-content/uploads/2014/02/LJAF-research-summary_PSA-Court_4_1.pdf) [<https://perma.cc/K7MZ-TD47>] (describing the genesis and development of the Public Safety Assessment instrument).

129. See Dewan, *supra* note 15, at A18.

jail populations declined considerably after a year-long trial administering the program resulted in no “ill effect[s].”<sup>130</sup>

## II. MECHANIZATION’S FAILED PROMISE

Part I explored how mechanization has arisen in criminal justice in an unbalanced way, reflecting the focus of law enforcement, interest groups, and lawmakers on reducing a particular species of inaccuracy: false negatives. This Part argues that this unbalanced approach has predictably led to three problems: (1) hidden subjectivity and error in “black box” processes falsely labeled as “human” or “mechanical”; (2) compromises on “softer,” but critical, values such as dignity, equity, and mercy; and, ironically, (3) too little mechanization in areas where more equitable deployment of mechanization could further enhance accuracy and objectivity.

### A. HIDDEN SUBJECTIVITY AND ERROR

#### 1. The Black Box

If a criminal justice actor’s primary purpose in deploying a literal or metaphorical “machine” is to reduce false negatives, and if the machine proves successful in doing so, that actor has an incentive to promote the machine’s epistemic authority. One manifestation of this incentive structure is the use of names for crime-detecting gadgetry that signal their virtue or mechanical objectivity—the “Drunk-O-Meter,” the “Breathalyzer,” the “Intoxilyzer 8000,” “TrueAllele.” Such colorfully labeled gadgetry surely appeals to Americans’ “instrument fetishism.”<sup>131</sup> Indeed, there is a long history of such fetishism; the invention of entertaining and ingenious instruments proved critical in centuries past to mathematicians seeking royal patronage and to the rise of astronomy and other mathematical sciences as disciplines with “cultural prestige.”<sup>132</sup>

Yet a machine’s authority can also be undermined by its technical intricacy. In describing the depiction of a polygraph in the 1948 film noir *Call Northside 777*, Jennifer Mnookin and Nancy West note that the focus on the machine’s graphs and a “jargon-filled” explanation of the process “effectively distances viewers from the very machine they are apparently being encouraged to admire, instilling in them a mistrust of its scientific complexity.”<sup>133</sup>

Many crime-detecting gadgets and software tend to be shrouded in “inscrutable black box[es]” that “hide the workings” in shiny steel contraptions or computer code.<sup>134</sup> These “black box” processes, because of their mechanical appearance and apparently simple output, have a veneer of objectivity and

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130. *Id.*

131. BUNN, *supra* note 10, at 188.

132. POOVEY, *supra* note 26, at 138–39, 141.

133. Mnookin & West, *supra* note 16, at 363–64.

134. NICHOLAS CARR, *THE GLASS CAGE: AUTOMATION AND US* 163 (2014); *see also* Omer Tene & Jules Polonetsky, *Judged by the Tin Man: Individual Rights in the Age of Big Data*, 11 J. TELECOMM. & HIGH

certainty. Not only do they obscure how the sausage is made, they obscure that their output is sausage at all. In truth, these processes all have hidden subjectivities and errors that often go unrecognized and unchecked, thus potentially “facilitat[ing] the masking of illegitimate or illegal discrimination behind layers upon layers of mirrors and proxies.”<sup>135</sup>

Ultimately, all machines are “purposeful organization[s] for a strictly predetermined end,”<sup>136</sup> executing the instructions of human programmers based on data or material inputted by human operators. As such, they reflect the factual assumptions and value choices of their creators. An understanding of machines requires a recognition that “human intentions, plans, and assumptions are always built into [them].”<sup>137</sup> Even a simple list of data is interpretive in that it “embod[ies] theoretical assumptions about what should be counted, how one should understand material reality, and how quantification contributes to systematic knowledge about the world.”<sup>138</sup> Environmental law scholars have written of the “science charade”—the attempt to pass off decisions as purely scientific that actually involve contentious value choices<sup>139</sup>—and of the tendency for environmental models to seem objective, despite the presence of subjective assumptions of human behavior or the effects of environmental degradation on economic growth.<sup>140</sup> Even in “robot morality,” an emerging field involving machines that make complex ethical “judgments” based on thousands of factors,<sup>141</sup> humans input the factors. So far, only a person can resolve the old “Ethics 101” problem of “whether a conductor should flip a switch that will kill one person to avoid a crash in which five would otherwise die.”<sup>142</sup>

Outside the criminal justice context, scholars have recognized the hidden subjectivities of algorithms in the law. In the credit scoring context, a seemingly objective “score” is the result of carefully chosen factors that nearly always

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TECH. L. 351, 366 (2013) (“It is hard to audit, challenge or amend processes that are concealed in a black box.”).

135. Tene & Polonetsky, *supra* note 134, at 358 (citation omitted).

136. MUMFORD, *supra* note 22, at 87.

137. DAVID A. MINDELL, OUR ROBOTS, OURSELVES: ROBOTICS AND THE MYTHS OF AUTONOMY 10 (2015).

138. POOVEY, *supra* note 26, at xii; *see also* Itiel Dror, Editorial, *The Ambition to be Scientific: Human Expert Performance and Objectivity*, 53 SCI. & JUSTICE 81, 81 (2013) (“Even with quantification and statistical tools, the human element still plays a critical role . . . [S]ampling and determining what qualifies as ‘data’ to be used as input to the instrumentation and statistical models are highly influenced by motivational and expectation biases.”).

139. *See, e.g.*, Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn’t Always Good Policy*, 75 WASH. U. L. Q. 1029, 1035–36 & n.17 (1997) (arguing that the “strictly science” mandate of the ESA invites the “charade” by failing to account for the limits of objective science as a means of resolving what are often policy disputes (citing Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613 (1995))).

140. *See, e.g.*, James D. Fine & Dave Owen, *Technocracy and Democracy: Conflicts Between Models and Participation in Environmental Law and Planning*, 56 HASTINGS L.J. 901, 928–29 (2005).

141. *See* Robin Marantz Henig, *Death by Robot*, N.Y. TIMES MAG., Jan. 9, 2015, at MM16.

142. *Id.*

correlate to race, gender, and class.<sup>143</sup> Ken Bamberger has noted the possibility of “automation biases” favoring corporate self-interest in software designed to ensure compliance with risk-management regulations.<sup>144</sup> In the legal research context, the *WestlawNext* algorithm has been identified for its “potential to change the law” by biasing results away from “less popular legal precedents” that “effectively become invisible.”<sup>145</sup> And in the voting context, scholars have documented errors and racial bias in felon exclusion lists created with the help of commercial software.<sup>146</sup>

Such hidden subjectivities also abound in crime-detecting machines. In simple algorithms used to prove a fact relevant to guilt, such as field sobriety tests (FST) that prove alcohol impairment (e.g., stating the alphabet backwards), flaws or biases may be relatively easy to detect. A juror could draw on personal experience reciting the alphabet backwards (even while sober) to understand that FSTs may produce higher false-positive rates.<sup>147</sup> But when a process involves multiple layers of automation or relatively inaccessible code or other technology, human operators as well as fact finders might find meaningful scrutiny of the process itself impossible.

For example, consider breath-alcohol machines. The infrared-technology-based “Intoxilyzer 8000” produces nothing but a “print-out card” reporting blood alcohol concentration,<sup>148</sup> making further scrutiny of its results difficult. In Ohio, a group of defendants noticed both that the machine was producing a curiously high number of “ambient fail” readings—a common result when the device draws in air to compensate for the presence of interfering substances—and that the device was not properly programmed to differentiate between residual alcohol in the mouth and alcohol found in deep lung air, thus potentially leading to false positives.<sup>149</sup> After attempted validation testing with the

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143. See Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 10–16 (2014) (criticizing automated credit scoring systems for their “opacity, arbitrary results, and disparate impact on women and minorities”).

144. See Kenneth A. Bamberger, *Technologies of Compliance: Risk and Regulation in a Digital Age*, 88 TEX. L. REV. 669, 676 (2010).

145. Ronald E. Wheeler, *Does WestlawNext Really Change Everything? The Implications of WestlawNext on Legal Research*, 103 LAW LIBR. J. 359, 368 (2011).

146. See Guy Stuart, *Databases, Felons, and Voting: Bias and Partisanship of the Florida Felons List in the 2000 Elections*, 119 POL. SCI. Q. 453, 454 (2004) (analyzing extensive data produced from voter exclusion lists to “explain the extent of the errors[,] . . . the source of their biases, and the partisanship surrounding their use”).

147. See BARRON H. LERNER, *ONE FOR THE ROAD: DRUNK DRIVING SINCE 1900*, at 49–62 (2011) (discussing the history of FSTs and noting a prevalence of errors in early procedures).

148. See *People v. Miller*, 125 Cal. Rptr. 341, 342 (1975) (noting that although a defendant in the Intoxilyzer era was entitled to have breath samples preserved, that right was inapplicable to the Intoxilyzer 8000 because that device produced nothing more than a printout card).

149. See, e.g., Jon Saia, *The Inconvenient Truth About the Intoxilyzer 8000 Breath Alcohol Testing Instrument*, LAW OFFICES OF SAIA & PIATT, INC., <http://www.888oviohio.com/Articles/OVI-Tests-Evidence/2007/The-Inconvenient-Truth-of-Standardized-Field-Sob.aspx> [<https://perma.cc/LS7J-B844>] (last visited Jan. 25, 2016).

device, officials in at least two states have declined to authorize its use,<sup>150</sup> and one trial court in Ohio refused to admit its results at trial.<sup>151</sup>

To date, only one group of litigants has successfully gained access to a breath machine's source code, and even then, only upon court order after the state initially refused to disclose it.<sup>152</sup> Upon examination of the 1,113 pages of code of the "Intoxilyzer 5000," a group of defense experts in a consolidated set of Minnesota cases found failures to incorporate margins of error, the potential for erroneous "deficient sample" readings based on an artificially high breath-volume requirement and failure to warn the operator of interference from radio frequencies and sudden voltage changes.<sup>153</sup>

Photographic and filmic evidence likewise bear the potential for hidden bias. Nineteenth-century philosophers saw photographs as "paragons of . . . human virtues" because, at their best, "machines offer[] freedom from will—from the willful interventions" that are "the most dangerous aspects of subjectivity."<sup>154</sup> Yet a photographer's choice of lens or filter can drastically affect the version of reality it offers.<sup>155</sup> Researchers have found a significant effect on trial verdicts from a "simple change in camera perspective" on a videotaped interrogation.<sup>156</sup> In red light camera systems, the accuracy of the code determines the accuracy of the time stamp on any piece of footage; it is the programmer who determines how generous the ticketing algorithm's "grace period"<sup>157</sup> might be. But these

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150. See Memorandum from Mark Gwyn, Ass. Dir., Tenn. Bureau of Investigation, on Evaluation of Breath Alcohol Instruments, to Larry Wallace, Dir., Tenn. Bureau of Investigation (Sept. 18, 2003) (on file with author). The Tennessee Bureau declined to recommend the Intoxilyzer 8000 for use in state prosecutions because it "failed to yield satisfactory results" in accurately determining blood alcohol content levels. *Id.*; see also Terrence R. Rudes, *Intoxilyzer 8000 (OH-5): What You Need to Know*, in OHIO STATE BAR ASS'N, 2012 ANNUAL CONVENTION, TRAFFIC LAW COMM., INTOXYLYZER 8000, at § 2.1, § 2.2 (2012) (noting that Alaska has declined to certify the Intoxilyzer 8000 for use in the state).

151. See Alan Johnson, *Judge Finds Breathalyzer Not Scientifically Reliable*, COLUMBUS DISPATCH (Aug. 22, 2013, 9:08 AM), <http://www.dispatch.com/content/stories/local/2013/08/22/judge-finds-breathalyzer-not-scientifically-reliable.html> [<https://perma.cc/T7VW-92SJ>].

152. See *In re Source Code Evidentiary Hearings in Implied Consent Matters*, 816 N.W.2d 525, 529 (Minn. 2012).

153. See *id.* at 544–45. For further discussion of issues with the Intoxilyzer and similar machines, including insight into the importance of source code, see generally Charles Short, Note, *Guilt by Machine: The Problem of Source Code Discovery in Florida DUI Prosecutions*, 61 FLA. L. REV. 177, 179 (2009) (exploring the issue of source code discovery by DUI defendants).

154. Lorraine Daston & Peter Galison, *The Image of Objectivity*, 40 REPRESENTATIONS (SPECIAL ISSUE) 81, 83 (1992).

155. See Benjamin V. Madison III, *Seeing Can Be Deceiving: Photographic Evidence in a Visual Age—How Much Weight Does It Deserve?*, 25 WM. & MARY L. REV. 705, 740–41 (1984).

156. G. Daniel Lassiter et al., *Videotaped Interrogations and Confessions: A Simple Change in Camera Perspective Alters Verdicts in Simulated Trials*, 87 J. APPLIED PSYCHOL. 867, 867 (2002); see also RICHARD A. LEO, POLICE INTERROGATION AND AMERICAN JUSTICE 304–05 (2008).

157. See, e.g., *Baltimore Motorists Caught by Red Light Cameras*, WBALTV (May 8, 2003, 8:18 AM), <http://www.wbalv.com/Baltimore-Motorists-Caught-By-Red-Light-Cameras/8934064> [<https://perma.cc/FUR3-NNYM>] (noting residents' complaints that Baltimore's camera systems' one-tenth-of-a-second grace period—"the time from which the light turns red to when the camera fires"—is shorter than other cities').

choices are also hidden within proprietary source code,<sup>158</sup> leading some members of the public to criticize photo-radar and red light-camera systems as “trial[s] by machine.”<sup>159</sup>

Even forensic DNA typing has hidden errors and subjectivities at every level. For example, it is a programmer who decides which peaks on a graph to consider in reporting the forensic DNA profile found in a sample. If a peak is small, it might be an artifact of the testing process or software, or it might be a real genetic marker in a degraded or otherwise compromised sample. The decision about what “analytical threshold” to set for counting peaks as true genetic markers for purposes of including or excluding someone as a suspect is a choice based on both assumptions about facts in the world (how often a small peak might be a real genetic marker) and values (who should bear the cost of an erroneous “match” call).<sup>160</sup> These choices are similar to the value choices made in medical diagnosis algorithms, where software designers must make value choices about how far to tolerate false negatives and positives.<sup>161</sup> Yet these choices are not obvious from reading the reports and graphs typically turned over to the defendant during pretrial discovery. Rather, to uncover them, a defendant must ask for and receive a computer disc with the raw data, buy the software or consult an expert who owns the software, and then rerun the analysis with alternative thresholds and assumptions to see what new peaks emerge that might have been ignored by government analysts.

The assumptions underlying the likelihood ratios reported by probabilistic genotypic software such as TrueAllele are also buried in proprietary code. TrueAllele’s creator Mark Perlin has executed over twenty-five revisions to its 170,000+ lines of source code, with no published documentation as to what has been revised or why.<sup>162</sup> And in conference simulations involving hypothetical mixtures, TrueAllele and several competing programs have come to different

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158. See e.g., Scott Calvert & Luke Broadwater, *City in \$2 Million Dispute With Xerox Over Camera Tickets*, BALT. SUN (Apr. 24, 2013), [http://articles.baltimoresun.com/2013-04-24/news/bs-md-xerox-dispute-20130424\\_1\\_brekford-corp-81-red-light-cameras-xerox-state](http://articles.baltimoresun.com/2013-04-24/news/bs-md-xerox-dispute-20130424_1_brekford-corp-81-red-light-cameras-xerox-state) [<https://perma.cc/54X8-MJ9X>] (reporting that Xerox has refused to disclose source code for its proprietary red-light camera software).

159. Jay Romano, *Speeders Beware: New Device Looms*, N.Y. TIMES (Sept. 1, 1991), <http://www.nytimes.com/1991/09/01/nyregion/speeders-beware-new-device-looms.html?pagewanted=all> [<https://perma.cc/4HZ3-SVDP>] (observing that some have called red light cameras “trial by machine” because the defendants are often guilty until proven innocent).

160. See Murphy, *supra* note 91, at 491, 510–11 (discussing subjectivity in allele calling); cf. MINDELL, *supra* note 137, at 207 (noting that automated car algorithms represent a form of “cost functions themselves [that] embody human judgments about priorities”).

161. See Felicitas Kraemer et al., *Is There an Ethics of Algorithms?*, 13 ETHICS & INFO. TECH. 251, 251 (2011).

162. See Joe Palazzolo, *Defense Attorneys Demand Closer Look at Software Used to Detect Crime-Scene DNA*, WALL ST. J. (Nov. 18, 2015, 5:17 PM), <http://www.wsj.com/articles/defense-attorneys-demand-closer-look-at-software-used-to-detect-crime-scene-dna-1447842603> [<https://perma.cc/E73R-5W3Z>].

results in terms of guessing mixture ratios.<sup>163</sup> As TrueAllele's creator put it, the programs "give different answers based on how an analyst sets their input parameters."<sup>164</sup> Although TrueAllele has been subject to peer-reviewed validation studies,<sup>165</sup> the studies are condensed results without underlying data for independent reviewers to access.<sup>166</sup>

With access only to validation studies conducted on certain types of mixtures, it is difficult to gauge the adaptability of the software to cases involving vague and borderline data, where—because of compromised samples or a high number of contributors—it should report no statistic at all. The creator's boasts—that TrueAllele "always giv[es] an answer," always makes "full use" of the data, and reports statistics even in the "most challenging" mixtures<sup>167</sup>—may be a sign of algorithmic overreaching. As one defense expert warned, "TrueAllele is being used on the most dangerous, least information-rich samples you encounter, and typically in the most important cases."<sup>168</sup> Nonetheless, TrueAllele's creators have refused to turn over its source code to defendants on grounds of trade secrets, even under protective order, and courts have thus far declined to compel disclosure.<sup>169</sup>

Perhaps the ultimate opportunity for hidden subjectivity in algorithmic decision making would be in a jury completely—and literally—mechanized. In 1983, a commentator in a technology magazine criticized an AI company's attempt to create a computerized jury, predicting that "robot juries would be marketed by profit-making firms . . . that would have an incentive to create programs biased in favor of conviction, since state officials are the intended purchasers."<sup>170</sup>

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163. See, e.g., L. Prieto et al., *EuroforGen-NoE Collaborative Exercise on LRmix to Demonstrate Standardization of the Interpretation of Complex DNA Profiles*, 9 FORENSIC SCI. INT'L: GENETICS 47, 47 (2013); see also Michael D. Coble, Nat'l Inst. Standards Tech., MIX13: An Interlaboratory Study on the Present State of DNA Mixture Interpretation in the United States, 5th Ann. Prescription for Criminal Justice Forensics, Fordham Univ. School of Law (June 6, 2014), [http://www.cstl.nist.gov/strbase/pub\\_pres/Coble-ABA2014-MIX13.pdf](http://www.cstl.nist.gov/strbase/pub_pres/Coble-ABA2014-MIX13.pdf) [<https://perma.cc/BZ84-QWH2>]. Although all software packages presented in the MIX13 study correctly identified the contributors to a mixture, only one program—Charles Brenner's *DNA View*—guessed the correct mixture ratio. See *id.*

164. See Letter from Mark W. Perlin, Chief Sci. & Exec. Officer, Cybergenetics, to Jerry D. Varnell, Contract Specialist, U.S. Dep't of Justice, Procurement Section, at 3 (Apr. 1, 2015), [http://www.cyngen.com/information/newsroom/2015/may/Letter\\_to\\_FBI.pdf](http://www.cyngen.com/information/newsroom/2015/may/Letter_to_FBI.pdf) [<https://perma.cc/2SKL-YC2Z>] [hereinafter Perlin Letter].

165. See, e.g., *People v. Super. Ct. ex rel. Chubbs*, No. B258569, 2015 WL 139069, at \*7 (Cal. Ct. App. Jan. 9, 2015).

166. See Palazzolo, *supra* note 162 (quoting defense expert Dan E. Krane, who reviewed the validation studies and testified against TrueAllele's admission, as saying, "I don't know how [TrueAllele] arrives at its answers").

167. See Perlin Letter, *supra* note 164, at 3.

168. Palazzolo, *supra* note 162.

169. See, e.g., *Chubbs*, 2015 WL 139069, at \*6.

170. Bruce M. Tindall, *Robot Jury Neither Impartial Nor Randomly Selected*, INFOWORLD, Apr. 25, 1983, at 65.

Hidden biases also abound in algorithms used at sentencing. Poorly constructed actuarial instruments used in so-called “evidence-based sentencing” can lead judges in jurisdictions without sentencing guidelines to base sentences on questionable and racially skewed proxies for future dangerousness and blameworthiness, such as family stability and length of prior record.<sup>171</sup> In turn, the hopeful experience of New York with the Arnold Foundation’s *Public Safety Assessment* in decreasing unnecessary pretrial detention (a trend that has not raised crime rates<sup>172</sup>) suggests that use of these older, race-correlated variables in sentencing has likely increased, rather than decreased, sentences.

In addition to having hidden biases, algorithms inevitably contain random errors of mistyping or mistranslation.<sup>173</sup> Anyone who has blindly followed a Google Maps instruction into a dead end or seen the new “PITCHf/x” system in Major League Baseball wildly err in calling a strike<sup>174</sup> appreciates that machines can make mistakes and that algorithms contain bugs.<sup>175</sup> Legal scholars have documented such errors in contexts outside criminal justice. In administrative law, where computer-assisted legal reasoning is the primary form of benefits assessment, the translation of welfare laws into computer code has caused several problems. For example, programmers embedded rules into code in Colorado’s automated food stamp and Medicaid eligibility determinations that simply did not exist in the authorizing statutes and that actually violated state and federal law.<sup>176</sup>

Bugs arise in the criminal context as well. For example, the software used to calculate sentences under the federal guidelines (ASSYST) had inaccuracies that went uncorrected for long periods—a primary reason it was discontinued in the 1990s.<sup>177</sup> Likewise, critics of red light cameras in the United States argue that the systems are “susceptible to bugs or hackers” or could “fail to fairly and properly translate” traffic law “into computer code.”<sup>178</sup> And in the Fourth Amendment context, the Supreme Court has repeatedly addressed (and upheld) the legality of searches that were the product of computer error, such as

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171. See Starr, *supra* note 126, at 803; Feeley & Simon, *supra* note 117, at 461.

172. See *supra* note 128 and accompanying text.

173. An amusing, if disturbing, artistic representation of the mistranslation from legal to machine code is the surrealistic play-turned-movie *One Way Pendulum* (Woodfall Film Productions 1965), in which an eccentric insurance clerk builds an electronic courtroom that interprets all language—including idioms—literally, resulting in the trial of his son for murder, with the primary evidence being that he wears black clothes.

174. See Ben Lindbergh, *Rise of the Machines?*, GRANTLAND (Nov. 8, 2013), <http://grantland.com/features/ben-lindbergh-possibility-machines-replacing-umpires/> [<https://perma.cc/5KDA-B4YC>].

175. Several plane crashes have also been blamed on a combination of machine error and automation complacency by a human pilot. See MINDELL, *supra* note 24, at 267.

176. See Citron, *supra* note 115, at 1268.

177. See, e.g., Steven R. Lindemann, Commentary, *Published Resources on Federal Sentencing*, 3 FED. SENT’G REP. 45, 45–46 (1990); see also U.S. SENT’G COMM’N, ANNUAL REPORT—YEAR IN REVIEW (1996) (noting that the 1996 version of the ASSYST 2.1 software would likely be the last).

178. Jay Stanley, *The Three Dimensions of the Privacy Apocalypse*, AM. CIV. LIBERTIES UNION (Nov. 13, 2013, 11:34 AM), <https://www.aclu.org/blog/three-dimensions-privacy-apocalypse> [<https://perma.cc/SU6Z-W4JU>].

outdated arrest warrants that were erroneously kept in the state police database.<sup>179</sup> Related issues have arisen with respect to Apple's "Find My iPhone" App, which has been used in criminal cases to justify seizures of suspects in theft and robbery cases.<sup>180</sup> Because of a glitch in Sprint's location-tracking services, the app was directing numerous people, erroneously, to one man's house in Nevada, prompting him to put a "No Lost Cell Phones!" sign on his door.<sup>181</sup> And a "minor miscode" in STRMix, a probabilistic genotyping program, potentially affected match statistics in several cases in Australia.<sup>182</sup>

These bugs are, of course, ultimately the product of human error in programming and input. But they are errors that are often difficult to discern simply from machine output alone. We know when we finally drive into a ditch after following Google Map or when a robot umpire makes a wild call, but we might not realize an administrative welfare benefits denial is the result of a code error until months or years later, when someone bothers to double check.

## 2. The Man Behind the Curtain

Although the previous section described hidden subjective judgments by algorithm designers and modelers, some apparent "machines" are not machines or algorithms at all; their subjectivities are not merely baked into a program that then drives an otherwise mechanical process, but are actually the product of individualized human judgment or manipulation. In promoting the epistemic authority of proffered evidence, litigants have sometimes put forward evidence falsely labeled as mechanical—the man behind the curtain falsely perceived as the Wizard of Oz.

The polygraph is perhaps the most glaring example we have in American justice of a false machine. Historians have suggested the polygraph be understood as one of many body measuring instruments that "de-emphasize[ ] the operator" in a way that falsely suggests their "incontestable superiority" over human observation.<sup>183</sup> A polygraph is not, in fact, a lie-detecting machine; rather, it simply measures physical characteristics that a human examiner then uses to infer whether the subject is deceptive, based on judgment, experience,

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179. See, e.g., *Florence v. Bd. of Chosen Freeholders*, 132 S. Ct. 1510, 1511 (2012) (holding that a strip search based on a warrant held erroneously in the computer system was legal); *Herring v. United States*, 555 U.S. 135, 135 (2009) (holding that items obtained during an arrest on a warrant that was erroneously held in the computer system were not excludable under the Fourth Amendment); *Arizona v. Evans*, 514 U.S. 1, 6 (1995) (same).

180. See, e.g., *Pickett v. State*, 112 A.3d 1078, 1090 (Md. Ct. Spec. App. 2015); *People v. Banks*, No. B260917, 2015 WL 7568560, at \*2 (Cal. Ct. App. Nov. 24, 2015).

181. See Lawrence Mower, *If You Lose Your Cellphone, Don't Blame Wayne Dobson*, LAS VEGAS REV.-J. (Jan. 13, 2013, 1:59 AM), <http://www.reviewjournal.com/news/las-vegas/if-you-lose-your-cellphone-dont-blame-wayne-dobson> [<https://perma.cc/BF3A-FFQ5>].

182. See David Murray, *Queensland Authorities Confirm 'Miscode' Affects DNA Evidence in Criminal Cases*, COURIER-MAIL (Mar. 20, 2015, 8:34 AM), <http://www.couriermail.com.au/news/queensland/queensland-authorities-confirm-miscode-affects-dna-evidence-in-criminal-cases/news-story/833c580d3f1c59039efd1a2ef55af92b> [<https://perma.cc/3EAP-94BE>].

183. BUNN, *supra* note 10, at 71 (citation omitted).

and physical interaction with the suspect. Where the examiner is a member of law enforcement and an inference of deception may lead to incarceration, the state exerts control over the “mechanical” outcome in a way that becomes largely invisible. The state’s “power disguises itself by disappearing into its architecture.”<sup>184</sup> It is precisely the skill of the examiner that most determines the polygraph’s error rate; there is little dispute that, on their own, heart rate, blood pressure, and skin conductance are poor proxies for deception.<sup>185</sup> In the hands of a skilled examiner who has undergone robust training and certification requirements, the polygraph does not fare poorly at all, at least compared to other types of evidence routinely admitted or to the jury itself, for that matter.<sup>186</sup> The point here is that the polygraph should be judged for what it is—subjective examiner testimony, aided by machine-measured data—and not as a “lie detector,” to be fetishized or feared because it is a “trial by machine.”

Like the polygraph, a photograph can also be the product of individualized subjective judgment, even beyond the already subjective calls embedded in camera and photography design, such as lens and filter. Courts and litigants in the early days of photography appeared to recognize the medium’s manipulability, conditioning admission on the photographer himself testifying about the image-generating process and certifying its accuracy.<sup>187</sup> Now, so long as a photograph is not obviously doctored and a witness authenticates it as accurately depicting what it represents, courts “readily accept” it and accord it “substantial faith to the reliability of the photographic process.”<sup>188</sup> Yet photography is highly susceptible to manipulation,<sup>189</sup> capable of being “doctored or altered”<sup>190</sup> or even mimicked by computer design.<sup>191</sup>

The problem arises with other crime-detecting machines as well. In probabilis-

184. William Bogard, *Simulation and Post-Panopticism*, in *ROUTLEDGE HANDBOOK OF SURVEILLANCE STUDIES* 30, 31 (Kirstie Ball et al. eds., 2012).

185. See *United States v. Scheffer*, 523 U.S. 303, 333–34 (1998) (Stevens, J., dissenting); *United States v. Piccinonna*, 885 F.2d 1529, 1540 (11th Cir. 1989) (Johnson, J., concurring in part and dissenting in part) (observing that “the level of skill and training of the examiner” is of utmost importance in determining “the reliability of the results” (citations omitted)).

186. See Shniderman, *supra* note 39, at 434 (acknowledging that many scholars argue that the polygraph is no more unreliable than other forms of forensic evidence routinely admitted).

187. See Jennifer L. Mnookin, *The Image of Truth: Photographic Evidence and the Power of Analogy*, *YALE J.L. & HUMAN.* 1, 39 (1998); see also Mnookin, *supra*, at 40 n.143 (citing cases in which courts required the testimony of someone familiar with the subject matter depicted by the photograph).

188. Madison, *supra* note 155, at 714–15.

189. See, e.g., Zachariah B. Parry, Note, *Digital Manipulation and Photographic Evidence: Defrauding the Courts One Thousand Words at a Time*, 2009 U. ILL. J.L. TECH. & POL’Y 175, 175–76 (2009); Karen D. Williams, Comment, *Disparity in Copyright Protection: Focus on the Finished Image Ignores the Art in the Details*, 58 AM. U. L. REV. 169, 172 (2008) (“With advances in design and photography software, the lines between photography and graphic design are blurring.”); Raphael Winick, *Intellectual Property, Defamation and the Digital Alteration of Visual Images*, 21 COLUM.-VLA J.L. & ARTS 143, 150 (1997) (“[C]omputers can now eliminate many of the inconsistencies and other internal clues that had betrayed previous methods of altering visual images.”).

190. *Scott v. Harris*, 550 U.S. 372, 378 (2007).

191. See, e.g., *Ashcroft v. Free Speech Coal.*, 535 U.S. 234, 254–55 (2002) (noting that virtual child pornography is often so realistic that it is indistinguishable—even by experts—from actual photographs).

tic genotyping software, some programs allow an analyst to see the comparison reference—the suspect’s sample and case-relevant information—before completing his analysis.<sup>192</sup> This loophole opens up an otherwise automated process, devoid of subjectivity based on case information, to individualized contextual bias.<sup>193</sup> Breath machines, too, have a history of being susceptible to manipulation; courts expressed concern about the reliability of early breath machines in part based on reports that officers could manipulate their dials—“Dial-a-Drunk”—to make a sober driver appear impaired.<sup>194</sup> And some actuarial instruments for assessing culpability or dangerousness in sentencing or mental health hearings, intended to bring objectivity to such assessments, include numerical “scores” that are based on a clinician’s own individualized assessment of the subject’s glibness, grandiosity, and other subjective variables. Such variables may be highly relevant, but a decision based on them is not mechanical.

In the sentencing guidelines context, the people behind the curtain are the prosecutors and police who make charge-and-arrest decisions. Guidelines were intended to bring uniformity to sentences between judges and within a judge’s own docket, but their existence has created opportunities for prosecutors to charge cases creatively in a way that triggers whatever precise sentence they believe is just.<sup>195</sup> That charging decision, in turn, is entirely discretionary, save any internal memoranda creating charging norms among prosecutors themselves.<sup>196</sup> Similarly, although mandatory minimum sentencing appears on its face to be a uniform means of punishing certain categories of offenders, black offenders are more likely than similarly situated white offenders to be charged in a way that triggers mandatory minimums.<sup>197</sup> Even police officers have discretion to determine sentencing under the guidelines, as they consciously and precisely design “buy-bust” or “fake-stash-house-robbery” sting operations to trigger certain mandatory minimums or sentencing enhancements based on quantity and type of narcotic or drug involved, and on whether the operation involves a conspiracy.<sup>198</sup>

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192. See Perlin Letter, *supra* note 164, at 3.

193. See generally Itiel E. Dror & Greg Hampikian, *Subjectivity and Bias in Forensic DNA Mixture Interpretation*, 51 SCI. & JUST. 204, 204–08 (2011) (demonstrating the biasing effect of case-specific factual information on mixture interpretation by DNA analysts).

194. See JEANNE SWARTZ, AM. PROSECUTORS RESEARCH INST., BREATH TESTING FOR PROSECUTORS: TARGETING HARDCORE IMPAIRED DRIVERS 11 (2004).

195. See, e.g., Máximo Langer, *Rethinking Plea Bargaining: The Practice and Reform of Prosecutorial Adjudication in American Criminal Procedure*, 33 AM. J. CRIM. L. 223, 279 (2006).

196. See, e.g., BIBAS, *supra* note 118, at 41–42 (discussing the vastness of prosecutorial discretion).

197. See M. Marit Rehavi & Sonja B. Starr, *Racial Disparity in Federal Criminal Sentences*, 122 J. POL. ECON. 1320, 1323–24 (2014).

198. See, e.g., Bruce Hay, *Sting Operations, Undercover Agents, and Entrapment*, 70 MO. L. REV. 387, 390–91 (2005) (describing buy-bust operations); Brad Heath, *ATF Uses Fake Drugs, Big Bucks To Snare Suspects*, USA TODAY (June 28, 2013, 11:26 AM), <http://www.usatoday.com/story/news/nation/2013/06/27/atf-stash-houses-sting-usa-today-investigation/2457109/> [<https://perma.cc/H757-9ZJ2>] (explaining fake stash houses).

The converse of the “man behind the curtain” problem—“false humanization”—exists as well. The mere fact that a mechanical process involves a layer of human intervention does not mean that the human is exercising complex individualized judgment entirely independent of the machine. Human operators or audiences interacting with machines tend too often to “defer to the wisdom of algorithms,”<sup>199</sup> developing what technology scholars call “automation complacency.”<sup>200</sup> As a result, they cannot take over for the machine when it errs or fails, which it will inevitably do. For example, human pilots that are used to relying on autopilot programs are forgetting how to fly, leading to unnecessary crashes.<sup>201</sup> And although everyone knows not to drive into a ditch or drive the wrong way on a one-way road, many drivers lose “situational awareness”<sup>202</sup> once they start following the instructions of satellite-enabled maps, forgetting that their human judgment is sometimes needed to stay on course. This problem is a cousin of the “black box problem” in the sense that the more inscrutable the machine, the worse the feeling of alienation and the worse the complacency.<sup>203</sup>

Signs of automation complacency are evident in the mechanized criminal adjudication context as well. In forensic latent fingerprint analysis, existing computer models that search for potentially matching fingerprints and then allow an expert to choose among them have actually contributed to contextual bias and misattribution.<sup>204</sup> The computer tends to choose the closest potential hits, meaning the most potentially confounding cases. The expert assumes that one of the cases chosen by the computer must be the source, thus choosing from what appears to be the best fit among them.<sup>205</sup> And to the extent some human judgment could be helpful to TrueAllele’s accuracy, signs of automation complacency have emerged—twelve scientists in New York were recently caught cheating on the TrueAllele qualification test.<sup>206</sup> One of the scientists was on his way to testifying in a criminal case the next day, but was replaced by a supervisor at the last minute, with defense counsel prohibited from inquiring about the scandal before the jury.<sup>207</sup> And in the sentencing context, judges tend to defer to the results of actuarial instruments or to allow the availability of such

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199. CARR, *supra* note 134, at 2.

200. See Raja Parasuraman & Dietrich H. Manzey, *Complacency and Bias in Human Use of Automation: An Attentional Integration*, 52 HUMAN FACTORS 381, 381 (2010).

201. See *id.* at 382.

202. See, e.g., CARR, *supra* note 134, at 43.

203. See Matthew B. Crawford, *Shop Class as Soulcraft*, NEW ATLANTIS, Summer 2006, at 7 (describing new car engines as having a “creeping concealedness,” not unlike “the shimmering, featureless obelisk that so enthralled the cavemen in the opening scene of the movie *2001: A Space Odyssey*. Essentially, there is another hood under the hood.”).

204. See Simon A. Cole, *More Than Zero: Accounting for Error in Latent Fingerprint Identification*, 95 J. CRIM. L. & CRIMINOLOGY 985, 1064–65 n.394 (2005).

205. See *id.*

206. See Brendan J. Lyons, *Cheating Scandal Fouls State Police Test*, ALBANY TIMES UNION (Jan. 17, 2015, 8:26 AM), [www.timesunion.com/news/article/Cheating-scandal-fouls-State-Police-test-6021600.php](http://www.timesunion.com/news/article/Cheating-scandal-fouls-State-Police-test-6021600.php) [<https://perma.cc/WQY8-45HU>].

207. MURPHY, *supra* note 12, at 102.

results to inflate the importance of recidivism risk in their sentence calculation beyond what weight the judge would otherwise give such factors.<sup>208</sup>

### 3. Proxy Drift and the Seduction of Quantification

All rules are over or underinclusive by nature.<sup>209</sup> Some rules governing criminal liability and punishment are underinclusive; for example, maximum penalties on crimes set by legislatures are rules that set a ceiling, rather than a floor, on punishment by judges. Others are overinclusive, broadening rather than narrowing the scope of criminality. Where a proxy is a decently tight, rational fit with the morally blameworthy or dangerous conduct for which it is a proxy, such as with per se DUI alcohol laws, its overinclusiveness may not be unduly offensive to other values, such as accuracy in the form of minimizing false positives.

But as the following examples suggest, determinable proxies for criminality deployed primarily to minimize acquittals of the guilty, rather than as a systematic means of rendering a liability regime more accurate, often tend to be loose or irrational fits. And although other areas of law might tolerate inaccurate proxies, criminal law is a field in which the specter of false positives looms large. For example, “[s]choolboys are taught” that it is “[b]etter that ten guilty persons escape, than that one innocent suffer.”<sup>210</sup> Moreover, a criminal conviction—unlike pronouncements of liability in other areas of law—is unique in that its very grave purpose is to communicate “the moral condemnation of [the] community.”<sup>211</sup> Although low-level regulatory and public welfare “crimes” exist that challenge this norm, they are, for now, a carefully circumscribed and exceptional corner of criminal law. Thus, irrational or overly broad proxies for blameworthiness should concern us a great deal.

In the DUI context, the very definition of the crime has shifted from being “impaired,” a complex fact requiring the jury’s complex individualize moral judgment, to having a BAC of .08%. This proxy itself is not necessarily problematic; .08% has decades of careful epidemiological research to show that driving at .08% BAC increases relative crash risk.<sup>212</sup> But new, per se DUI marijuana laws that attempt to analogize to DUI alcohol laws are highly

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208. Starr, *supra* note 126, at 866–68 (citing literature arguing that decision makers often defer to “scientific models that they do not really understand” and suggesting that actuarial instruments drive judicial sentencing decisions).

209. See generally SCHAUER, *supra* note 21, at 31–34 (discussing the over and underinclusiveness of rules).

210. Alexander Volokh, n *Gilty Men*, 146 U. PA. L. REV. 173, 174 (1997) (quoting 4 WILLIAM BLACKSTONE, COMMENTARIES \*352).

211. Henry M. Hart, Jr., *The Aims of the Criminal Law*, 23 L. & CONTEMP. PROBS. 401, 406 (1958); see also BIBAS, *supra* note 118, at xxiv (“Criminal justice, more than almost any other area of law, is morally freighted in the popular imagination, and its moral significance is linked closely to its legitimacy.”).

212. The most dramatic increase is at .15%, but the threshold has been reduced over the years, especially during the 1970s–80s. See Roth, *supra* note 72, at 870–72.

problematic. Before the recent wave of legalization, states defined DUI marijuana either through a subjective impairment standard or a zero-tolerance approach, based on the illegality of the drug.<sup>213</sup> After legalization, zero-tolerance laws no longer work. Instead, policymakers in several states have attempted to analogize to .08% and define DUI marijuana numerically, establishing legal thresholds for THC in the blood.<sup>214</sup> Yet, unlike the linear and predictable relationship between BAC and increased relative crash risk, no such relationship exists between similar crash metrics and THC blood levels; to the extent such studies do exist, they suggest that drivers with only THC in their blood are not responsible for a disproportionate number of fatal automobile accidents.<sup>215</sup> Passage of such irrational laws, however well-intended, reflects a narrow focus on reducing false negatives and a succumbing to, what Sally Merry has referred to as, the “seduction of quantification”<sup>216</sup>—seeking a number for the sake of measurability—at the expense of a dramatically high false-positive rate.

The sentencing guidelines are also an example of the “fuzzy math” that occurs when the search for a numerical proxy is motivated by a one-sided desire to combat leniency rather than systematically combat inaccuracy. In operationalizing its desire to ensure that new prison sentences under the guidelines would not be lower than past average sentences, the Sentencing Commission committed a glaring error: it averaged parole board decisions since 1977 as a “numerical anchor” for the new mandatory ranges for all punishment.<sup>217</sup> In looking only to average sentences given by parole boards to imprisoned offenders, the Sentencing Commission included in its calculations only those sentences that had a number attached—that is, periods of incarceration. It completely and irrationally ignored sentences of probation.<sup>218</sup> As a result, sentences were dramatically increased nearly overnight: the average time served by a federal prisoner rose from thirteen to forty-three months.<sup>219</sup> Similarly, in fashioning mandatory ranges for theft and fraud, the Commission used “amount of loss” as a proxy for blameworthiness, leading to perverse results, such as life in prison for sympathetic first-time offenders employed by companies that happened to

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213. See, e.g., ARIZ. REV. STAT. § 28-1381 (2012) (indicating zero tolerance for driving under the influence). The Arizona Supreme Court has since made clear that the zero tolerance law applies only to THC and its impairing metabolites. See *State ex rel. Montgomery v. Harris*, 346 P.3d 984, 985 (Ariz. 2014).

214. See Roth, *supra* note 72, at 882–84.

215. *Id.* at 887–88, 897–912.

216. See generally SALLY ENGLE MERRY, *THE SEDUCTIONS OF QUANTIFICATION: MEASURING HUMAN RIGHTS, GENDER VIOLENCE, AND SEX TRAFFICKING* (forthcoming 2016) (exploring the distorting effects of the quest for measurable indicators in the context of human rights).

217. See U.S. SENT’G COMM’N, *SUPPLEMENTAL REPORT ON THE INITIAL SENTENCING GUIDELINES AND POLICY STATEMENTS* 22 (1987).

218. Adelman, *supra* note 125, at 297 (citation omitted).

219. *Id.* (citation omitted).

be publicly traded.<sup>220</sup>

#### B. PRESSURES ON “SOFT” VALUES

Section II.A made the case that the contingent, results-oriented approach to mechanized criminal justice has predictably allowed automation pathologies to go unchecked, threatening the very objectivity and accuracy allegedly motivating mechanization’s rise in the first place. But there are other costs to pursuing mechanization with a narrow focus on detecting more crime, convicting the guilty, and punishing the blameworthy. These costs include threats to other systemic values—dignity, equity, and mercy—our system should, and purports to, safeguard. The virtue of these values is perhaps harder to define and quantify than accuracy, which is all the more reason they might be inadvertently set aside in the pursuit of “truth.” But they are still virtues that have a pedigreed history in American criminal justice.

The violation of these principles may even be inadvertent. Once a state has reduced a complex social problem to a key determinable element, “[e]verything that interfere[s] with the efficient production of the key [element]” tends to be “implacably eliminated” from the decision-making process, leading to value distortion.<sup>221</sup> In his recent book *Automation and Us*, Nicholas Carr uses the example of a robot vacuum that does not distinguish dust bunnies from crickets: some people, if sweeping the floor manually, would spare a cricket’s life; but in delegating our vacuuming to a robot, we abdicate moral decisions about life or death.<sup>222</sup>

#### 1. Dignity

A recent report on mass incarceration by the National Research Council set forth principles that it viewed as necessary to a just penal system.<sup>223</sup> One was “citizenship,” which was defined to include “a minimum standard of human dignity.”<sup>224</sup> The report cited numerous legal and correctional organizations in

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220. *See id.* at 303 n.59 (“Under the Guidelines, it may well be that all but the most trivial frauds in publicly traded companies may trigger sentences amounting to life imprisonment . . .” (citing *United States v. Ebbers*, 458 F.3d 110, 129 (2d Cir. 2006))).

221. Thus, although a society may have a preexisting commitment to human rights, premised on benevolent aims in its problem-solving attempts, it may inadvertently end up violating human rights once it starts down the path of simplification. Scott uses the example of Tanzania, where an attempt to account for and register the citizenry for purposes of unity and social control became an aggressive and sometimes violent regime of forced villagization. *See* SCOTT, *supra* note 113, at 223.

222. *See* CARR, *supra* note 134, at 185.

223. *See* NAT’L RESEARCH COUNCIL, *supra* note 18, at 320–33. The National Research Council acts as the research arm of the prestigious National Academy of Sciences, a private, nonprofit institution that routinely works with United States government officials on issues of policy informed by science. *See Overview: NAS Mission*, NAT’L ACAD. OF SCI., <http://www.nasonline.org/about-nas/mission/> [https://perma.cc/D4LJ-2KNB] (last visited Jan. 26, 2016).

224. NAT’L RESEARCH COUNCIL, *supra* note 18, at 327–28.

the United States that also have identified dignity or humanity as a value.<sup>225</sup> Thomas Hobbes even believed in a “right to resist” punishment and a right to “self-preservation” that was inherent in being human.<sup>226</sup> Although the term “dignity” does not appear in the Constitution, the Supreme Court has nodded to it from time to time,<sup>227</sup> most recently to condemn prison overcrowding in *Brown v. Plata*.<sup>228</sup> The Court has also condemned invasions of suspects’ bodies to produce evidence in ways that are contrary to dignity. In *Rochin v. California*, the Court admonished police officers who had forcibly induced an inmate to vomit morphine capsules he had swallowed, recognizing that “breaking into the privacy” of the suspect’s body does “more than offend some fastidious squeamishness or private sentimentalism,” it “shocks the conscience.”<sup>229</sup> In doing so, the Court noted that decisions like this reveal the need for human judges, concluding that “constitutional adjudication is [not] a function for inanimate machines.”<sup>230</sup>

As discussed in Part I, law enforcement has deployed gadgetry both to decipher and discipline the body of the criminal and to surveil and regulate the multiplicity of bodies found in a population. Such gadgetry, therefore, runs a particular risk of invading privacy and degrading a subject’s humanity. Indeed, perhaps the most famous judicial decision about the polygraph invoked the concept of personhood in excluding its results from trial. Justice Linde of the Oregon Supreme Court—in concurring with the exclusion of polygraph results in a case where the parties had stipulated to its admission—opined that use of the machine violated the very humanity of its subjects. Whatever its reliability, he wrote, the polygraph violates the principle that “parties and the witnesses are treated as persons to be believed or disbelieved by their peers rather than as electrochemical systems to be certified as truthful or mendacious by a machine.”<sup>231</sup>

But other body-invading gadgets long deployed in the criminal context have taken much longer to face judicial scrutiny. Take the penile plethysmograph (PPG), an instrument that purports to measure a man’s sexual arousal based on the volume of his erection while watching sexually stimulating images.<sup>232</sup> The

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225. See *id.* at 328–29 (citing AM. BAR ASS’N, ABA STANDARDS FOR CRIMINAL JUSTICE, TREATMENT OF PRISONERS 201 (3d ed. 2011) (declaring that prisoners should not be subject to “harassment” or “disparaging” treatment)).

226. Alice Ristorph, *Respect and Resistance in Punishment Theory*, 97 CAL. L. REV. 601, 605 (2009).

227. See, e.g., *Furman v. Georgia*, 408 U.S. 238, 273 (1972) (Brennan, J., concurring) (punishment should not be “degrading to human dignity”).

228. 131 S. Ct. 1910, 1928 (2011) (“Prisoners retain the essence of human dignity inherent in all persons. Respect for that dignity animates the Eighth Amendment prohibition against cruel and unusual punishment.”).

229. 342 U.S. 165, 172 (1952).

230. *Id.* at 171–72.

231. *State v. Lyon*, 744 P.2d 231, 238 (Or. 1987) (en banc) (Linde, J., concurring).

232. See Jason R. Odeshoo, *Of Penology and Perversity: The Use of Penile Plethysmography on Convicted Child Sex Offenders*, 14 TEMP. POL. & CIV. RTS. L. REV. 1, 2 (2004).

PPG was originally created by Czech psychiatrist Kurt Freund in the 1950s as a means of studying homosexuality;<sup>233</sup> in recent years, however, the machine has been used by law enforcement to test whether paroled sex offenders continue to be attracted to minors. In a particularly sympathetic case, the Second Circuit vacated a probation requirement that required an offender submit to PPG testing, noting that the condition had no rehabilitative purpose, was an affront to the offender's "humanity," and appeared to have been imposed simply because it was "standard" to do so.<sup>234</sup> In the meantime, however, the practice continues elsewhere.<sup>235</sup>

The most troubling aspect of these cases is not that a probation department would choose to subject a man to such a bizarre, demeaning procedure. Rather, it is that the procedure was "standard," that the mere existence of the machine was justification enough to use it on the bodies of criminals, and that once it produced evidence helpful to parole revocations, no incentive existed to scrutinize the implicit shift in values that took place to accommodate its use.

Although the *Rochin* Court condemned the pumping of a suspect's stomach, five years later the Court upheld forced blood testing of an unconscious DUI suspect in *Breithaupt v. Abram*.<sup>236</sup> Again, what is noteworthy is not that a majority of the Court ultimately upheld the constitutionality of forced chemical testing of an unconscious man. Rather, it is that the Court deemed the mere fact "that so many States make use of the [blood] tests" for measuring intoxication as belying "the suggestion that there is anything offensive about them."<sup>237</sup> In the DNA context, questionable practices—such as "familial searching"<sup>238</sup> of relatives of offenders in DNA databases and use of "rogue" databases that include crime victims, autopsy suspects, and those who have inadvertently shed DNA in public places<sup>239</sup>—have all been justified in part on the circular logic that these practices make DNA typing more useful as a crime-solving tool and that intrusive biometric databases already exist.<sup>240</sup>

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233. Kurt Freund, *Reflections on the Development of the Phallometric Method of Assessing Erotic Preferences*, 4 ANNALS OF SEX RESEARCH 221, 223 (1991).

234. See *United States v. McLaurin*, 731 F.3d 258, 263 (2d Cir. 2013) (citation omitted).

235. See, e.g., *United States v. Dotson*, 324 F.3d 256, 261 (4th Cir. 2003) (upholding the use of PPG testing as consistent with federal statutory law (citing 18 U.S.C. § 3583(d) (2012))); Jason Molinet, *Ex-NFL Star Darren Sharper To Undergo Bizarre Penile Testing as Part of Plea Deal in Serial Sex Assault Case*, N.Y. DAILY NEWS (Apr. 10, 2015, 10:10 AM), <http://www.nydailynews.com/news/crime/darren-sharper-subject-penile-plethysmograph-testing-article-1.2180158> [<https://perma.cc/S8WR-5F8Z>] (discussing Sharper's Arizona case).

236. 352 U.S. 432, 436–37 (1957).

237. *Id.* at 437 n.3.

238. See Erin Murphy, *Relative Doubt: Familial Searches of DNA Databases*, 109 MICH. L. REV. 291, 291, 297–300 (2010) (discussing the mechanics of the "familial searching" process and arguing against the process because of "equality, accuracy, privacy, racial discrimination, and democratic accountability" concerns).

239. MURPHY, *supra* note 12, at 168.

240. See, e.g., *Maryland v. King*, 133 S. Ct. 1958, 1968 (2013) (acknowledging that DNA databases are reasonable because similar databases are an "expanding technology already in widespread use throughout the Nation"); Transcript of Oral Argument at 35, *King*, 133 S. Ct. 1958 (No. 12-207)

## 2. Equity and Mercy

The American criminal justice system is designed with safety valves in mind—“circuitbreaker[s] in the State’s machinery of justice.”<sup>241</sup> At least in theory, every level of the criminal system allows room for the exercise of so-called “equitable” discretion: the discretion not to document or record criminal acts, not to arrest, not to charge, not to convict, and not to punish according to “strict legal justice” because doing so would be unjust, considering the individualized circumstances.<sup>242</sup> Adjudication is “intended to be equitably individualized.”<sup>243</sup> The virtue of equitable discretion stems from the reality that criminal laws are by nature overinclusive and not intended to be fully enforced. Indeed, our system would literally cease to function under a regime of total enforcement. The overinclusiveness of law is inevitable; law cannot be captured through statute or judicial opinion in a perfectly particularized manner, and there is thus no dispute that the law as written does not perfectly capture “justice.” Thus, equitable discretion is not understood by moral philosophers as a flouting of the law, but as a necessary part of making it whole; that is, equity “may be regarded as a ‘correcting’ and ‘completing’ of legal justice.”<sup>244</sup> Logically, then, the more potentially overbroad a rule of criminal liability and punishment, the greater the need for equity.<sup>245</sup>

The history of American criminal justice, as well as mainstream moral philosophy, also suggests an important role for “mercy” by juries and judges in tempering criminal liability and punishment. Unlike equity, which is a necessary part of rendering overinclusive laws just, mercy is leniency granted by the grace of private persons beyond what justice alone demands or even allows. When a judge is merciful, he “imposes . . . a hardship less than [the offender’s] just deserts.”<sup>246</sup> Martha Nussbaum describes it as “gentleness going *beyond* due proportion”<sup>247</sup> and although it moves beyond justice, “mercy seasons justice.”<sup>248</sup> It is an “important moral virtue,”<sup>249</sup> one that shows compassion and a shared humanity; it “helps to check” our “narrow and self-involved tenden-

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(statement of Alito, J.) (describing the case as “perhaps the most important criminal procedure case . . . in decades”).

241. *Blakely v. Washington*, 542 U.S. 296, 306–07 (2004).

242. See Nussbaum, *supra* note 20, at 93 (“[P]articular judgments, superior in flexibility to the general dictates of law, should bend round to suit the case.” (citation omitted)).

243. Josh Bowers, *Legal Guilt, Normative Innocence, and the Equitable Decision Not To Prosecute*, 110 COLUM. L. REV. 1655, 1723 (2010).

244. Nussbaum, *supra* note 20, at 93 & n.19 (explaining that equity is part of justice, specifically that “[e]quity is putting law into the condition to which it aspires in the first place”).

245. See generally Bowers, *supra* note 243 (explaining the pedigreed concept of equitable discretion and exploring prosecutors’ general lack of expertise in the factors relevant to its exercise).

246. Jeffrie G. Murphy, *Mercy and Legal Justice*, in JEFFRIE G. MURPHY & JEAN HAMPTON, *FORGIVENESS AND MERCY* 162, 166 (1998).

247. Nussbaum, *supra* note 20, at 97 (emphasis in original) (discussing Aristotle).

248. WILLIAM SHAKESPEARE, *THE MERCHANT OF VENICE*, act 4, sc. 1 (Jay L. Halio ed., Oxford Univ. Press 2008) (1993).

249. Murphy, *supra* note 246, at 176.

cies.”<sup>250</sup> And it is a virtue our history embraces. In colonial days, when most felonies were punishable by death, juries often convicted defendants of lesser crimes—often at the prompting of judges—simply to spare them death or when justice would otherwise demand it based on their conduct.<sup>251</sup> Mercy is alive and well in our pardon and clemency systems, in jury nullification, and in decisions by prosecutors and police to look the other way—not because prosecution or arrest would be unjust, but out of pity for a fellow sympathetic human being.<sup>252</sup>

The public recognition of the need for equity and mercy in American criminal justice, and the potential for mechanization to threaten it, is evident in the indignant reactions to suggestions over the years, particularly in the heady early days of artificial intelligence, to replace jurors and judges with robots or computers. In 1983, a computer journal floated the suggestion of replacing criminal jurors with robots, prompting a critic to respond: “Where would freedom of the press be . . . if John Peter Zenger had been tried by a robot jury?”<sup>253</sup> And in responding to Harold Spaeth’s famous study that predicted thirty-three out of thirty-four Supreme Court decisions over a two-year stretch, a 1974 editorial titled “Computerized Justice” declared that “[t]he day judges and justices, whatever their human failings, give way to the machines is the day society comes apart. . . . When it comes to being judged, we’ll take our chances before a human being every time.”<sup>254</sup>

Although robot juries and judges are far from a reality, the state’s use of mechanization to close loopholes in detection, conviction, and punishment of the legally guilty places obvious pressure on the system’s ability to safeguard equity and mercy in several respects. First, authoritative proof itself may make the exercise of mercy rarer. Scholars have speculated that jury nullification might become a rare event if proof of guilt becomes increasingly certain through the use of DNA or neuroscience technologies.<sup>255</sup> When a jury nullifies in a typical case, nothing about the general “not guilty” verdict signals whether the acquittal is based on extralegal considerations or on a belief in legal

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250. *Id.*

251. See BIBAS, *supra* note 118, at 6–9, 23–24.

252. See, e.g., *United States v. Acosta*, 149 F. Supp. 2d 1073, 1075–76 (E.D. Wis. 2001) (discussing a criminal defendant’s right to a general verdict and the fact that special verdict forms are disfavored in criminal cases).

253. Tindall, *supra* note 170, at 65. Zenger, a subversive journalist in colonial America, was the victim of a political prosecution after he printed an unflattering report of a colonial governor, but was saved by a jury who nullified notwithstanding Zenger’s clear technical guilt on libel charges. Truth was not a defense to libel at the time. See *The Trial of John Peter Zenger*, U.S. NAT’L PARK SERV., <http://www.nps.gov/feha/learn/historyculture/the-trial-of-john-peter-zenger.htm> [<https://perma.cc/T6UH-HNYU>] (last visited Jan. 26, 2016).

254. *Computerized Justice*, VICTORIA ADVOCATE, Sept. 13, 1974, at 4A; see generally KATJA FRANKO AAS, SENTENCING IN THE AGE OF INFORMATION: FROM FAUST TO MACINTOSH 63–105 (2005) (discussing a trend towards “computerised justice”).

255. See Julie Seaman, *Black Boxes: fMRI Lie Detection and the Role of the Jury*, 42 AKRON L. REV. 931, 932, 938 (2009) (speculating that as neuroimaging-based lie detection becomes more reliable, jury nullification may decrease); see also Roth, *supra* note 89, at 1693 (noting that jury instructions on the definitive nature of DNA or other scientific proof in a given case might discourage nullification).

innocence. The more authoritative proof becomes, the more obvious it will be that an acquittal is the product of nullification. And, of course, the shift toward streamlining through low-level proxy offenses that do not trigger the right to a jury trial has rendered less frequent the exercise of equitable and merciful discretion by fact finders. A judge might want to nullify, but unlike the jury, he is not a black box. He must place his factual findings on the record in open court, subject to appellate review.

The shift away from nullification in cases involving authoritative proof may be normatively desirable overall; juries nullify for all sorts of morally repugnant reasons, and frequent nullification would arguably do violence to the rule of law. These concerns may be heightened where the proof of legal guilt is overwhelming, rendering instances of nullification more obvious. Nonetheless, Justice Linde certainly seemed to think that the jury should have the chance to play its role in the “central myth” of a criminal trial without being hamstrung by a mechanical lie detector, however reliable.<sup>256</sup> In any event, the shift is worth noting so that we do not close other safety valves assuming that nullification will safeguard equity and mercy in an era of increasingly authoritative proof.

One form of authoritative proof—the “red light camera”—offers a quirky but illuminating example of how the elimination of safety valves can be a latent, inadvertent consequence of the coupling of authoritative proof of guilt with a mechanical liability regime offering no safety valve in charging or punishment. In the first years after the daguerreotype’s invention in 1839, courts were already concerned that the new medium would render the jury obsolete. By “both promis[ing] and threaten[ing] to provide authoritative knowledge,” photographs “both promised and threatened to eliminate human judgment from the process of legal fact-finding.”<sup>257</sup> In the twenty-first century, the red light camera has proven these concerns prescient. Despite their vast numbers,<sup>258</sup> red light cameras have faced passionate criticism from certain portions of the American public, being labeled “trial by machine”<sup>259</sup> or “robo-tickets.”<sup>260</sup> The director of the New Jersey American Civil Liberties Union (ACLU) complained that “[i]f I’m speeding because my wife is going into labor, or I’m speeding because I’m drunk as a skunk, *that distinction can’t be made by a machine.*”<sup>261</sup> Ultimately, this concern is one sounding in equity and mercy, and it has gained traction: ten states have banned red light cameras and thirteen others prohibit the use of

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256. *State v. Lyon*, 744 P.2d 231, 238 (Or. 1987) (en banc) (Linde, J., concurring).

257. Mnookin & West, *supra* note 16, at 376 (emphasis added).

258. As of January 2016, 439 communities in the United States have red light cameras and 139 have speed cameras. See *Printable List of Cities with Red Light and Speed Cameras*, INS. INST. FOR HIGHWAY SAFETY, HIGHWAY LOSS DATA INST., <http://www.iihs.org/iihs/topics/laws/printablelist?print-view> [https://perma.cc/H4AG-RH44] (last visited Jan. 27, 2016).

259. See, e.g., Romano, *supra* note 159 and accompanying text.

260. Dennis Romero, *Dreaded Red Light Camera Tickets Are Legit, California High Court Rules*, L.A. WEEKLY (Dec. 11, 2013, 12:44 PM), <http://www.laweekly.com/news/dreaded-red-light-camera-tickets-are-legit-california-high-court-rules-4174342> [https://perma.cc/LT48-CBTA].

261. Romano, *supra* note 159 (emphasis added).

speed cameras, although with narrow exceptions.<sup>262</sup> Other states have bills pending to defund their use<sup>263</sup> or have rules prohibiting law enforcement or insurance companies from treating violations caught on camera as “points” against one’s license or rates.<sup>264</sup> And the most recent federal transportation authorization bill prohibits states from using federal funds for such systems.<sup>265</sup>

The red light camera system is not necessarily an example of an offensive mechanical liability regime. Indeed, it may save money and lives or prove a powerful tool for debiasing ticketing decisions otherwise made by human officers. These are empirical questions beyond the scope of the project. Red light tickets are also not offenses bearing the stigma of criminality. If there were an omniscient machine that detected every driver on the road with a BAC exceeding .08%—such as an ignition device that could cut the engine<sup>266</sup>—and automatically sent a criminal trial summons in the mail, the public may well be outraged. A similar result may occur if Virginia’s controversial reckless driving law, which imposes criminal punishment for exceeding eighty miles per hour, were subject to a regime of automatic arrest and punishment.<sup>267</sup> But to be sure, some noncriminal automated enforcement regimes are clearly troubling in their overinclusiveness. For example, certain American school districts use automated attendance systems to refer students to truancy court automatically when the student has accrued a certain number of absences. As one disability rights group’s complaint alleges, the automatic enforcement aspect of the system results in “no room for correction if an absence should be excused because it is related to a student’s disability.”<sup>268</sup> Ultimately, even the most seemingly innocuous proxies systematically overpunish if they are set with an eye toward minimizing false negatives and are triggered and executed in an automated way without a safety valve.

Numerous other mechanical proxies exist in the law that, if coupled with authoritative proof or a mandatory policy of prosecution or punishment, would jeopardize equity and mercy. With respect to some of them, this coupling has

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262. See *Speed and Red Light Camera Laws*, GOVERNORS HIGHWAY SAFETY ASS’N (Jan. 2016), [http://www.ghsa.org/html/stateinfo/laws/auto\\_enforce.html](http://www.ghsa.org/html/stateinfo/laws/auto_enforce.html) [<https://perma.cc/28Q8-DA5W>].

263. See, e.g., *Illinois Bills Seek to Ban Red-Light Cameras Drivers Hate*, CHI. SUN-TIMES (Feb. 12, 2015, 5:16 PM), <http://chicago.suntimes.com/news-chicago/7/71/365165/illinois-bills-seek-ban-red-light-cameras-drivers-hate> [<https://perma.cc/3AUL-W4FZ>].

264. See *Red Light Running*, INS. INST. FOR HIGHWAY SAFETY (May 2015), [http://www.iihs.org/iihs/topics/laws/automated\\_enforcement?topicName=red-light-running](http://www.iihs.org/iihs/topics/laws/automated_enforcement?topicName=red-light-running) [<https://perma.cc/7SNV-BGJA>].

265. See Moving Ahead for Progress in the 21st Century Act, Pub. L. No. 112-141, § 1533, 126 Stat. 405, 584 (2012).

266. Existing ignition “interlock” devices condition the starting of a motor on an alcohol-free breath result. See Jim Gold, *Curbing Drunken Drivers: Should Ignition Interlock Be Required on Every Car?*, NBC NEWS (Jan. 5, 2012, 8:49 AM), [http://usnews.nbcnews.com/\\_news/2012/01/05/9957132-curbing-drunken-drivers-should-ignition-interlock-be-required-on-every-car](http://usnews.nbcnews.com/_news/2012/01/05/9957132-curbing-drunken-drivers-should-ignition-interlock-be-required-on-every-car) [<https://perma.cc/4QL8-AFED>].

267. See VA. CODE ANN. § 46.2-862 (2012). Under the Virginia statute, drivers will also be found guilty of reckless driving for exceeding the posted speed limit by twenty miles per hour or more. See *id.*

268. Letter from Dustin Rynders et al., Disability Rights Tex., to Cindy Swain, Tex. Educ. Agency, Div. Fed. & State Educ. Policy, at 2 n.3 (May 27, 2015), <http://youthlaw.org/wp-content/uploads/2015/05/TEA-FTAS-Force-Out-Complaint-Final-May-27-2015.pdf> [<https://perma.cc/Z9TZ-7DPP>].

already occurred. Take statutory rape laws, viewed by many as a rational use of proxies in substantive criminal law. Although the paradigmatic offenders targeted by these laws centuries ago were older men preying upon young girls, this may no longer be the case. For example, 58% of those prosecuted for statutory rape in California in 1999 were under the age of twenty, and several states even prosecute consensual sex where both parties are underage.<sup>269</sup> Under some statutory rape laws, legal scholars have recently pointed out that even an adult victim of nonconsensual rape by an underage perpetrator could be found guilty.<sup>270</sup> The concern over such an absurd prosecution is not hypothetical; in certain instances, adult females with severe cognitive limitations have been charged with statutory rape under circumstances that suggest they themselves did not consent.<sup>271</sup> These controversial prosecutions appear to be the result of prosecutorial charging policies that leave insufficient room for equitable discretion. But the reason such a policy is so problematic is that it is coupled with a mechanical liability regime that has eliminated complex human judgment at the jury stage by using age as a proxy for lack of consent, which would otherwise be a jury issue. One could imagine the same issue arising with other mechanical proxies embedded in state criminal codes, including sentencing enhancements based on the victim's age,<sup>272</sup> distinctions in larceny and destruction of property liability based on amount of loss,<sup>273</sup> distinctions between drug infractions and drug misdemeanors based on quantity of drug,<sup>274</sup> tax evasion liability based on amount of withheld tax,<sup>275</sup> and laws criminalizing underage drinking.<sup>276</sup>

Finally, restraints on judicial discretion clearly threaten a layer of equitable and merciful discretion that the system would otherwise have. It is hard to argue with the sentiment that the federal sentencing guidelines—literally capable of execution by computer program—rendered judges no more than “automa-

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269. See Kate Sutherland, *From Jailbird to Jailbait: Age of Consent Laws and the Construction of Teenage Sexualities*, 9 WM. & MARY J. WOMEN & L. 313, 316 (2003) (citation omitted); see also Charles A. Phipps, *Misdirected Reform: On Regulating Consensual Sexual Activity Between Teenagers*, 12 CORNELL J.L. & PUB. POL'Y 373, 391 (2003).

270. See Russell L. Christopher & Kathryn H. Christopher, *The Paradox of Statutory Rape*, 87 IND. L.J. 505, 506–09 (2012) (discussing *Heynard v. State*, 689 So. 2d 239 (Fla. 1996)).

271. See Christopher & Christopher, *supra* note 270, at 547–49.

272. See, e.g., CAL. PENAL CODE § 368(2)(B), (3)(B) (West 2014) (enhancing sentence by five or seven years if the victim is seventy years of age or older).

273. See, e.g., *id.* § 487(b)(3) (grand larceny if theft by agent, servant, or employee totals \$950 in the aggregate over a twelve-month period); *id.* § 594(b)(1) (increasing vandalism fines for damage exceeding \$400).

274. See, e.g., CAL. HEALTH & SAFETY CODE § 11357(b)–(d) (West 2014) (distinguishing marijuana infractions based on whether possessed amount is above or below 28.5 grams).

275. See, e.g., CAL. REV. & TAX CODE § 19701(a) (West 2014) (assigning fines for falsifying documents that result in a tax liability of \$15,000 or more).

276. See, e.g., CAL. BUS. & PROF. CODE § 25662(a) (West 2014) (classifying underage drinking as a misdemeanor, punishable by fines or community service).

tons”<sup>277</sup> when they were binding. Nonetheless, frequent attempts by the judiciary to critique the guidelines as “machine justice” or “push button justice” before *Booker* all failed.<sup>278</sup> To the supporters of guidelines and mandatory minimum sentencing, the restraint was a feature, not a bug. Nonetheless, studies with real federal juries found that jurors’ recommended sentences were significantly lower than the guidelines’ range,<sup>279</sup> further confirming that the push for uniformity led to overpunishment. In any event, as with other discretionless regimes, the removal of judicial discretion to exercise equity and mercy becomes more problematic as the rest of the system, before it reaches the judge, becomes more mechanical as well.

### C. MISSING MECHANIZATION

A final, and ironic, problematic consequence of the results-oriented deployment of mechanization is the lack of mechanization in areas where it is not as clearly a tool for reducing false negatives but still would be a powerful tool for increasing accuracy and objectivity in criminal adjudication.

#### 1. Debiasing Testimony

The first context in which the uneven focus of lawmakers, law enforcement, and interest groups on false negatives may have stifled mechanization as a potentially more powerful debiasing tool is in the rendering of proof. The lack of a systematic, nationwide policy of body-worn cameras on every police officer in the United States is a failure of imagination and policy. Numerous issues would have to be resolved in terms of cost, preservation, and discovery procedures, as well as ensuring that officers could not determine when and where to turn off the cameras. But there seems to be a bipartisan consensus growing for their deployment, and the fact that it has taken from the 1980s, when videotape first became available, seems, in part, a predictable result of a contingent approach to mechanization. The failure to grant defendants greater access to potentially authoritative and searchable forms of proof, such as DNA

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277. See STITH & CABRANES, *supra* note 127, at 169; see also Lee Anne Fennell, *Between Monster and Machine: Rethinking the Judicial Function*, 51 S.C. L. REV. 183, 208 (1999) (describing the guidelines as turning judges into “justice machine[s]”).

278. See, e.g., *People v. Kincaid*, 316 N.E.2d 220, 225 (Ill. 1974) (objecting to sentencing scheme, with the defendant referring to the imposition of a mandatory minimum as “computerized justice”); Editorial, *House Without Mercy*, WASH. POST, Apr. 4, 2003, at A20 (referring to an amendment restricting judicial discretion as “mechanical justice”); Editorial, *Machine Justice*, WASH. POST, June 6, 1953, at 6 (describing proposed mandatory minimum sentences “machine justice”); Editorial, *The Injustice of Push-Button Justice*, L.A. TIMES, Apr. 28, 1974, at F2 (calling mandatory minimum sentences “mechanical, push-button justice”); George Robeson, Comment, *Heading Toward Push-Button Justice*, LONG BEACH PRESS-TELEGRAM, Sept. 12, 1995, at B9 (calling California’s three-strikes law “push-button justice”); Carolyn Susman, *Computerized Justice Frustrates Judge Cohen*, PALM BEACH POST, Mar. 6, 1989, at 1B (quoting a judge that referred to state sentencing guidelines as “[c]omputerized justice”).

279. See, e.g., James S. Gwin, *Juror Sentiment on Just Punishment: Do the Federal Sentencing Guidelines Reflect Community Values?*, 4 HARV. L. & POL’Y REV. 173 (2010).

databases and facial recognition software, to buttress third-party perpetrator defenses or to check the accuracy of statistics used by law enforcement to prove identification from pattern match evidence, is also a predictable consequence of state-run data collection; “[I]ike gluttons, the government will collect everything it can; and like misers, it will keep the data and its operations secret.”<sup>280</sup>

The absence of automation in match calling and match statistic reporting in forensic pattern evidence disciplines other than DNA has also increased the likelihood of false positives, or at least a falsely inculpatory portrayal of evidence, before juries. Subjective human judgment in forensic fingerprint and toolmark analysis potentially leads to errors in at least three ways. The first is through contextual bias, when human analysts’ match calls are affected by irrelevant case-related information or having seen the reference sample.<sup>281</sup> As the National Academy of Sciences concluded in a 2009 report, “there is no good evidence to indicate that the forensic science community has made a sufficient effort to address the bias issue.”<sup>282</sup>

Second, subjective judgment can cause error through inaccuracies in match calling based on imprecision and human error. For example, toolmark analysts (along with experts in similar disciplines like facial recognition) use a “look method” to determine, based on their professional judgment and experience, whether a projectile matches a particular firearm. As one researcher noted in a patent application for his toolmark analysis software, the “look method” is “very timeconsuming,” requiring a “high level of training and skill” for credibility.<sup>283</sup> In latent print analysis, examiners must make difficult subjective judgment calls about whether deviations between two samples are true differences or artifacts of a compromised sample, such as a smudge. One researcher on bias in forensic examinations found that only 16% of fingerprint experts observed the same number of minutiae when analyzing the same latent mark twice, and nearly half had three or more differences between one examination and the other.<sup>284</sup>

Third, subjective forensic pattern identification analysis can erroneously infer individualization based on false assumptions or ignorance about the variability of patterns in the population. Fingerprint, toolmark, and facial recognition examiners describe the significance of a match in highly subjective terms, such as “reasonable degree of ballistic certainty” or declaring a match “to the exclusion of all other firearms in the world.”<sup>285</sup> At best, toolmark analysis

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280. Jane Bambauer, *Collection Anxiety*, 99 CORNELL L. REV. ONLINE 195, 205 (2013) (citing Jack M. Balkin, *The Constitution in the National Surveillance State*, 93 MINN. L. REV. 1, 17 (2008)).

281. See, e.g., Itiel E. Dror et al., *Cognitive Issues in Fingerprint Analysis: Inter- and Intra-Expert Consistency and the Effect of a “Target” Comparison*, 208 FORENSIC SCI. INT’L 10, 16–17 (2011).

282. NAT’L RESEARCH COUNCIL OF THE NAT’L ACADS., *supra* note 82, at 8–9 n.8.

283. Automated Sys. and Method for Toolmark Analysis, U.S. Patent No. 7,212,949 B2, at [1–2] (filed Aug. 31, 2005) (issued May 1, 2007) [hereinafter Automated Sys. Patent].

284. See Dror, *supra* note 281, at 16–17.

285. See DANIEL L. CORK ET AL., BALLISTIC IMAGING: COMMITTEE TO ASSESS THE FEASIBILITY, ACCURACY, AND TECHNICAL CAPABILITY OF A NATIONAL BALLISTICS DATABASE 84 (2d ed. 2008) (citations omitted).

involves a human examiner who “is generally unable to quantify his or her level of certainty or the probability of making an erroneous conclusion.”<sup>286</sup>

Expert interpretive software, with the proper safeguards to ensure transparency and accuracy in its code and assumptions, would help minimize all three sources of human error. First, computer software could be programmed in a way to exclude all irrelevant case-related information from the inquiry and to reveal details in a sequential fashion. To the extent case-related information should be considered at some point, it could be added at the end after a more objective assessment of the evidence has been completed. Second, computer programs and databases could help uniformly label characteristics of patterns using set criteria—DNA genetic markers, fingerprint “whorls” and “loops,” and tool ridges and projectile striations—making the declaration of a match more objective. Companies have secured patents for automated programs to call toolmark matches based on three-dimensional imaging.<sup>287</sup> Third, software and databases could be used to help determine the statistical significance of a match by assessing the variability and rarity of various characteristics in the population at large. Much work on population statistics has been done in the DNA context, which is why DNA analysts are able to report match probabilities to juries, rather than simply statements of individualization “to a reasonable degree of certainty.” If properly subjected to reliability safeguards and human checks, automated interpretation software seems to hold promise for making expert interpretation of pattern software more accurate, which is a win for the state and defendant alike.

## 2. Debiasing Juries

Although the state’s focus on reducing false negatives has led to checks on the jury’s complex human judgment in the form of mechanical proxies for criminality, it has stifled the development of mechanization that might be seen as intruding upon the jury’s determination of credibility. It is helpful to remember the lofty, if unrealistic, goals of those in the artificial intelligence movement who first suggested “robot juries.” In 1983, the General Robotics Corporation began a national campaign to give litigants in federal criminal cases the option of having their cases adjudicated by an “electronic jury” rather than human jury. In an apparent near-parody of its position, the company nonetheless touted a robot jury’s fairness and objectivity:

We are attempting to replace the warm, living, human juries with a cold, dead, robot jury so that citizens may have a plain and speedy adjudication or arbitration of their disputes . . . . Our slogan is ‘Equal Justice Under the Law,’ which will be a welcome relief to anyone who has ever had a trial by jury. . . .

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286. Automated Sys. Patent, *supra* note 283, at [2].

287. See, e.g., *id.* at [7]; see generally CORK, *supra* note 285, at 194–95 (noting new proprietary algorithms that employ three-dimensional toolmark imaging).

We want to quantify what has been an emotional, prejudicial process and make it objective.<sup>288</sup>

Although a true robot jury would be problematic for reasons discussed earlier, a ban on mechanization that might help debias the jury's credibility determinations is a mistake. The hurdle, for now, is that courts have almost universally rejected so-called lie-detection evidence of credibility at trial on grounds that it is unreliable or that, even if reliable, it would usurp the jury's credibility-determining role. In its most recent pronouncement on the polygraph, a plurality of the Supreme Court has opined both that jurors "are presumed to be fitted" for "[d]etermining the weight and credibility of witness testimony" by "their natural intelligence and their practical knowledge of men and the ways of men,"<sup>289</sup> and that, regardless, a "fundamental premise of our criminal trial system is that '*the jury is the lie detector.*'"<sup>290</sup>

Although both of these objections deserve serious treatment, they have answers,<sup>291</sup> and neither should stop lawmakers or courts from thinking creatively about how results of credibility aids might be incorporated, in a less tyrannical way, as an anti-bias measure at trial. Indeed, there is little dispute that the jury is quite inaccurate at lie detecting.<sup>292</sup> Among its other frailties, the jury is tainted by implicit racial bias; the fact that a vast percentage of white spectators found homicide victim Trayvon Martin's girlfriend Rachel Jeantel uncredible as a witness may well be an example of a well-documented cross-racial "demeanor gap"<sup>293</sup> rather than a result of the jurors' "natural intelligence."<sup>294</sup> Nor is it the case that the public necessarily believes in the jury's ability to ferret out lies. The myth that "lie detecting is what our juries do best"<sup>295</sup> may no longer be tenable in the age of science-based convictions and exonerations. Nor is the jury particularly skilled at determining when witnesses are sincere but mistaken, as recent empirical studies on eyewitness identification testimony have shown.<sup>296</sup>

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288. David Needle, *Computer Dispenses Justice: Impartial Terminal, Not Jury, Gives Verdict*, INFOWORLD, Feb. 28, 1983, at 1, 6 (quoting both a company spokesperson and the creator of the program).

289. *United States v. Scheffer*, 523 U.S. 303, 313 (1998) (quoting *Aetna Life Ins. Co. v. Ward*, 140 U.S. 76, 88 (1891)).

290. *Id.* at 313 (quoting *United States v. Barnard*, 490 F.2d 907, 912 (9th Cir. 1973) (emphasis added)).

291. See *supra* Section I.A.1.

292. See Fisher, *supra* note 56, at 707.

293. See generally Joseph W. Rand, *The Demeanor Gap: Race, Lie Detection, and the Jury*, 33 CONN. L. REV. 1, 3 (2000) ("[J]urors attempting to make the credibility determinations entrusted to them by our judicial system are likely to be regularly misled by the deceitful witness or mistakenly distrustful of the truthful one." (citation omitted)).

294. *Scheffer*, 523 U.S. at 313.

295. Fisher, *supra* note 56, at 577.

296. See Max Minzner, *Detecting Lies Using Demeanor, Bias, and Context*, 29 CARDOZO L. REV. 2557, 2573 n.81 (citing studies showing that jurors overvalue eyewitness identification testimony).

Some courts have expressed concern that polygraph examiner testimony would have a mesmerizing and therefore prejudicial effect on the jury because of the polygraph's apparent mechanical provenance. As Part II's discussion of the "man behind the curtain" phenomenon made clear, this concern is understandable. But if the polygraph's status as "machine" is a social construct to begin with, one would think it could be deconstructed as well. Judges might allow expert testimony about skin conductance and its limited association with deception with clear jury instructions to prevent abuse. One legal scholar in the 1980s offered guidelines for helping jurors use Bayesian reasoning to incorporate polygraph results into their credibility determinations without being overly swayed by them.<sup>297</sup> With such safeguards, polygraph examiner testimony would not be substantially different in this respect from expert testimony on eyewitness identifications, false confessions, psychiatric disorders, gang practices, or other issues in which jurors must draw inferences based on "base rates" (such as, for example, studies estimating what percentage of cross-racial eyewitness identifications are erroneous). Courts could also selectively admit polygraph examiner testimony only when offered by a defendant, as some scholars have suggested.<sup>298</sup> After all, some automated deception detectors have different error rates depending on whether they are detecting the truth or lies.<sup>299</sup> One defense neuroimaging expert testified in a recent admissibility hearing that No-Lie MRI had only a 7% false negative rate.<sup>300</sup> And states could condition admission of polygraph results on disclosing how many tests the defendant took to eliminate the concern that a defendant can simply undergo as many tests as it takes to get an exculpatory result. If we care about reducing false positives (wrongful convictions) and have reason to believe the jury is a particularly incompetent lie detector, it is not obvious why modest lingering reliability concerns about the polygraph should preclude admission entirely when safeguards to educate the jury are in place.

### 3. Debiasing Judges

There is no question that human judges—if left to their own devices completely—often sentence in biased and irrational ways based on factors that reflect racial bias or other considerations irrelevant to blameworthiness or

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297. See James A. Finder, *Statistical Implications of Reasoning with Polygraph Evidence: Developing Instructions for the Trier of Fact*, 3 *CARDOZO L. REV.* 581, 582 (1982).

298. See, e.g., Seaman, *supra* note 255, at 939 ("[I]t is unacceptable to sacrifice truth—to convict a factually innocent defendant, say—in order to preserve some notion of legitimacy or protection of jury fact-finding . . ."); George C. Thomas III, "Truth Machines" and Confessions Law in the Year 2046, 5 *OHIO ST. J. CRIM. L.* 215, 227 (2007).

299. See, e.g., Tommaso Fornaciari & Massimo Poesio, *Automatic Deception Detection in Italian Court Cases*, 21 *ARTIFICIAL INTELLIGENCE & LAW* 303, 320 (2013) (describing text-analysis software that accurately detected lies about 53% of the time and the truth about 75% of the time).

300. See *United States v. Semrau*, No. 07-10074 MI/P, 2010 WL 6845092, at \*4 (W.D. Tenn. June 1, 2010).

risk.<sup>301</sup> If mechanization could enhance judicial decision making to make it truly more uniform and reflective of legitimate purposes of punishment, its mechanical nature should not deter the system from using it. State sentencing guidelines, for example, appear to have increased uniformity of sentences without dramatically and immediately increasing prison growth in a way that seems unreflective of community norms.<sup>302</sup> The Arnold Foundation's Public Safety Assessment—discussed in Part I—is a good candidate for a rational-expert system that could be used in both sentencing as well as the bail context. Significantly, the assessment avoids reliance on the very types of irrelevant factors that scholars have found objectionable in the evidence-based sentencing context and has decreased incarceration rates with no negative effect on public safety. Yet, so long as influential sentencing guidelines and evidence-based sentencing guarantee harsher penalties, there will surely be little political will, at least on the part of state legislatures, to fund, implement, and much less require, a validated public safety assessment for sentencing.

Nor has there been significant interest in the United States in so-called "Sentencing Information Systems" (SISs). SISs attempt to increase uniformity within individual judges' decision making by showing judges, using computer software, what they or other judges have done in similar cases<sup>303</sup> SISs would add a layer of uniformity to judges' assessments of moral blameworthiness, and not simply risk assessment, the latter of which critics claim is overemphasized by the use of actuarial instruments. Yet to date, only one jurisdiction in the United States has attempted to use an SIS.<sup>304</sup> There may be serious questions about such programs, including automation bias concerns, but they are popular in other countries. Indeed, judges in some nations have endorsed computer-assisted sentencing as a means of maintaining judicial independence rather than

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301. See, e.g., Sonja B. Starr & M. Marit Rehani, *Mandatory Sentencing and Racial Disparity: Assessing the Role of Prosecutors and the Effects of Booker*, 123 YALE L.J. 2, 4–6 (2013) (finding that racial disparities after *United States v. Booker*, 543 U.S. 220 (2005), did not increase but continue to persist following expansion of judicial discretion).

302. See Langer, *supra* note 195, at 278–79 & n.219.

303. See, e.g., Richard V. de Mulder & Helen M. Gubby, *Legal Decision Making by Computer: An Experiment with Sentencing*, 4 COMPUTER L.J. 243, 245 (1983); Maria Jean J. Hall et al., *Supporting Discretionary Decision-Making with Information Technology: A Case Study in the Criminal Sentencing Jurisdiction*, 2 U. OTTAWA L. & TECH. J. 1, 4 (2005). These programs seek to "build a decision support system for sentencing," which assists a human judge in rendering a just sentence. See Uri J. Schild, *Criminal Sentencing and Intelligent Decision Support*, 6 ARTIFICIAL INTELLIGENCE & LAW 151, 151 (1998) (emphasis in original).

304. See Michael A. Wolff, *Missouri's Information-Based Discretionary Sentencing System*, 4 OHIO ST. J. CRIM. L. 95, 99 n.19 (2006) (stating that the purpose behind Missouri's system is similar to that motivating SISs—that is, to provide judges with sentencing-information from judges in similar cases) (citation omitted). Judges have not widely used the system, however. See Ryan W. Scott, *How (Not) to Implement Cost as a Sentencing Factor*, 24 FED. SENT'G REP. 172, 174 (2012) (reporting that only 13.5% of Missouri judges "regularly" use information from the state database when considering plea agreements) (citation omitted).

succumbing to the “mechanistic complexity” of sentencing guidelines.<sup>305</sup>

### III. TOWARD A “BIOTECHNIC” CRIMINAL ADJUDICATION

This Part suggests guiding principles for a systems approach to machine-age criminal adjudication that consciously seeks to promote man–machine collaboration wherever it would best advance systemic values, and that allows man and machine to help each other be their best “selves.” The goal is an approach that is “biotechnic,” Lewis Mumford’s term for a paradigm in which mechanization enhances preexisting human goals, rather than a “megatechnic” approach that pursues mechanization either for its own sake, or alternatively, for the narrowly defined strategic interests of the powerful.<sup>306</sup>

#### A. TRIAL BY CYBORG: A SYSTEMS APPROACH

David Brooks recently suggested that “[o]ur identity as humans is shaped by what machines and other animals can’t do.”<sup>307</sup> One might think, then, that the way to design a criminal adjudication system for the future would be to simply list the comparative advantages of humans and machines and delegate tasks to each accordingly: credibility determinations are rendered by the jury, punishment is rendered by computer, and so on. In 1951, the National Research Council developed a heuristic called “Fitts’ List” that attempted to reduce to a set of rules the “cognitive niche”<sup>308</sup> of men and machines—and the list is precisely as one would expect: humans are good at complex, individualized judgment requiring tacit understanding and knowledge, whereas machines are good at power, speed, uniformity, and precision.<sup>309</sup>

But as the previous Parts make clear, humans are sometimes their best selves when checked by or intertwined with machines, and vice versa. Researchers have written in the systems engineering context about the dangers of so-called

305. See Cyrus Tata & Neil Hutton, *Beyond the Technology of Quick Fixes: Will the Judiciary Act to Protect Itself and Shore Up Judicial Independence? Recent Experience from Scotland*, 16 *FED. SENT’G REP.* 67, 67 (2003).

306. See generally MUMFORD, *supra* note 22 (warning against the blind pursuit of mechanization and discussing the inherent dangers of a society that pursues mechanization for its own sake). I recognize that Mumford himself spent little time theorizing man–machine interaction and was critiqued for overlooking cybernetics. See, e.g., DAVID A. MINDELL, *BETWEEN HUMAN AND MACHINE: FEEDBACK, CONTROL, AND COMPUTING BEFORE CYBERNETICS* 1–3 (2002). Nevertheless, I invoke Mumford’s concept of “biotechnics”—and not simply the cyborg metaphor—to capture Mumford’s vision of a system that views instruments and algorithms as a means of advancing preexisting commitments to core criminal justice values.

307. David Brooks, Op-Ed, *Our Machine Masters*, *N.Y. TIMES*, Oct. 30, 2014, at A31.

308. Richard N. Langlois, *Cognitive Comparative Advantage and the Organization of Work: Lessons from Herbert Simon’s Vision of the Future* 23 (U. Conn., Dep’t Econ. Working Papers, No. 200220, 2002).

309. See Mary (Missy) Cummings, *Man Versus Machine or Man + Machine?*, *IEEE INTELLIGENT SYS.*, Sept./Oct. 2014, at 2–3 (citing NAT’L RESEARCH COUNCIL, *COMM. AVIATION PSYCHOL., HUMAN ENGINEERING FOR AN EFFECTIVE AIR-NAVIGATION AND TRAFFIC-CONTROL SYSTEM* (Paul M. Fitts ed., 1951)).

“MABA-MABA” lists.<sup>310</sup> Instead, man–machine interface designers should focus on what men and machines can do when enhanced by the other, and then ask, “how do we make them get along better?”<sup>311</sup> Historian David Mindell writes that “[t]he most advanced (and difficult) technologies are not those that stand apart from people, but those that are most deeply embedded in, and responsive to, human and social networks.”<sup>312</sup>

Accordingly, we could think of our system as one of “trial by cyborg”—bionic experts, juries, and judges, rendering enhanced, humane justice. The “trial by cyborg” concept may seem utopian, given the way that mechanization has been coopted by the state in the past. But as Donna Haraway writes in her *Cyborg Manifesto*, we should perhaps be skeptical of any “demonology of technology” that denies us the ability to imagine a “[c]yborg imagery” that might “suggest a way out of the maze of dualisms” that has, after all, led to oppressive criminal justice practices.<sup>313</sup>

The concept of “trial by cyborg” should hopefully reveal a new host of possibilities for enhancing testimony and jury and judge decision making. Instead of taking every task now completed by a human bailiff, clerk, probation officer, or parole board member and asking how it might be *replaced* by automation, we could be taking each task and asking how it might be *humanely enhanced* by automation. Perhaps we should use expert systems with databases, much like those incorporated in SISs, to assist in determining the admissibility of scientific evidence,<sup>314</sup> a context that appears to have a pro-prosecution bias.<sup>315</sup> Perhaps we should use text analysis software, now in beta testing in Europe, as another data point to help jurors determine whether a witness is lying.<sup>316</sup> Perhaps we should embrace the work of IBM, the creator of the computerized Jeopardy champion “Watson,” for building supercomputers that offer real-time fact checking of statements made by witnesses on the stand.<sup>317</sup>

The ultimate wisdom of these suggestions will depend on whether such automation could be incorporated into decision making while safeguarding against automation pathologies, along with all the usual policy questions of whether the increase in accuracy or uniformity or efficiency is worth the cost to other values. The point for now is that by shedding “MABA/MABA” thinking,

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310. See, e.g., Dekker & Woods, *supra* note 23, at 240.

311. See *id.*

312. MINDELL, *supra* note 137, at 9.

313. Haraway, *supra* note 33, at 316.

314. See, e.g., Pamela S. Katz, *Expert Robot: Using Artificial Intelligence to Assist Judges in Admitting Scientific Expert Testimony*, 24 ALB. L. J. SCI. & TECH. 1, 3 (2014).

315. See, e.g., Susan D. Rozelle, *Daubert Schmaubert: Criminal Defendants and the Short End of the Science Stick*, 43 TULSA L. REV. 597, 597–98 (2007).

316. See Fornaciari & Poesio, *supra* note 299, at 303.

317. See Robert C. Weber, *Opinion, Why ‘Watson’ Matters to Lawyers: Computer’s Artificial Intelligence Could Be a Boon to Legal Research—and Might Even Come in Handy in the Courtroom*, NAT’L L.J. (Feb. 14, 2011), <http://www.nationallawjournal.com/id=1202481662966/Why-Watson-matters-to-lawyers> [<https://perma.cc/R9R2-EQ8H>].

we allow ourselves to consider biotechnic enhancements of adjudication without clinging to romanticized or archaic notions of what humans can do on their own—or fear-based notions of what machines might do on their own.

## B. ENSURING OBJECTIVITY AND ACCURACY

### 1. Front-End Design and Regulatory Safeguards

Our criminal justice system should systematically implement front-end regulatory safeguards to better ensure fairness and accuracy of mechanical and algorithmic proof. In the Fourth Amendment context, Daphna Renan has discussed the need for administrative safeguards to assess the impact of surveillance on privacy, given the disconnect between the realities of modern surveillance and the transactional “one-off” nature of Fourth Amendment analyses.<sup>318</sup> The extensive regulation of breath-alcohol machines, with requirements that follow best practices guides from scientists, offers a glimpse of the potential for regulatory safeguards.<sup>319</sup> Other examples would be protocols requiring that videotaped confessions use particular camera angles and lighting settings or remove officer discretion in terms of timing of the recording, prohibition on editing, and the like.

With respect to software evidence, states could also develop, design, and disclose safeguards, such as tests for pursuing intentional miscoding by “rogue programmers”<sup>320</sup> and—regardless of whether source codes remain proprietary—enable “[r]uthless public scrutiny”<sup>321</sup> of the assumptions and value judgments underlying software and actuarial instruments, above and beyond existing validation studies. Software could also be designed with interfaces that make explicit, and delegate to the human operator, the value choices being made. David Mindell uses the example of a Google-automated car in which a human driver could turn a knob labeled “risk” to go faster to get to a meeting on time, tolerating the higher likelihood of an accident.<sup>322</sup> One could imagine a similar

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318. See generally Daphna Renan, *The Fourth Amendment as Administrative Governance*, 68 STAN. L. REV. (forthcoming 2016) (explaining the need for programmatic probable cause analysis to govern large-scale search policies and algorithms, rather than traditional, transaction-based probable cause analysis).

319. For example, California requires that forensic alcohol analysts be licensed with the state’s Department of Health, 17 CAL. CODE REG. §§ 1215.1(k), 1216(a), 1216.1 (2014), and mandates that technicians run a blank sample once daily that shows less than .01% blood alcohol concentration if the machine is to be used. See *id.* §§ 1220.1–3. The National Highway Transportation Safety Administration prohibits states from using machines other than those listed as approved in the Federal Register. See Conforming Products List of Alcohol Screening Devices, 77 Fed. Reg. 35,747, 35,748 (June 14, 2012).

320. See Jane Huffman Hayes & Jeff Offutt, *Recognizing Authors: An Examination of the Consistent Programmer Hypothesis*, 20 SOFTWARE TESTING, VERIFICATION & RELIABILITY 329, 330 (2010) (discussing the possibility of identifying specific software programmers based on their respective programming styles).

321. See Doremus, *supra* note 139, at 1148 (advocating for public scrutiny as a better check on federal agency action than formal scientific peer review).

322. See MINDELL, *supra* note 137, at 207.

interface for TrueAllele so that operators, litigants, and jurors understand the riskiness of reaching a definitive conclusion with a particularly compromised DNA sample. Such front-end safeguards should be “dynamic” rather than “static,” continually updated by local stakeholders and reviewers in light of new information about the reach and effects of a technology, law enforcement needs, and levels of compliance.<sup>323</sup>

We should also implement best practices and perhaps statutory requirements that combat automation complacency in human operators of, or collaborators with, machines and consumers of machines and machine output. In doing so, we should draw upon newly emerging fields such as ergonomics, “human factors engineering,” and “adaptive automation” to design automation that “injects a dose of humanity into the working relationships between people and computers.”<sup>324</sup> Techniques for ensuring that human judgment is not overborne by machines include “regular feedback,” giving pertinent information “without recommending specific courses of action,” or giving “alternative interpretations, hypotheses, or choices.”<sup>325</sup> For example, one legal scholar suggested that criminal sentencing be bifurcated, with judges rendering a moral blameworthiness-based sentence first, then using actuarial instruments in a second, independent stage to determine conditions of supervised release or to determine which offenders, notwithstanding blameworthiness, might be good candidates for diversion programs.<sup>326</sup> With such safeguards, probability models and measurable information can “provide a framework within which people exercise judgment,” rather than replace such judgment.<sup>327</sup> With the right safeguards, “[v]aluing only what is measurable is not an inevitable consequence of using actuarial methods.”<sup>328</sup>

Our system also needs to implement a systematic check on the state’s tendency toward ineptitude in translating complex judgments about moral blameworthiness into determinable proxies. One solution would be a presumption against machine-measurable numerical proxies or bases for sentencing enhancements unless they are subject to some level of scientific peer review, say, by the National Research Council or the well-regarded, bipartisan National Commission on Forensic Science.<sup>329</sup> It is hard to imagine that the current wave

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323. See Bamberger, *supra* note 144, at 730 (suggesting a “dynamic account” of ensuring algorithmic objectivity in the corporate compliance context, rather than a “static set of external rules” that would likely “result[] only in cosmetic trappings of compliance”) (citation omitted).

324. See CARR, *supra* note 134, at 164–65.

325. *Id.* at 165–66.

326. See Jennifer Skeem, *Risk Technology in Sentencing: Testing the Promises and Perils* (Commentary on Hannah-Moffat, 2011), 30 JUSTICE Q. 297, 299 (2013).

327. Katherine Y. Barnes, *Against Judgment*, 93 CORNELL L. REV. 689, 697 (2008) (reviewing BERNARD E. HARCOURT, *AGAINST PREDICTION: PROFILING, POLICING, AND PUNISHING IN AN ACTUARIAL AGE* (2007)).

328. *Id.* at 696.

329. *But see* Doremus, *supra* note 139, at 1146–47 (noting the limitations of formal scientific peer review). Robust public scrutiny could accompany such review. *See id.* at 1148.

of per se DUI marijuana laws, or federal sentencing enhancements that to this day treat methamphetamine distribution as significantly worse than powder cocaine distribution, would survive such peer review.

To be clear, the answer is not to forego mechanical proxies entirely. Machines can be allies in tackling complex problems not because they make things simpler, but because they enhance our own unique human experience with powers of perception, speed, and precision that humans could not dream of attaining unaided. That is what breath-testing machines did for the crash-risk studies that led to .08% BAC laws, which might be the closest thing American criminal law has to a liability-regime-by-cyborg. That is what the Public Safety Assessment is apparently doing for bail determinations in some cities. And that is perhaps what some new machine, perhaps yet to be invented, will do for the drugged driving problem.

## 2. Back-End Adversarial Safeguards

American criminal procedure and evidence law offers, at least in theory, meaningful ways of ensuring the reliability of human witnesses, from the oath,<sup>330</sup> to the Confrontation Clause,<sup>331</sup> to the hearsay rule,<sup>332</sup> to rules facilitating impeachment, to the federal Jencks Act<sup>333</sup> and its state analogs that require disclosure of prior statements of witnesses for impeachment purposes. But these courtroom safeguards, designed for human witnesses, do little to meaningfully allow defendants to test the reliability of evidence that is not individualized, such as forensic drug reports.<sup>334</sup> As David Sklansky has noted, none of the hundreds of wrongful convictions underlying DNA exonerations in this country appear to have been the result of the inability of a defendant to cross-examine a forensic expert.<sup>335</sup> And such courtroom safeguards also seem an awkward fit for machines themselves.<sup>336</sup> Does an Intoxilyzer printout have “credibility” to be

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330. To be deemed competent to testify in court, a witness must swear an oath. *See, e.g.*, FED. R. EVID. 603. Of course, some witnesses are hearsay-declarants whose statements might be admissible under a hearsay exception even though the statements were not made under oath.

331. The Confrontation Clause of the Sixth Amendment, as currently interpreted by the Supreme Court, prohibits the prosecution from introducing the “testimonial hearsay” of an absent declarant, unless the declarant is unavailable and the defendant had a prior opportunity to cross-examine him. *See Crawford v. Washington*, 541 U.S. 36, 68–69 (2004).

332. *See, e.g.*, FED. R. EVID. 801, 802 (excluding out-of-court statements of declarants to prove the truth of the matter asserted in the statement, with numerous exceptions).

333. *See* 18 U.S.C. § 3500(b) (2012) (requiring disclosure of substantially verbatim prior statements of witnesses on the subject matter of their testimony before they testify, for potential impeachment value).

334. *See, e.g.*, Erin Murphy, *The Mismatch Between Twenty-First-Century Forensic Evidence and Our Antiquated Criminal Justice System*, 87 S. CAL. L. REV. 633, 657 (2014).

335. *See* David Alan Sklansky, *Hearsay's Last Hurrah*, 2009 SUP. CT. REV. 1, 18.

336. *See* Brian Sites, *Rise of the Machines: Machine-Generated Data and the Confrontation Clause*, 16 COLUM. SCI. & TECH. L. REV. 36, 42 (2014) (lamenting that the Confrontation Clause bestows “no right to cross-examine the operators of many modern machines”).

impeached, and is it something that could “confront” the defendant it is “accusing”?

Some defendants in cases involving automated proof have argued that the Confrontation Clause and the rule against hearsay require the disclosure of source code and other materials critical to assessing the reliability of machine output. Scholars, too, have suggested the need to broadly construe the Confrontation Clause as “safeguarding the ability of a defendant to probe and to fight back against the evidence offered against him,”<sup>337</sup> rather than as simply guaranteeing cross-examination and physical confrontation of live witnesses. Under this interpretation, confrontation should require that algorithms used to build a case for arrest, guilt, or punishment must be *open source*, at least to the extent necessary to allow the scientific and legal community to meaningfully scrutinize the otherwise hidden human errors, manipulation, and subjectivities embedded therein.<sup>338</sup> Other researchers have written passionately about the need for open source codes for any computer programs used in scientific research to ensure a minimal level of accessibility and scrutiny.<sup>339</sup> Thus far, however, every court to have addressed the issue has ruled that machine output or source code is not an “assertion” for purposes of the hearsay rule and not “testimonial” for purposes of the Confrontation Clause.<sup>340</sup> Because the accuser is simply a machine rather than a person, neither the Sixth Amendment nor the rule against hearsay has anything to say about the ability to be confronted with the raw data the machine spits out or the code that programmed it in the first place.<sup>341</sup> As one court put it, “an algorithm cannot be cross-examined.”<sup>342</sup>

I address the application of traditional doctrines of impeachment and confrontation to mechanical witnesses in future work. And a detailed treatment of the topic is beyond the scope of this project. Suffice it to say that adversarial testing of machines and algorithms will require meaningful defense and researcher access to materials necessary to test the reliability of algorithms, whether by statutory right or constitutional obligation.

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337. Sklansky, *supra* note 335, at 71.

338. *See also* Murphy, *supra* note 334, at 661 (arguing that criminal defendants should have the ability to meaningfully defend against technologically sophisticated evidence created with the help of private companies, and that “[t]o the extent that private, proprietary information may be at stake, radical transparency may require accommodations—such as gag orders, conditionally admitted evidence, or restrictive disclosure”).

339. *See, e.g.*, Darrel C. Ince et al., *The Case for Open Computer Programs*, 482 NATURE 485, 485 (2012).

340. *See, e.g.*, *People v. Goldsmith*, 326 P.3d 239, 249–50 (Cal. 2014) (holding that photographs, video, data, and time stamps taken by red light cameras were not hearsay and thus could be admitted as evidence).

341. *See* Karen Neville, *Programmers and Forensic Analyses: Accusers Under the Confrontation Clause*, 10 DUKE L. & TECH. R. 1, 9–10 (2011); *see also* Bullcoming v. New Mexico, 131 S. Ct. 2705, 2722 (2011) (Sotomayor, J., concurring).

342. *State v. Melsky*, 2013 WL 1776037, at \*4 (N.J. Super. Ct. App. Div. Apr. 26, 2013).

## C. PROTECTING “SOFT” VALUES

A just system of criminal adjudication in the machine age will also implement systematic checks on threats to dignity, equity, and mercy. This is obviously no easy or simple task, and its full treatment is beyond the scope of this Article. It will surely require drawing from a range of tools, such as constitutional enforcement; judicial opinion writing and shifts in jury instructions; statutory and regulatory safeguards; agency culture shifts through education and hiring practices; and public education and direct action. Solutions might even come from markets or pressure on markets. Someone has to make body-measuring devices, for example. The “Monarch 21 PPG,” an “FDA approved penile plethysmograph” with a butterfly logo on its “convenient carrying case” for stimuli-viewing goggles, is manufactured by Behavioral Technology, Inc. (BTI).<sup>343</sup> The public could pressure BTI not to sell its product for use in probation and parole revocation hearings, just as the public has pressured drug manufacturers not to sell their product to states for use in lethal injection.<sup>344</sup>

One way to check violations of dignity is, perhaps ironically, to expand the scope of a potentially invasive form of mechanization to reach populations that otherwise have a privilege of criminality because they are not currently surveilled under the status quo combination of “hot spot” surveillance and a subjective, “individualized suspicion” framework of policing. Scholars have proposed, for example, random surveillance of high-income neighborhoods<sup>345</sup> or universal DNA databases<sup>346</sup> as tools to remove bias from policing. Unlike the human error that plagues suspicion-based criminal investigation,<sup>347</sup> random error from mechanical processes is “refreshingly democratic.”<sup>348</sup> Along the same lines, Paul Butler has noted that the “electronic nose,” a new device for detecting narcotics, “would have the interesting, and beneficial, potential to equalize drug law enforcement and reduce racial disparities.”<sup>349</sup> Although such suggestions might be inefficient and costly and would need to be checked themselves for input biases,<sup>350</sup> their consideration would lead to more open and

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343. See *Monarch 21 PPG*, BEHAVIORAL TECH., INC., <https://www.btimonarch.com/page.php/monarch21PPG/Monarch-21-PPG.html> [<https://perma.cc/Q9RZ-7SK6>] (last visited Jan. 29, 2016).

344. See Mary D. Fan, *The Supply-Side Attack on Lethal Injection and the Rise of Execution Secrecy*, 95 B.U. L. REV. 427, 429 (2015).

345. See Jane Bambauer, *Hassle*, 113 MICH. L. REV. 461, 507–08 (2015) (advocating randomness in searches); Bernard E. Harcourt & Tracey L. Meares, *Randomization and the Fourth Amendment*, 78 U. CHI. L. REV. 809, 866 (2011).

346. See Andrea Roth, *Maryland v. King and the Wonderful, Horrible DNA Revolution in Law Enforcement*, 11 OHIO ST. J. CRIM. L. 295, 309 (2013).

347. See HARCOURT, *supra* note 117, at 2–3.

348. Jane Bambauer, *Defending the Dog*, 91 OR. L. REV. 1203, 1207 (2013). *But see* Lisa Lit et al., *Handler Beliefs Affect Scent Detection Dog Outcomes*, 14 ANIMAL COGNITION 387 (2011) (arguing that dog handler beliefs that scent was present affected whether dogs alerted on a location).

349. PAUL BUTLER, LET’S GET FREE: A HIP-HOP THEORY OF JUSTICE 156–57 (2009).

350. For example, Erin E. Murphy has argued that a universal DNA database might still lead to inequitable policing practices based on which crime scenes and cases the police chose to collect DNA to begin with. See MURPHY, *supra* note 12, at 260–62.

honest debates about the dignity interest implicated by invasive genetic or photographic surveillance practices.

States could also require agencies seeking funding for, or deployment of, body-measuring devices or surveillance techniques to first submit a dignity impact statement<sup>351</sup> of the likely effect on the dignity of the subject. Such a solution would require thoughtful consideration of how to avoid what administrative law scholars call the “secondary mandate” problem, in which agencies’ compliance with decision process requirements is compromised by their desire to fulfill their primary mission instead.<sup>352</sup> The answers might lie in ensuring independence from law enforcement of the agencies responsible for mechanization’s design, increasing the public transparency of choices, and changing agency culture through hiring criteria or training.

In the absence of an unprecedented legislative shift away from proxy crimes, the safeguarding of human safety valves in liability and punishment will require an increase in the power of other actors—police, prosecutors, juries, and judges—to exercise equitable and merciful discretion.<sup>353</sup> Judges, or the public through constitutional referendum, could more explicitly embrace jury nullification as a legal right, and even disclose potential penalties to jurors,<sup>354</sup> to alleviate pressure to conform in cases involving authoritative proof. Prosecutors should be trained in mental illness, drug addiction, implicit bias in policing, and a host of other factors potentially relevant to the exercise of charging discretion, and could even, as Josh Bowers has suggested, outsource that call to jurors.<sup>355</sup> Only such a systems approach can ensure that the “red light camera problem”—the inadvertent loss of equitable discretion through the modern interplay of rule-based liability and authoritative proof—does not continue to be replicated in a criminal context.

#### D. INTERROGATING AUTOMATION’S ABSENCE

As section II.C explored, the use of machines in crime detection and proof, when automation pathologies are in check, can be a powerful tool for avoiding wrongful convictions based on the type of proof that relies on human witnessing

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351. See Osagie K. Obasogie, *The Return of Biological Race? Regulating Innovations in Race and Genetics Through Administrative Agency Race Impact Statements*, 22 S. CAL. INTERDISC. L.J. 1, 55 (2012) (advocating for the use of “race impact assessments” for biotechnologies that either make claims about the biological significance of race or “disproportionately affect minority communities”).

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

353. See generally BIBAS, *supra* note 118, at 133–65 (proposing various methods to increase public participation in punishment decisions).

354. A judge in Georgia recently told jurors in a robbery case that a guilty verdict on the greatest count would lead to a mandatory life-without-parole sentence, upon learning that no law prohibited the practice of doing so. See Bill Rankin, *Are They Out of Order? DA, Judge Feuding in Fulton*, ATLANTA J.-CONST. (Sept. 10, 2015, 12:03 AM) <http://www.myajc.com/news/news/crime-law/are-they-out-of-order-da-judge-feuding-in-fulton/nnbw4/> [https://perma.cc/4QLS-R3UZ].

355. See Josh Bowers, *The Normative Case for Normative Grand Juries*, 47 WAKE FOREST L. REV. 319, 321 (2012).

and interpretation, such as confessions and eyewitnesses. It can also be a powerful tool for correcting implicit and explicit racial and other bias in juries and judges. A just system of criminal adjudication for the machine age would thus systematically assess whether a form of mechanization is being deployed to its fullest as a debiasing tool. If TrueAllele exists for DNA but no such program exists for toolmarks, or if surveillance cameras exist in certain contexts but not others, why is that, and who benefits from such lack of mechanization or romanticization of unenhanced human judgment? If powerful interests benefit, chances are that some form of equitable surveillance should be considered.<sup>356</sup> Some forms of equitable surveillance are surely necessary already—body-worn cameras, for example—whereas others will make themselves known when the time comes.

### CONCLUSION

When a Wall Street Journal reporter asked A.L.I.C.E.—the Artificial Linguistic Internet Computer Entity—whether “she” would serve on a jury, the computer responded, “I am not so sure if I would like to serve on a jury.”<sup>357</sup> Who can blame her? Moral condemnation of a criminal defendant is, and should be, difficult. According to one historian, humans find it so difficult that the “reasonable doubt” instruction was created to coax hesitant jurors to condemn defendants to die even in the absence of metaphysical certainty.<sup>358</sup> But in a landscape where mechanization has developed in a contingent way skewed toward overpunishment, jurors and judges are being treated as if they need not exercise moral judgment at all. They are being treated, that is, like machines. Although mechanization holds much potential for enhancing accuracy and fairness in adjudication, we should not allow it to eliminate moral condemnation from the equation. Rather, we should harness it to better identify those worthy, or not worthy, of moral condemnation.

Of course, scientists now speak of the inevitability of the so-called “Singularity”—the day computers become smarter than humans.<sup>359</sup> When that day comes, we may well have literal robots as witnesses, jurors, and judges. Indeed, our entire existence might be moot. Until then, however, if we want complex individualized judgment to be a part of criminal adjudication—if we want moral condemnation to retain its rarity and gravity and signaling effect—while also

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356. Cf. FRANK PASQUALE, *THE BLACK BOX SOCIETY: THE SECRET ALGORITHMS THAT CONTROL MONEY AND INFORMATION* 218 (2015) (noting that in the context of corporate crime, “[i]nstead of using surveillance technology against American citizens, the government could deploy it on our behalf”).

357. Jacob Gershman, *Could Robots Replace Jurors?*, WALL ST. J. L. BLOG (Mar. 6, 2013, 1:30 PM), <http://blogs.wsj.com/law/2013/03/06/could-robots-replace-jurors/> [<https://perma.cc/S65V-W9LX>].

358. See JAMES Q. WHITMAN, *THE ORIGINS OF REASONABLE DOUBT: THEOLOGICAL ROOTS OF THE CRIMINAL TRIAL* 12–13 (2008).

359. See Eric Molinsky, *Soon, Computers Will Become More Intelligent Than Us. Then What?*, PUB. RADIO INT’L (Jan. 26, 2014, 4:30 PM), [www.pri.org/stories/2014-01-26/soon-computers-will-become-more-intelligent-us-then-what](http://www.pri.org/stories/2014-01-26/soon-computers-will-become-more-intelligent-us-then-what) [<https://perma.cc/QJ5W-Y9BF>].

harnessing mechanization as a powerful debiasing tool, we will need to embrace a new vision of “cyborg” expert witnesses, juries, and judges. We should reject both a romanticized view of the virtues of unaided human justice and a fetishistic or statist view of the virtues of mechanical justice. As the rise of machines continues, the real “trial by machine” to fear, at least for now, is not that envisioned by paranoid instrument fetishists. Rather, to paraphrase Pogo, we have seen the Machine, and it is Us.