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## Essay

# Revisiting *Dreyfus*: A More Complete Account of a Trial by Mathematics

D.H. Kaye<sup>†</sup>

Courts have struggled with “probability evidence.”<sup>1</sup> A few have tried to expel nearly all quantitative assessments of evidence.<sup>2</sup> Others have propounded complex and arbitrary rules of admissibility.<sup>3</sup> Still others have uncritically, and perhaps un-

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1. By “probability evidence,” I mean quantitative expressions, derived with the aid of the mathematical theory of probability, of the chance that certain events will occur. Such evidence or argument rarely is relevant in itself, but is supposed to assist the judge or jury in evaluating the probative force of facts established by other testimony, such as an apparent match in handwriting characteristics, in blood types, in hair fibers, and so on. For surveys of leading cases of involving probability evidence and efforts to extract useful principles from them, see 1 MCCORMICK ON EVIDENCE § 209, at 904 (Kenneth S. Broun ed., 6th ed. 2006); D.H. Kaye, *The Admissibility of “Probability Evidence” in Criminal Trials* (pts. 1 & 2), 26 JURIMETRICS J. 343 (1986), 27 JURIMETRICS J. 160 (1987) [hereinafter Kaye, *Probability Evidence*]. A deeper analysis can be found in DAVID H. KAYE ET AL., *THE NEW WIGMORE, A TREATISE ON EVIDENCE: EXPERT EVIDENCE* § 12.4 (2004) [hereinafter KAYE ET AL., *THE NEW WIGMORE*].

2. See *State v. Schwartz*, 447 N.W.2d 422, 428–29 (Minn. 1989); *State v. Kim*, 398 N.W.2d 544, 548–49 (Minn. 1987); *State v. Boyd*, 331 N.W.2d 480, 482–83 (Minn. 1983); *State v. Carlson*, 267 N.W.2d 170, 175–76 (Minn. 1978). But see *State v. Bloom*, 516 N.W.2d 159, 167 (Minn. 1994) (creating an exception to the Minnesota rule prohibiting testimony regarding some probabilities for DNA evidence).

3. See, e.g., D.H. Kaye, *The Probability of an Ultimate Issue: The Strange Cases of Paternity Testing*, 75 IOWA L. REV. 75 (1989) (discussing the intricate rules of admissibility that have arisen with respect to paternity testing).

comprehendingly, accepted such assessments.<sup>4</sup> This Essay examines one notorious case that has been said to fall in the last category, the *Dreyfus* case. In a brilliant and influential article published over thirty years ago, Professor Laurence Tribe presented the case as a prime example of the irresistible power of even grossly fallacious mathematical demonstrations to overwhelm a legal tribunal.<sup>5</sup> Not long afterward, Justice Douglas reiterated this view of the extraordinary power of mathematical evidence to confound court and counsel.<sup>6</sup> A distinguished national panel also described the *Dreyfus* case as showing “the ability of mathematical evidence to paralyze critical examination.”<sup>7</sup> And, as the Minnesota Supreme Court attempted for the sixth time to fashion reasonable rules for the admission of expert testimony about DNA evidence,<sup>8</sup> one Justice insisted that

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4. See Kaye, *Probability Evidence* (pt. 2), *supra* note 1, at 163–67. The most recent and notorious abuse of criminal probability evidence occurred in the prosecution of Sally Clark for allegedly murdering her two children. See, e.g., Kevin Barraclough, Book Review, 329 BRIT. MED. J. 177, 177 (2004) (reviewing JOHN BATT, *STOLEN INNOCENCE: A MOTHER'S FIGHT FOR JUSTICE—THE AUTHORISED STORY OF SALLY CLARK* (2004)); A.P. Dawid, *Bayes's Theorem and Weighing Evidence by Juries*, in BAYES'S THEOREM 71, 75 (Richard Swinburne ed., 2002); Stephen J. Watkins, *Conviction by Mathematical Error? Doctors and Lawyers Should Get Probability Theory Right*, 320 BRIT. MED. J. 2, 2–3 (2000).

5. Laurence H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329, 1332–34 (1971).

6. *Hull v. United States*, 404 U.S. 893, 895–96 n.3 (1971) (Douglas, J., dissenting from denial of certiorari). Oddly, *Hull* involved little or no quantified evidence. Justice Douglas would have reversed a smuggling conviction because the government lacked direct evidence that defendants—who were walking on a highway, close to two knapsacks of marijuana, and three-quarters of a mile from “possibly the hottest spot on the Mexican border for smuggling”—had crossed the border with the marijuana. *Id.* at 894. He reasoned that, because the agent's testimony about the “hot spot” was based on “anecdotal experiences in four prior investigations,” it amounted to “statistical evidence” that “[c]ourts have been hesitant to admit . . . because of the ease with which it can be abused.” *Id.* at 895–96.

7. PANEL ON STATISTICAL ASSESSMENTS AS EVIDENCE IN THE COURTS, NAT'L RESEARCH COUNCIL, *THE EVOLVING ROLE OF STATISTICAL ASSESSMENTS AS EVIDENCE IN THE COURTS* 215 (Stephen E. Fienberg ed., 1989). For a more complete description of the panel's work, see D.H. Kaye, *Improving Legal Statistics*, 24 LAW & SOC'Y REV. 1255, 1260–63 (1990). For reviews of psychological research into the alleged tendency of jurors to overvalue probability evidence, see David H. Kaye & Jonathan J. Koehler, *Can Jurors Understand Probabilistic Evidence?*, 154(A) J. ROYAL STAT. SOC'Y 75 (1991); William C. Thompson, *Are Juries Competent to Evaluate Statistical Evidence?*, 52 LAW & CONTEMP. PROBS. 9 (1989).

8. See *State v. Alt*, 505 N.W.2d 72, 72 (Minn. 1993); *State v. Johnson*, 498 N.W.2d 10, 14 (Minn. 1993); *State v. Jobe*, 486 N.W.2d 407, 419–20 (Minn.

“the infamous *Dreyfus* case” proved that if “an erroneous statistical probability plays any significant role in the conviction of an innocent person, the error has not only destroyed the life of the innocent person but has in some sense dehumanized the community.”<sup>9</sup>

The case in question is the court-martial of French Army Captain Alfred Dreyfus at the turn of the nineteenth century.<sup>10</sup> It is a case of such injustice that it toppled a government. But despite its legend in the literature on legal statistics, *Dreyfus* is not a case of mathematics run amok, unchecked and uncomprehended. To the contrary, the defects in the mathematical proof were dramatically exposed, and this evidence did not lead Dreyfus’s judges to condemn him. Accordingly, Dreyfus’s contrived conviction, as intolerable as it was, does not militate against the admission of “probability evidence.”

#### THE DREYFUS CASES: AN OVERVIEW

*Dreyfus* is not a single case, but rather a series of connected military, civil, and criminal proceedings.<sup>11</sup> They began in 1894 with a court-martial that convicted Dreyfus of transmitting military secrets to Germany and sentenced him to life imprisonment on Devil’s Island.<sup>12</sup> The verdict, which was tainted by a secret dossier, fabricated evidence, and widespread anti-Semitism in the French army and populace, became an in-

1992); *State v. Nielsen*, 467 N.W.2d 615, 619–20 (Minn. 1991); *State v. Schwartz*, 447 N.W.2d 422, 428–29 (Minn. 1989).

9. *State v. Bloom*, 516 N.W.2d 159, 173 (Minn. 1994) (Coyne, J., dissenting). The majority of the court held that an expert may testify to the frequency of occurrence of a DNA profile when this frequency is computed according to a “conservative” procedure devised by a committee of the National Research Council. *Id.* at 160–61 (majority opinion) (citing COMM. ON DNA TECH. IN FORENSIC SCI., NAT’L RESEARCH COUNCIL, DNA TECHNOLOGY IN FORENSIC SCIENCE (1992)). Not long after that, a second committee wrote that this “ceiling” procedure was not necessary; in its view, more extreme probabilities could be justified scientifically. COMM. ON DNA FORENSIC SCIENCE: AN UPDATE, NAT’L RESEARCH COUNCIL, THE EVALUATION OF FORENSIC DNA EVIDENCE 35 (1996).

10. Histories of the Dreyfus affair are plentiful and opinionated. A detailed account is given by a Parisian lawyer and professor in JEAN-DENIS BREDIN, *THE AFFAIR: THE CASE OF ALFRED DREYFUS* (Jeffrey Mehlman trans., George Braziller 1986) (1983). A shorter essay that focuses on the legal proceedings is Benjamin F. Martin, *The Dreyfus Affair and the Corruption of the French Legal System*, in *THE DREYFUS AFFAIR: ART, TRUTH, AND JUSTICE* 37 (Norman L. Kleeblatt ed., 1987).

11. See Martin, *supra* note 10, at 40–48.

12. BREDIN, *supra* note 10, at 92–102, 113.

ternational *cause célèbre*.<sup>13</sup> As evidence of Dreyfus's innocence began to mount and as it became known that French military authorities had manufactured additional evidence to keep the case from being reopened, the French army and government were shaken.<sup>14</sup> The discovery of one forgery, purporting to be a letter from an Italian military attaché, prompted the suicide of the colonel working in military intelligence who had prepared it and produced the resignations of the chief of the Army's General Staff and the Minister of War.<sup>15</sup>

France's highest court, the *Cour de Cassation*, sitting en banc as a result of special legislation, vacated the judgment of the military court.<sup>16</sup> After five years of brutal conditions on Devil's Island, Dreyfus returned to a second court-martial.<sup>17</sup> At Rennes in 1899, this court again found Dreyfus guilty of treason.<sup>18</sup> Issuing a compromise verdict referring to extenuating circumstances (and prompting Dreyfus to ask "Since when have there been 'extenuating circumstances' for treason?"), the court sentenced Dreyfus to another five years' confinement.<sup>19</sup> The verdict was so poorly received that within two weeks the President of the Republic pardoned Dreyfus.<sup>20</sup>

After further political upheavals and a War Office report finding that most of the evidence at Rennes either did not relate to Dreyfus or had been altered to make it appear that it did, the *Cour de Cassation* granted a petition for review.<sup>21</sup> In 1906, declaring that no credible evidence of treason ever existed, the court annulled the verdict of the Rennes court-martial.<sup>22</sup> Dreyfus, the man twice convicted of treason, returned to the army and was awarded the cross of the Legion of Honor.<sup>23</sup>

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13. *Id.* at 92-110.

14. *Id.* at 114-20.

15. *Id.* at 328-34.

16. *Id.* at 381-83.

17. *Id.* at 388-97.

18. *Id.* at 427.

19. LOUIS L. SNYDER, *THE DREYFUS CASE: A DOCUMENTARY HISTORY* 335-36 (1973).

20. BREDIN, *supra* note 10, at 433-34.

21. *Id.* at 456-65.

22. Martin, *supra* note 10, at 47 (arguing that this judgment of acquittal, as opposed to remanding the case to the army, was procedurally improper but politically expedient).

23. BREDIN, *supra* note 10, at 481-85.

BERTILLON'S ANALYSIS OF THE *BORDEREAU*

The document that initiated the 1894 prosecution was a letter, known as the *bordereau*.<sup>24</sup> Retrieved from a wastepaper basket in the German embassy, the *bordereau* listed several relatively unimportant documents about French artillery and troops.<sup>25</sup> French intelligence officers decided that Dreyfus was the culprit. (Why not? He was a Jew and an Alsatian.)<sup>26</sup> They collected and contrived evidence to support this thesis and ignored or suppressed all contrary evidence.<sup>27</sup> The resulting dossier was sufficient to convince the French government to convene the 1894 court-martial.<sup>28</sup>

Handwriting experts contacted by the army and the Ministry of Justice studied the *bordereau* and reached conflicting conclusions.<sup>29</sup> The most notorious analysis came from Alphonse Bertillon, the head of the Bureau of Identification in the Paris Police Department.<sup>30</sup> Bertillon claimed that Dreyfus wrote the *bordereau* in a way that would make it look like a forgery of his own handwriting.<sup>31</sup> Bertillon advanced this "self-forgery" theory at both of Dreyfus's military trials and also at the criminal libel trial of the novelist, Emile Zola, for his vitriolic public letter, *J'accuse*, which denounced the army for "one of the greatest iniquities of the century" in its handling of the *Dreyfus* case.<sup>32</sup>

To Bertillon, the proof of "self-forgery" was scientific, incontestable and infallible—in a word, *géométrique*.<sup>33</sup> According to the leading account in U.S. legal literature, this proof included computations of the probabilities of selected coincidences "between the lengths of certain words and letters in [the *bordereau*] and the lengths of certain words and letters in correspondence taken from Dreyfus'[s] home."<sup>34</sup> Furthermore, from "[o]bscure lexicographical and graphological 'coincidences'

24. *Id.* at 59–69.

25. *Id.*

26. *Id.*

27. *Id.* The actual author was a French officer named Esterhazy who was providing information to the German military attaché. *Id.* at 318.

28. *Id.* at 65–69.

29. *Id.*

30. Bertillon achieved fame as the inventor of a system of identifying individuals from various body measurements. See, e.g., HENRY T.F. RHODES, ALPHONSE BERTILLON: FATHER OF SCIENTIFIC DETECTION 88–95 (1968).

31. BREDIN, *supra* note 10, at 73–74.

32. See SNYDER, *supra* note 19, at 185–90.

33. BREDIN, *supra* note 10, at 74.

34. Tribe, *supra* note 5, at 1332.

within the document itself," Bertillon divined that the letter contained coded information.<sup>35</sup>

For example, [he] stressed the presence of four coincidences out of the [twenty-six] initial and final letters of the [thirteen] repeated polysyllabic words in the [*bordereau*]. He evaluated at .2 the probability of an isolated coincidence and calculated a probability of  $(0.2)^4 = .0016$  that four such coincidences would occur in normal writing.<sup>36</sup>

Likewise, to establish that the letters had been traced over the word *intérêt* as it appeared in a letter in Dreyfus's brother's handwriting, Bertillon "computed the 'amazing' frequency with which certain letters in the [*bordereau*] appeared over the same letters of the word chain constructed by repeating *intérêt* a number of times, once a variety of complex adjustments had been made."<sup>37</sup>

35. *Id.* at 1332–33; see also Mary W. Gray, *Statistics and the Law: Intuitive Views of Evidence May Be Altered by Mathematical Analysis*, 56 MATHEMATICS MAG. 67, 68 (1983); Elmer B. Mode, *Probability and Criminalistics*, 58 J. AM. STAT. ASS'N 628, 639 (1963). Gray and Mode rely on a 1928 account, E.R. Hedrick, *The Reality of Mathematical Processes*, in THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS: THE THIRD YEARBOOK 35, 40–41 (1928), which notes the frequency of the letters of the French alphabet within the *bordereau* as contrasted with the proportions found in typical French prose as constituting the statistical evidence against Dreyfus. *Id.* I found no references to such testimony in the documents collected in LA REVISION DU PROCÈS DE RENNES (1909). See also *infra* note 42 and accompanying text.

36. Tribe, *supra* note 5, at 1333 n.8. Other writers are less clear on the details of Bertillon's purported demonstration and decryption of the letter. See, e.g., MICHAEL BURNS, DREYFUS: A FAMILY AFFAIR 138 (1991) ("Bertillon also maintained that clues to the traitor's finances were embedded in the document's lettering. Without explaining his method, he announced that Dreyfus had received the sum of five hundred thousand francs."). A more recent account suggests that the calculation involving the twenty-six polysyllabic words did not relate to some code involving initial and final letters, as described by Professor Tribe, but rather to the positioning of the words on the paper:

After having traced on the "bordereau" with five mm interval vertical lines, Bertillon showed that some pairs of polysyllabic words (among twenty-six) had the same relative position with respect to this grid. Making allusion to the theory of probability, Bertillon stated that these coincidences could not be attributed to a normal handwriting. . . . After his deposition, Bertillon gave an example of the probability calculation: if the individual probability for one coincidence is set to 0.2, then the probability of observing four coincidences is  $(0.2)^4 = 0.0016$ .

F. Taroni et al., *Forerunners of Bayesianism in Forensic Science*, 38 JURIMETRICS J. 183, 189 (1998) (discussing *Déposition Bertillon (du 18 janvier, 2 février, 4 février et 6 février 1899)*, in LA REVISION DU PROCÈS DREYFUS—ENQUÊTE DE LA COUR DE CASSATION 482, 482–500 (P.V. Stock ed., 1899)); see also COLIN G.G. AITKEN & FRANCO TARONI, STATISTICS AND THE EVALUATION OF EVIDENCE FOR FORENSIC SCIENTISTS 123 (2d ed. 2004).

37. Tribe, *supra* note 5, at 1333.

## THE IMPACT OF BERTILLON'S TESTIMONY

Bertillon's recondite analysis may have had some impact in the first court-martial before the defense had the opportunity to examine his work carefully. The principal exponent of this view is the novelist Armand Charpentier, who wrote that Dreyfus's counsel, two observers from the General Staff, and the prosecuting attorney "afterwards declared that they had not understood a word of Bertillon's demonstration."<sup>38</sup> As for the judges, Charpentier merely states that "it may reasonably be supposed that [they] were equally mystified," and he remarks that in any event, "they . . . allowed themselves to be impressed by the scientific phraseology of the system."<sup>39</sup>

Since the 1894 proceedings were closed to the public and were not transcribed, Charpentier's attributions seem somewhat speculative. Moreover, most accounts of the court-martial identify a dramatic announcement by a high-ranking intelligence official that an "honorable person" informed him that Dreyfus was a traitor as the event that swayed the previously doubtful tribunal.<sup>40</sup> Bertillon's performance is rarely depicted as being even remotely persuasive.<sup>41</sup>

38. ARMAND CHARPENTIER, *THE DREYFUS CASE* 53 (J. Lewis May trans., 1935) (1933).

39. *Id.* The British historian, Guy Chapman, provides a slightly different account:

[Bertillon's system] was complex and needed a lot of explanation with the aid of diagrams and blackboards. The court heard him through for an hour, stunned by his unintelligible verbosity. All they understood was that Bertillon believed that Dreyfus had forged the *bordereau* in a mixture of his own hand and those of his wife and brother.

GUY CHAPMAN, *THE DREYFUS TRIALS* 48 (1972).

40. *E.g.*, BREDIN, *supra* note 10, at 94 (noting that this baseless testimony was "the stroke of the bludgeon that brought Dreyfus down" (translating ARMAND CHARPENTIER, *LES COTÉS MYSTÉRIEUX DE L'AFFAIRE DREYFUS* 70 (1930))).

41. *See, e.g.*, BURNS, *supra* note 36, at 138 ("Looking on, the prisoner [Dreyfus] attached no importance to Bertillon's testimony; he considered it, as did most observers, 'the work of a madman.'" (translated from ALFRED DREYFUS, *CINQ ANNÉES DE MA VIE* 69 (F. Maspero 1982) (1901))); NICHOLAS HALASZ, *CAPTAIN DREYFUS: THE STORY OF A MASS HYSTERIA* 51 (1955) ("[T]he testimony was not hurting him . . . Bertillon entangled the court in a highly 'scientific' explanation of why the dissimilarities between Dreyfus'[s] handwriting and the handwriting on the *bordereau* proved that Dreyfus had been disguising his handwriting. No one could follow it, and after a while everyone gave up trying."); MARTIN P. JOHNSON, *THE DREYFUS AFFAIR: HONOUR AND POLITICS IN THE BELLE ÉPOQUE* 27 (1999) ("Bertillon . . . apparently made a bad impression with the court.").



Although the actual impact of Bertillon's pseudo-science in the first court-martial is difficult to gauge, in all the subsequent proceedings, other experts exposed Bertillon's "proofs" as vacuous.<sup>42</sup> In the Rennes court-martial, for example, a letter provided by the world-renowned mathematician, Henri Poincaré, identified "colossal errors" in Bertillon's analysis and flatly declared that no unprejudiced person with a scientific education could possibly find any merit in it.<sup>43</sup> In a meticulous report prepared at the request of the *Cour de Cassation*, Poincaré and two other distinguished scholars showed that the supposedly improbable coincidences said to confirm Dreyfus's authorship of the *bordereau* were of the type and frequency to be expected when one searches for any and all coincidences.<sup>44</sup> For instance, the relevant probability of the four coincidences in the initial and final letters of the thirteen polysyllabic words is not .0016. That figure is the probability of exactly four coincidences in four words. The probability of four *or more* out of thirteen is approximately .7, indicating that such "coincidences" are common.<sup>45</sup>

Thus, the *Dreyfus* case is a clear example of an early abuse of probability theory, but it is not a compelling example of

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42. Those who describe the expert testimony as directed to the relative frequencies of specific letters report that eminent mathematicians explained to the court that, while the precise distribution of letters in the allegedly coded message may have been unusual, some such departure from the average was not especially unlikely. Among the many possible proportions in which the letters might appear, any particular set of proportions—even the most likely—is individually improbable. To appreciate this point, consider tossing a balanced coin 100 times. The single most probable outcome is fifty heads and fifty tails, but its probability is less than ten percent. Thus, the mathematician Painlevé, who was to become Prime Minister of France, reputedly declared: "Give me the works of Racine and I will show you that he, too, by your foolish tests is a traitor, for the works of Racine, like the letters of Dreyfus, do not show the most probable distribution." Gray, *supra* note 35, at 68 (citing Hedrick, *supra* note 35, at 41); Mode, *supra* note 35, at 639 (citing Hedrick, *supra* note 35, at 41). Although it makes a good story, the account of Bertillon's claim of a coded message and Painlevé's eloquent dismissal of it could be apocryphal. The late statistician William Kruskal searched without success for an authoritative source of the quotation reported by Hedrick. A sample of his inquiries attempting to document this quotation is available from the author.

43. LA REVISION DU PROCÈS DE RENNES, RÉQUISITOIRE ÉCRIT DE M. LE PROCUREUR GÉNÉRAL BAUDOIN 116-17 (1907).

44. Tribe, *supra* note 5, at 1333; *Examen Critique Des Divers Systemes Ou Etudes Graphologiques Auxquels a Donne Lieu Le Bordereau: Rapport de Mm. Darboux, Appell, et Poincaré*, in 3 L'AFFAIRE DREYFUS: LA REVISION DU PROCÈS DE RENNES 500 (1909).

45. Tribe, *supra* note 5, at 1333 n.8.

judges or jurors beguiled and bemused by mathematics into convicting an innocent person. The courts-martial and related proceedings were so imbued with anti-Semitism, political machinations, and outright perjury, forgery, and fabrications that the mathematical errors pale in significance.<sup>46</sup> Bertillon's forensic forays were more often greeted with ridicule than respect.<sup>47</sup> In the Zola trial, for instance, the reaction to Bertillon's testimony about the "infallible and transcendent method of graphology" was "laughter from the audience."<sup>48</sup> At the Rennes court-martial, one witness, a skilled draftsman, showed that Bertillon's measurements of the spacing and positions of letters were inaccurate, and another expert

by applying Bertillon's argument to any page of writing taken up at random, succeeded in demonstrating geometrically and infallibly that that page was a forgery. To the accompaniment of the laughter of the whole court, he made use of a page of M. Bertillon's own report for his demonstration! Learned members of the Institute and professors at the Ecole des Chartes also gave evidence which completely destroyed Bertillon's deposition . . . .<sup>49</sup>

It is not surprising, then, that most accounts do not identify the mathematical testimony as an important cause of the convictions.<sup>50</sup>

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46. Martin, *supra* note 10, at 45–46. Martin describes the Rennes trial as follows:

Brought back from his hellish prison stay, Dreyfus appeared a broken man and inspired little confidence. In contrast, the military officers who testified against him . . . were much more impressive. Because of the lax rules of evidence, they were permitted to make impassioned denunciations and to repeat hearsay, much of it long since discredited. Trained magistrates might have sorted through the maze of testimony, but the seven officers on the court-martial board were hardly that. The prosecution argued that Dreyfus's guilt was proved not by a single document or act but by a cat's cradle of evidence that resolved into a pattern indicating that he was a traitor. Unable to discredit every accusation and every document, the defense could not prevail against this nebulous case.

*Id.*

47. JACQUES KAYSER, *THE DREYFUS AFFAIR* 346–47 (Nora Bickley trans., 1931).

48. SNYDER, *supra* note 19, at 300. At the end of his testimony, "the unhappy Bertillon withdrew amid hoots of laughter . . ." BREDIN, *supra* note 10, at 262.

49. KAYSER, *supra* note 47, at 346–47 ("[A]ll [these experts] were agreed in declaring once again that the [b]ordereau was written by Esterhazy."); see also SNYDER, *supra* note 19, at 305 ("The experts had done an effective job in ridiculing Bertillon's evidence.")

50. See, e.g., BREDIN, *supra* note 10; CHAPMAN, *supra* note 39. But see Tribe, *supra* note 5, at 1333–34 (citing CHARPENTIER, *supra* note 38, at 52–53, for the view that the 1899 Rennes court was "mystified" and "impressed by the

Filmsy accusations, supported only by vague character evidence, fabricated hearsay, forged documents, and pathological science, make the *Dreyfus* affair a fascinating chapter in legal history. But it is a poor example of the supposed power of mathematics to paralyze critical thought and to insulate itself from effective refutation. If anything, the *Dreyfus* cases demonstrate that forensic abuses of applied probability can be detected and corrected.

This reconstruction of the events in *Dreyfus* does not mean that probability evidence is innocuous and should be routinely admitted. A single set of proceedings, conducted under the glare of publicity in a highly politicized atmosphere, could hardly support so sweeping a claim. But neither can the *Dreyfus* cases be relied on for the proposition that "probability evidence" is too mystifying to be admissible. The apparent consensus in the legal literature that the convictions are paradigmatic of the paralysis of "critical examination" induced by "mathematical evidence"<sup>51</sup> is, on balance, inconsistent with the historical record. Whether the dangers of such evidence are any greater than those of more conventional modes of proof remains an important question for the law of evidence,<sup>52</sup> but the resolu-

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scientific phraseology of the system"). Charpentier, however, was speculating about the 1894 Paris court-martial. See *supra* text accompanying notes 38–39. In the 1899 court martial at Rennes, Bertillon was called as the sixty-first witness. SNYDER, *supra* note 19, at 300. He "went into a long-winded defense in incomprehensible and unintelligible terms of his 'infallible system.'" *Id.* According to a contemporaneous report in the *London Times*, Bertillon was absolutely, even ridiculously unintelligible. . . . The Judges and the counsel for the defense assumed an attitude of unimpeachable correctness, and did their best to understand. The public and the journalists, on the contrary, after an hour's heroic effort . . . gave up the task and repaired to the courtyard of the Lycée, there to exchange ideas on the possibility of human credulity.

*Id.* at 301. The next two experts to testify did "an effective job in ridiculing Bertillon's evidence." *Id.* at 305. The first "demonstrated with the aid of a blackboard the fallacy of Bertillon's calculations." *Id.* at 305–06. The second "aroused laughter by showing a page borrowed from a report by Bertillon himself and confusing him with it." *Id.* at 306. Likewise, in describing the 1899 trial, Charpentier writes that several experts, including Poincaré, "exposed the incoherence and stupidity of Bertillon's system." CHARPENTIER, *supra* note 38, at 233; see also *id.* at 265 ("The Court did not attach very much weight to Bertillon's far-fetched demonstrations."); OCTAVE MIRBEAU, L'AFFAIRE DREYFUS 302 n.2 (1990) ("Au procès de Rennes, sa déposition incohérente le fera considérer comme fou par tous les spectateurs non prévenus.").

51. See *supra* note 7 and accompanying text.

52. See, e.g., *United States v. Morrow*, 374 F. Supp. 2d 51, 63 (D.D.C. 2005) (rejecting the defendant's motion to exclude testimony about a DNA identification because of the possibility of confusion over the odds of a DNA

tion of this issue should no longer be influenced by a dubious reconstruction of the past.

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match, but indicating a willingness to reconsider the issue at trial); *United States v. Coleman*, 202 F. Supp. 2d 962, 971 (E.D. Mo. 2002) (finding that a geneticist's testimony in a case involving mitochondrial DNA identification that there is a "95 percent chance that 99.93 percent of the people in North America don't have the sequence associated with [the defendant]" would not be unfairly prejudicial), *aff'd*, 349 F.3d 1077 (8th Cir. 2003); KAYE ET AL., *THE NEW WIGMORE*, *supra* note 1, § 12.4.1(a); Daniel Shavero, *Statistical-Probability Evidence and the Appearance of Justice*, 103 HARV. L. REV. 530 passim (1989); Symposium, *Debate on Statistics and Evidentiary Theory*, 65 TUL. L. REV. 457 passim (1991).