WILL QUANTS RULE THE (LEGAL) WORLD?

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SUPER CRUNCHERS: WHY THINKING-BY-NUMBERS IS THE NEW WAY TO BE SMART. By *Ian Ayres*. New York: Bantam Dell. 2007. Pp. 272. $25.

INTRODUCTION

The quants are coming! And they are here to stay—so argues Professor Ian Ayres[1] in his new book, *Super Crunchers*, which details the brave new world of statistical prediction and how it has already begun to affect our lives. For years, academic researchers have known about the considerable and at times surprising advantages of statistical models over the considered judgments of experienced clinicians and experts. Today, these models are emerging all over the landscape. Whether the field is wine, baseball, medicine, or consumer relations, they are vying against traditional experts for control over how we make decisions.

To be sure, given its intended popular audience, *Super Crunchers* does not push the envelope in the judgment and decision-making field, spending most of its effort on summarizing and "translating" the recent successes in statistics and econometrics for the lay reader. But in this endeavor, it succeeds. Those who ordinarily cringe at numbers will find the book a delightful and educationally worthwhile read.

For the legal system, the take-home of Ayres's book and the examples he describes is clear. Courts should be using more statistical decision rules, not only because they promise greater accuracy, but also because they provide the consistency and transparency to which the law often aspires. In line with the Supreme Court's contemporary pronouncements on scientific evidence,[2] courts should be skeptical of traditional experts who testify from personal experience and intuition without quantified empirical data, and be more accepting of statistical evidence.

Although Ayres may have originally wanted to entitle his book *The End of Intuition* (pp. 55–56), the reality may be far more complicated than this suggests. A substantial recent literature has developed showing the superiority of intuitions and gut feelings, which the pro-statistics crowd has

    1. William K. Townsend Professor of Law, Yale Law School.

    2. General Electric Co. v. Joiner, 522 U.S. 136, 146 (1997) ("[N]othing . . . requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered.").

effectively ignored. In addition, supercrunching raises deep issues about profiling, individualized justice, and the nature of legal practice. Navigating these tensions between intuition, statistics, and the law will be the key challenge for the future.

I. Brave New World

Super Crunchers begins with an entertaining introduction to statistical modeling through a series of memorable examples. At the outset, we meet Orley Ashenfelter, the Princeton professor whose regression model for Bordeaux wine quality and prices sparked outrage among wine connoisseurs over a decade ago (pp. 1–6). Although famed wine taster Robert Parker denounced Ashenfelter as "an absolute total sham" (p. 3), Ashenfelter's simple regression model involving only rainfall and temperature data performs remarkably well in predicting wine quality—most importantly, his model predicts better than the experts.[3]

Wine tasters are not the only traditional experts under siege. Baseball fans will appreciate Ayres's reference to Michael Lewis's *Moneyball*.[4] The time-honored baseball scout, who spends countless hours watching prospects and assessing if they have "what it takes," now competes against the statistical model. The highly publicized success of "sabermetrics" for the Oakland A's and Boston Red Sox has made supercrunching a permanent fixture in America's pastime (pp. 8–9).

Similarly, the clinical judgment of physicians is under increasing attack, as seen in the trend toward evidence-based medicine (pp. 81–102). Doctors unsurprisingly fall prey to the same mental biases that psychologists have shown to afflict the rest of us: They are overly impressed by anecdotal evidence, even though such reasoning can lead to incorrect inferences based on coincidence (p. 89). Once they formulate a theory or diagnosis, they are susceptible to tunnel vision, failing to consider alternatives and ignoring contradictory evidence.[5] Sometimes, the medical profession does not even know why a particular procedure is performed a certain way—it is merely how things have always been done.[6] Those familiar with recent debates over scientific evidence in forensics and toxic torts will undoubtedly recognize the tune.[7]

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3. Pp. 2–4 (citing Orley Ashenfelter et al., *Bordeaux Wine Vintage Quality and the Weather*, Chance, Fall 1995, at 7).

4. Pp. 7–9 (citing Michael Lewis, Moneyball: The Art of Winning an Unfair Game (2003)).

5. Pp. 97–98; *cf.* Keith A. Findley & Michael S. Scott, *The Multiple Dimensions of Tunnel Vision in Criminal Cases*, 2006 Wis. L. Rev. 291 (discussing tunnel vision in the criminal justice system).

6. *See, e.g.*, Jerome Groopman, How Doctors Think 136–38 (2007) (discussing a procedure for draining fluid around the heart and its rather ad hoc development).

7. *See, e.g.*, Daniel J. Capra, *The* Daubert *Puzzle*, 32 Ga. L. Rev. 699, 720–21 (1998) (discussing the problems of anecdotal evidence in toxic-tort cases); Michael J. Saks & Jonathan J. Koehler, *The Individualization Fallacy in Forensic Science Evidence*, 61 Vand. L. Rev. 199, 209–10

Statistical tools offer a path out of this mess. For example, computer de-cision-tools can help doctors' intuition by suggesting alternative diagnoses (pp. 98–99). Digitalization and aggregation of medical records means more data for epidemiological analyses, and the possibility of computer-based decision-making is not far off, presuming that the medical establishment allows it (pp. 99–100).

But the transformative potential of statistical models does not end at re-placing traditional experts like wine connoisseurs, baseball scouts, and medical doctors. Ayres shows that number crunching is changing social and business interactions as well. Film companies use statistical tools to predict blockbusters (pp. 144–49). Matchmaking, a task traditionally reserved to friends and relatives, has become a sophisticated, statistically driven indus-try (pp. 23–28). Statistical models are even revolutionizing consumer relations. Credit card companies can lower interest rates, airlines can dole out flight perks, and casinos can swoop in with palliatives to keep their "best" customers placated just enough (pp. 28–31, 47–50, 58–60). As Ayres playfully suggests, in the future, when a seller starts giving you freebies, watch out (pp. 172–73).

At approximately its midpoint, *Super Crunchers* turns to cover some well-trodden ground in the decision-making literature that shows statistical methods to be often more accurate than experts.[8] One such study that Ayres discusses (p. 111) is a comprehensive meta-analysis of the clinical-statistical literature by psychologist William Grove and others, in which out "[o]f the 136 studies, 64 favored the actuary[,] . . . 64 showed approximately equiva-lent accuracy, and 8 favored the clinician."[9] Indeed, in some of these studies, statistical models were superior despite the experts being privy to more in-formation (statistical models generally require a shockingly small number of factors)[10] and even more outrageously, despite experts having the model re-sults at their disposal (pp. 116–17). Having a human override for catching "stupid" machine errors turns out to be counterproductive, because the safe-ty valve ends up introducing more errors than it prevents (pp. 121–23).

(2008) (discussing the lack of empirical foundation for the assumption that latent fingerprints are unique).

    8.   Pp. 108–11. There are many comprehensive reviews of this literature, but a recent treat-ment that includes a nice discussion of the reasons for the success of statistical methods can be found in MICHAEL A. BISHOP & J.D. TROUT, EPISTEMOLOGY AND THE PSYCHOLOGY OF HUMAN JUDGMENT 24–53 (2005).

    9.   William M. Grove & Paul E. Meehl, *Comparative Efficiency of Informal (Subjective, Impressionistic) and Formal (Mechanical, Algorithmic) Prediction Procedures: The Clinical-Statistical Controversy*, 2 PSYCHOL. PUB. POL'Y & L. 293, 298 (1996). Ayres attributes the meta-analysis to Grove and Meehl, but their article attributes the results to a study by Grove and others (without Meehl). *See* William M. Grove et al., *Clinical Versus Mechanical Prediction: A Meta-Analysis*, 12 PSYCHOL. ASSESSMENT 19 (2000).

    10.   The RRASOR statistical prediction tool for future violence is a striking illustration of the simplicity of statistical models. To predict future dangerousness, RRASOR considers four things: number of prior sexual offenses, age of release, victim gender, and relationship to victim. P. 120 (citing JOHN MONAHAN & LAURENS WALKER, SOCIAL SCIENCE IN LAW: CASES AND MATERIALS 400 (6th ed. 2006)).

Ayres also touches on the broader implications of statistical decision making and suggests some reasons for society's resistance to statistical methods. One reason is what Ayres entitles "The Status Squeeze" (p. 166). By standardizing the decision-making process, statistical models "threaten[] the status and respectability of many traditional jobs," particularly those of professionals with expertise (p. 166). As Ayres recounts, loan officers traditionally held "moderately high status position[s,] . . . were well paid and had real power to decide who did and did not qualify for loans" (p. 166). Statistical models, however, have since gutted the loan officer position, making them "nothing more than glorified secretaries" (p. 167). The loan officer tale is in many ways an ominous one for doctors and other professionals watching statistical models erode away their discretion. Their prestige, autonomy, and livelihood are at risk as the quants encroach on their territory.

Super Crunchers also briefly touches on a few other concerns about statistical methods: privacy, discrimination, and error. In terms of privacy, supercrunching certainly makes it more difficult for people to escape their pasts and futures, but as Ayres points out, much of the privacy concern has more to do with "the dark side of digitalization" and the availability of personal information than with the use of statistical methods per se (p. 176). To Ayres, the potential for discrimination is more troubling. For example, he worries that statistical methods can be used pretextually to mask underlying animus: "lenders can mine a database to find characteristics that strongly correlate with race and use those characteristics as a pretext for loan denials" (pp. 174–75). Concerns about error are similarly problematic to him. As the old saying goes, garbage in, garbage out; so if statistical models are riddled with errors or constructed by biased investigators, then they are hazardous indeed (p. 185). To address these concerns, Ayres emphasizes the importance of independent verification and open-access norms as the supercrunching world develops (p. 185).

II. SOME UNEXPLORED IMPLICATIONS

Despite its considerable success in getting even the most serious number-phobe excited about the ascendant supercrunching world, the book leaves several important areas underdeveloped. Perhaps a comprehensive treatment was not Ayres's intent, but I think the issues are worth exploring. At a minimum, *Super Crunchers* provides a useful launch pad for discussing these deeper problems.

A. *Superprofiling*

The first issue is profiling. Statistical models are essentially a kind of "superprofiling" and thus provoke the same concerns that accompany racial and other forms of profiling. As previously mentioned, *Super Crunchers* does raise the issue of statistical models being used as pretexts for discrimination, but to my mind, that barks up the wrong tree. Pretextual reasons are always a problem, irrespective of the form of decision making used, and

with statistical methods, there is at least data to test for hidden agendas. Traditional expert judgments are a complete black box, making discrimination notoriously difficult to prove. The constitutional prohibition on race-based preemptory challenges, for example, has become a paper tiger as courts have been hard-pressed to distinguish legitimate gut feelings from pernicious ones.[11]

In addition, to the extent that statistical methods create more accurate and nuanced profiles, they reduce unjustified stereotyping. Although historical redlining practices were surely in part motivated by animus, they also were arguably crude profiling mechanisms used by lenders to assess risk. Better statistical models mean less temptation to fall back on race as a (bad) proxy. Finally, statistical rules, being rule based and algorithmic, are more transparent and carry far lower risks of discrimination than the gut reactions of the average clerk. As Ayres acknowledges, "[r]egression equations, unlike flesh-and-blood loan officers, cannot harbor racial animus" (p. 174). What would we rather have: an airline check-in person who has the arbitrary discretion to give the first-class upgrade to the attractive-looking (read: white, young, and wealthy) customer, or the computer program that decides which customer is actually more economically valuable to the company?

The more fundamental problem with profiling is statistical error. Even if a model is perfectly well constructed, it will not be perfectly accurate. As impressive as it is, even a model that is 80% accurate will still be wrong 20% of the time. Shouldn't we worry about that 20%? For the statistically inclined, this concern may appear downright silly: since decision making always involves error, improving accuracy by switching from individualized, off-the-cuff decisions to statistical ones is a no-brainer. But the concern is both real and important, because errors caused by a statistical model's overgeneralizations often *feel* different from erroneous individualized determinations. For example, assume, as Michael Risinger's recent study suggests, that our individualized criminal justice system has an average wrongful-conviction rate of 3 to 5%.[12] While obviously a cause for concern, that rate does not provoke nearly the level of outrage that would ensue if we used a statistical model that knowingly imprisoned three innocents out of every hundred trials.

To my mind, however, Fred Schauer quite convincingly puts the issue of overgeneralizations to rest in his book *Profiles, Probabilities, and Stereotypes*,[13] in which he argues that particularization is essentially a myth.

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11.   *See, e.g.,* United States v. Lorenzo, 995 F.2d 1448, 1454–55 (9th Cir. 1993) (permitting peremptory challenges to three potential jurors with Hawaiian surnames for race-neutral reasons such as lack of attentiveness, financial hardship, and having long hair and a beard); Pamela S. Karlan, *Race, Rights, and Remedies in Criminal Adjudication,* 96 MICH. L. REV. 2001, 2021 & nn.96–101 (1998) (reporting explanations for excluding potential jurors such as weight, handwriting, clothing, and attitude).

12.   D. Michael Risinger, *Innocents Convicted: An Empirically Justified Factual Wrongful Conviction Rate,* 97 J. CRIM. L. & CRIMINOLOGY 761, 762 (2007) (defending a 3 to 5% wrongful conviction rate).

13.   FREDERICK SCHAUER, PROFILES, PROBABILITIES, AND STEREOTYPES (2003).

Inference fundamentally requires generalization and thus profiling and its resulting statistical errors are unavoidable, regardless of whether an expert or a statistical model makes the decision.[14] A more legitimate concern arises when statistical models cause innocent members of certain groups to be consistently and disproportionately burdened, rather than spreading these costs among all members of society more evenly.[15] For example, errors in the way Florida matched registered voters to convicted felons (who are not allowed to vote[16]) disproportionately affected African American voters in the 2000 election, causing considerable consternation (pp. 137–38).

B. *Two Ships Passing in the Night*

A second issue relates to whether statistical modeling leads to optimal decision making in only *some* contexts and, if so, when. In reading the book, one gets the impression that the coming age of statistical modeling is inevitable: given their overwhelming accuracy, statistical models will ultimately displace most, if not all, traditional clinical judgment and expert intuition. In the future, intuition will be relegated primarily to model design (pp. 195–200), and any reluctance to embrace statistical methods for day-to-day decision making is hopelessly nostalgic and indefensible.

But the future is not as straightforward as the one *Super Crunchers* paints. Even putting aside the various social and ethical concerns of statistical thinking outlined above, whether statistical models are in fact universally superior to human expertise is not at all clear. Indeed, even a casual reader of the decision-making literature might sense that something is amiss. While Ayres and other quants have heralded the coming of a statistical age, other commentators have breathed new life into intuitive judgment. For example, Malcolm Gladwell's bestseller *Blink*[17] and psychologist Gerd Gigerenzer's recent book *Gut Feelings*[18] have revisited and popularized the power of intuition. And these works only scratch the surface of an increasing literature on intuitive and expert thinking, which notably includes a potentially devastating critique from philosophers Hubert and Stuart Dreyfus that is two decades old.[19] The Dreyfuses claim that the rule-based approach to judgment used by early artificial-intelligence researchers—strikingly similar to that seen in many statistical models—faces an uphill battle when trying to sur-

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    14.   *See, e.g., id.* at 55–78 (dangerous dogs); *id.* at 160–67 (tax audits); *id.* at 299–300 (generally).

    15.   Schauer uses the example of young Middle Eastern men at the airport. *Id.* at 181–90.

    16.   A recent constitutional challenge to Florida's felon-disenfranchisement statute was ultimately rebuffed by an en banc Court of Appeals for the Eleventh Circuit. Johnson v. Governor of Fla., 405 F.3d 1214 (11th Cir. 2005) (en banc).

    17.   MALCOLM GLADWELL, BLINK: THE POWER OF THINKING WITHOUT THINKING (2005).

    18.   GERD GIGERENZER, GUT FEELINGS: THE INTELLIGENCE OF THE UNCONSCIOUS (2007).

    19.   HUBERT L. DREYFUS & STUART E. DREYFUS, MIND OVER MACHINE: THE POWER OF HUMAN INTUITION AND EXPERTISE IN THE ERA OF THE COMPUTER (1986).

pass the intuitive judgment of seasoned experts.[20] For the most part, this thesis has held true since it was published. As we all know, computers are very good at certain tasks but remain simply pathetic at others.

In an ironic twist, *Super Crunchers*'s subtitle, "Why Thinking-By-Numbers Is the New Way to Be Smart," actually embodies this complication. The allusion, of course, is to "painting-by-numbers," which connotes mechanical, wooden, or even phony artistry. Ayres's point is that number crunching, although seemingly uninspired, is in fact an enlightened path. However, his clever word play invites a more ambivalent interpretation. Painting-by-numbers is an efficient but suboptimal substitute. It allows those with little artistic talent to reliably produce something with a modicum of aesthetic value. The trade-off, however, is that the method never produces anything approaching the results of true artistic talent developed through a lifetime of experience and refinement.

Thinking-by-numbers may be a direct analog, with statistical models being a poor man's expert. Along these lines, statistical models are simplistic substitutes that enable unskilled persons to make reasonably good decisions. They may even beat people with some training and experience, but they never capture the nuanced and insightful thought processes of those with true mastery.[21] Take driving a car for instance: if you drive using a set of discrete rules—in other words, if you think too much—you will drive like a student driver, or more likely, crash.[22]

Perhaps some day, statistical models will indeed rule the world. While we all might like to think that human beings are special, I for one see little reason why models cannot ultimately match, if not best, our cognitive processes. But the fact remains that right now, statistical superiority has not been proven universally. Indeed, in the half century since Paul Meehl first identified this tension between clinical and statistical judgment,[23] the quants and intuitivists have been like two ships passing in the night. The quants yell and scream that statistical decision rules are superior to clinical judgment, deplore the glacial pace of reform, and accuse experts of obstructionism.[24] The intuitivists in contrast argue that experience-based decision-making and human intuition are surprisingly powerful, so we should not too quickly buy

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20.   *See id.* at 52–66.

21.   *See id.* at 63–66 (discussing problems that a rule-based model faces when replicating true expertise); *see also* SHOSHANA ZUBOFF, IN THE AGE OF THE SMART MACHINE 61 (1988) ("There are operators who know exactly what to do, but they cannot tell you how they do it." (quoting an engineer discussing plant operations)).

22.   *See* DREYFUS & DREYFUS, *supra* note 19, at 19–36 (using driving as an example in their taxonomy of skill acquisition).

23.   PAUL E. MEEHL, CLINICAL VERSUS STATISTICAL PREDICTION (1954).

24.   *See, e.g.,* ROBYN M. DAWES, HOUSE OF CARDS: PSYCHOLOGY AND PSYCHOTHERAPY BUILT ON MYTH (1994) (criticizing the spread of psychotherapy treatments based purely on clinical experience rather than backed by statistical data).

into deliberative models of rationality (and by extension, statistical mod-els).[25]

The challenge is to move past the compelling anecdotes and name-calling and determine more systematically when intuitive or clinical judg-ments are better than statistical decision rules, and vice versa. Surely there must be *some* useful guidelines. For example, since models generally re-quire large amounts of data to operate reliably, perhaps we should demand them only when dealing with relatively stable phenomena involving large populations and repeated events. But then again, defining "repeated" or "stable" may be tricky, particularly since experts tend to find too many ex-ceptional cases.[26] Knowledge about whether statistical models outperform only the average expert, or whether they indeed outperform even the best ones could also lead to useful direction. If it is only the average expert, then statistical methods should only be viewed as efficient proxies, and we should prefer models over experts for everyday expertise, but not for situa-tions in which we can count on the best experts being available. For example, in the legal context, courts would prefer models over experts in run-of-the-mill cases, but not in mass torts, where the parties would invaria-bly procure the world's best.

All of this, of course, is only speculation, but this sort of research is what the legal system desperately needs. Such general guidance would al-most certainly have a significant influence on how judges think about scientific evidence, particularly in an age of *Daubert* scrutiny.[27] Courts could of course demand specific comparisons between experts and models in each specific context, but that would be prohibitively expensive and rather limited in terms of flexibility. Courts have no time or resources to seek additional research, and so an overall theory of when to employ statistical models would be invaluable.

C. *Ruling the Legal World*

A final extension of *Super Crunchers* is to go beyond the battles over expert testimony and to explore the likely influence of statistical modeling

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25. Concededly, commentators frequently juxtapose intuition with more deliberative meth-ods of decision making, but the comparisons are generally with human deliberation, not statistical models. *E.g.*, GIGERENZER, *supra* note 18, at 16–19; GLADWELL, *supra* note 17, at 11–17; Daniel Kahneman, *Maps of Bounded Rationality: A Perspective on Intuitive Judgment and Choice, in* THE NOBEL PRIZES 2002, at 449, 450–52 (Tore Frängsmyr ed., 2003).

26. Pp. 121–22; *see, e.g.*, Robyn M. Dawes et al., *Clinical Versus Actuarial Judgment*, 243 SCI. 1668, 1670–71 (1989) (discussing studies suggesting that when experts deviate from actuarial conclusions because of alleged special cases, they often create more errors than they correct). The issue of exceptional cases was famously coined by Paul Meehl as the "broken leg problem" after the following hypothetical: suppose there is a statistical model for predicting whether a professor will go to the movies, but on this particular day, we know that the professor broke his leg. Presumably we would want to use this special information rather than trust the model. MEEHL, *supra* note 23, at 24–25.

27. Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993) (holding that trial judges must evaluate proffered expert witnesses to determine whether their testimony is both "relevant" and "reliable," a two-pronged test of admissibility).

on the legal world more generally. To be sure, Ayres mentions some law-related uses of statistics, such as detecting bid rigging for public contracts (pp. 42–45), understanding the effects of longer prison sentences (pp. 70–72), predicting future violence (pp. 118–21), and detecting discrimination (pp. 130–33), but *Super Crunchers* does not paint the broader picture of how statistics might fundamentally alter legal practice or legal decision-making. This omission is particularly unfortunate, as Ayres almost certainly has interesting insights to share on this score, and I would have loved to see them. Perhaps Ayres's self-characterization as a "gearhead" (p. 220) explains his desire to focus more on the models and less on law, but since we are all lawyers here, I think it appropriate to explore the significant and wide-ranging ramifications that statistical modeling will likely have on the law.

A core aspect of modern legal practice is prediction, as the venerable Justice Holmes presaged in *The Path of the Law*.[28] Lawyers use their experience along with traditional methods of legal analysis such as logic, analogy, and statutory interpretation to predict case outcomes for their clients.[29] But as *Super Crunchers* suggests, statistical models often turn out to be better crystal balls than traditional experts. If that superiority holds true in the legal sphere, might we be witnessing the death of the traditional lawyer, or at a minimum the beginnings of a sea change in legal practice?

Few attempts to statistically model legal decision making have yet made it into popular consciousness, but the early returns are impressive for the quants. For example, Ayres mentions the Supreme Court Forecasting Project, in which researchers pitted a statistical model of Supreme Court decision-making against a set of constitutional law luminaries.[30] In the study, the statistical model was able to predict cases in the 2002 term with 75% accuracy, trouncing the assembled experts and their paltry 59.1%.[31] More recently, Albert Yoon and I developed a model for the constitutionality of punitive damage awards in reported cases, achieving an average accuracy rate of 75%.[32] We do not have the intriguing expert comparison found in Supreme Court Forecasting Project, but one wonders if practitioners attain that level of prediction (and if so, why those cases are still litigated).

If statistical models of court decisions are more accurate than practitioners, then legal practice may be on the brink of a revolution. Rather than use their intuitive sense as to whether a case is a "good case" or not, attorneys should instead code their client's facts and ask a well-validated statistical model instead. And if attorneys are too technophobic or conservative to

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28.   Oliver Wendell Holmes, The Path of the Law (Jan. 8, 1897), *in* 110 HARV. L. REV. 991, 991 (1997) ("The object of our study, then, is prediction, the prediction of the incidence of the public force through the instrumentality of the courts.").

29.   *Id.* at 998.

30.   Pp. 104–08; Theodore W. Ruger et al., *The Supreme Court Forecasting Project: Legal and Political Science Approaches to Predicting Supreme Court Decisionmaking*, 104 COLUM. L. REV. 1150 (2004).

31.   Ruger et al., *supra* note 30, at 1171.

32.   Edward K. Cheng & Albert H. Yoon, Foretelling the Future in Punitive Damages Cases: A Statistical Approach (unpublished manuscript, on file with author).

make the leap, then their clients should demand it—after all, they are the ones who ultimately pay the bills.

Will the statistical world of law thus reduce attorneys to mere legal technicians who service the models? Decidedly not. The practice of law involves far more than predicting case outcomes. It involves advice, strategy, and persuasion; and while future statistical models may help lawyers do all of those things, clients will still need competent advocates who actually execute legal maneuvers in court. For this reason, I suspect that the legal world will ultimately embrace these statistical tools. Attorneys may be a risk-averse, conservative bunch, but there is no fundamental reason for them to fear supercrunching. Unlike loan officers, baseball scouts, and wine connoisseurs, lawyers will remain important in a statistical world because a good attorney can still move the odds in her client's favor. As such, if a company called "QuantLaw" starts offering statistical analyses of court decisions for attorneys, I will be the first person in line at the IPO.

Beyond legal practitioners, we can even take the statistical legal world to its radical conclusion and challenge the traditional roles of both judge and jury. Legal decision-making is ultimately just another form of decision-making, and thus the question arises whether statistical models will place pressure on these institutions as well.

Judicial rulings on questions of law are probably safe. These legal questions often involve value judgments, which (at least for now) are not within the ken of statistical models. One would have to develop quite a cramped view of lower court legal decision-making—for instance, that trial court decisions are mere predictions of appellate decisions—in order to justify displacing trial judges with statistical models.

Other judicial tasks are less secure. For example, sentencing lends itself more readily to statistical modeling, especially if uniformity is the primary goal. The Federal Sentencing Guidelines, although now defanged, were in many ways a quasi-statistical foray into the judicial role. Predictions of future dangerousness at sentencing are another opportunity. For years, psychologists have shown that actuarial models of future dangerousness are superior to the predictions of clinicians.[33] As Ayres notes, some states, notably Virginia, have begun to incorporate these statistical prediction tools into their commitment regimes (pp. 119–20). It will be interesting to see how many other jurisdictions do the same.

The jury faces a more formidable challenge, at least conceptually. Jury bashing is of course something of a sport in legal circles, though psychologists have increasingly shown much of the bashing to be unfair.[34] Historically, the problem with maligning juries is that their alternatives—judges—are not necessarily better at achieving factual accuracy. Judges suf-

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33. John Monahan, *Predictions of Violence: Scientific Status, in* 2 DAVID FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE § 10:13, at 137–41 (2007) (comparing clinical and actuarial methods of violence prediction).

34. *See generally* NEIL VIDMAR & VALERIE P. HANS, AMERICAN JURIES: THE VERDICT (2007) (comprehensively reviewing the literature on jury decision making).

fer many of the same cognitive limitations that affect jurors,[35] and they lack the diversity and strength-in-numbers found with juries. Consequently, it is not at all clear why we should prefer a single judge over a panel of lay jurors, particularly for fact finding. Statistical models, however, threaten to disrupt this standoff. No one has yet developed a statistical model for replacing the jury, but in principle, if statistical models can help us predict dangerousness, diagnose disease, and pick baseball players, why can they not help us assess who committed a murder or whether someone cheated on their taxes?

Unsurprisingly, the mere idea that statistical methods might supplement legal decision making generates unending and at times bitter controversy about what exactly the legal system stands for. The suggestion of using Bayesian evidentiary models several decades ago sparked a war in the evidence field that still rages today,[36] and as previously mentioned, the practice of profiling (even putting aside the race issue) leads to serious debates about the notion of justice.[37] Perhaps something about justice demands an individualized determination—we are deeply uncomfortable with targeting people or sending them to prison based on a probabilistic guess, and a guess is all statistical models can provide.[38] Yet, at the end of the day, consider this question: If you were on trial, would you rather have your fate decided by an 85 percent accurate statistical model or an 80 percent accurate jury?

None of this is to say that Americans will ever come around to amending the Constitution to implement this kind of statistically based adjudication system, but it certainly makes us think about whether our current system is worthwhile. As Ron Allen noted at a recent lecture, factual accuracy is not only critical for a "coherent study of evidence, [it is also] . . . the foundation upon which western civilization rests."[39] While it may be in vogue these days to focus on procedures, rights, and (depending on who you are) traditions, they do not mean very much without factual accuracy.[40] It is hard to feel warm and fuzzy about rights and procedures when you are rotting in jail.

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35. *See, e.g.*, Andrew J. Wistrich et al., *Can Judges Ignore Inadmissible Information? The Difficulty of Deliberately Disregarding*, 153 U. PA. L. REV. 1251, 1251–52 (2005).

36. *See, e.g.*, Ronald J. Allen & Michael S. Pardo, *The Problematic Value of Mathematical Models of Evidence*, 36 J. LEGAL STUD. 107 (2007); Michael O. Finkelstein & William B. Fairley, *A Bayesian Approach to Identification Evidence*, 83 HARV. L. REV. 489 (1970); Charles Nesson, *The Evidence or the Event? On Judicial Proof and the Acceptability of Verdicts*, 98 HARV. L. REV. 1357 (1985); Laurence H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329 (1971).

37. *See, e.g.*, BERNARD E. HARCOURT, AGAINST PREDICTION: PROFILING, POLICING, AND PUNISHING IN AN ACTUARIAL AGE 1–6 (2007); SCHAUER, *supra* note 13, at 299–300.

38. *See* Nesson, *supra* note 36, at 1362, 1378–85.

39. Ronald J. Allen, From the Enlightenment to Crawford to Holmes, Lecture at the American Association of Law Schools Evidence Conference (June 6, 2008) (transcript on file with author).

40. *See id.*

CONCLUSION

For now, statistical modeling remains esoteric and inaccessible, a technical realm for pointy-heads. But like so many other initially intimidating technologies—computers, MP3 players, and the internet—I suspect that supercrunching will mature into a user-friendly and accepted part of our daily lives. To gain this widespread acceptance, however, statistical methods will need creative thinkers to popularize the core ideas. In this regard, Ayres performs a remarkably valuable public service. The book raises far more questions than it answers, but that is precisely what such a teaser should do.