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Statistics and Big Data in the Criminal Trial: *What Are We Afraid of?*

Over the last twenty years, statistics, probabilistic estimates and quantitative evidence more generally have become increasingly common in criminal trials. This is due, to a great extent, to the discovery of DNA profiling. Experts now routinely testify at trial that the defendant's genetic profile matches the traces found at the crime scene and the chances of a coincidental match are, say, one in five hundred million. Since the matching profile is statistically rare, the defendant must be—or very likely to be—the source of the traces at the crime scene. To be sure, DNA evidence is just one example among many. The availability of Big Data is poised to make statistical evidence even more common. Sooner or later, statistical regularities drawn from data about people's income, socio-economic status, health, whereabouts, habits, preferences, beliefs, etc. will be used as incriminating evidence in the courtroom. In many ways, this futuristic scenario is as terrifying as it is real. But what are we afraid of, exactly? This book examines the legal, epistemological and ethical challenges that this statistical revolution poses for the criminal trial.

PART 1 will survey the different ways in which statistics have been used. This is the descriptive and historical part of the book focusing on four representative examples.

Identification – If the perpetrator and the defendant share a notable characteristic, say a genetic or phenotypical feature, this can serve to incriminate the defendant provided the shared characteristic is statistically rare. In a 1968 case, *People v. Collins*, a couple in Los Angeles was charged with robbery because it matched an eyewitness description. The prosecutor argued at trial that the matching characteristics were so statistically rare to make it unlikely than others could be the robbers. The problem was that no reliable data existed to justify the statistical claim. The discovery of DNA profiling in the eighties changed this state of affairs. DNA evidence relies on identifying characteristics that are genetic, and their statistical frequencies are known thanks to large databases storing the genetic information of millions of people.

Coincidences – Statistics can serve to assess whether an event, or a cluster of events, occurred accidentally or as a result of purposeful and guilty conduct. If a statistically suspicious number of cardiac arrests occur when a nurse is on duty, one might conclude that this cannot be an accident, so an inference of culpability is drawn. The 2003 Dutch case of Lucia de Berk is an example of this type of reasoning. In a 2014 Norwegian case, the tax inspectors thought that cash payments reported by a restaurant owner were too infrequent given certain benchmarks, and thus were likely due to intentional withholding. The suspicious underreporting was used as evidence of tax fraud.

Quantity estimation – In drug trafficking cases or grand theft cases, it may be hard to have direct evidence of the total amount of drugs illegally trafficked or the total amount of money stolen, especially if the alleged crime occurred over an extended period of time. Statistical methods can help to estimate a total quantity when no direct evidence of the total amount is available. The 1991 drug trafficking trial against Charles Shonubi is a well known example of this use of statistics.

Profiling – Statistics can show that individuals who fit a combination of characteristics—say,

single male, unemployed, with a history of drug abuse—are significantly more likely to commit a type of crime than people in the general population. Courts in the US and other countries tend to dismiss these profiling statistics because they are prejudicial. These statistical correlations can also quickly lead to inconsistencies. If a history of drug abuse makes one more likely to commit a crime but a college education makes one less likely, what to say of someone who has a history of drug abuse and is college educated? There are other profiling statistics, however, that courts are more willing to consider. If upon analyzing the crime scene, an expert asserted that the perpetrator must be a male, unemployed, etc. that description would often be allowed in court as evidence.

Having looked at some of the history of statistical evidence, *PART 2* of the book will turn to the future. As the four examples show, statistics are gaining momentum in the courtroom, but they are still far from playing a prominent role. The biggest obstacle is the fact that the requisite quantitative information is unavailable. In the age of Big Data, however, this is likely just a contingent fact, soon to be relegated to the past. I will therefore speculate about what statistical evidence could look like in the courtroom once we remove the current limitations on the availability of quantitative information. To start the discussion, I will examine different stylized scenarios known as 'proof paradoxes' which philosophers and legal theorists have created to think about statistical evidence at trial. As quantitative information becomes widespread, the following situation might well become the norm: Joe, an ordinary citizen like most of us, is charged with a crime. Extensive and reliable statistics show that, with an extremely high probability close to certainty, he must be the perpetrator. If Joe is convicted on the statistics alone, should this give us pause? Can it be acceptable to convict someone on statistics alone?

Prompted by this imaginary scenario, *PART 3* will reflect on the legal, moral and epistemological challenges that a statistical revolution, with the full support of Big Data, would pose for the criminal trial and the assessment of criminal responsibility. The focus will be on three challenges.

Specificity and cross-examination. The use of statistics in the criminal trial forces us to rethink the role of cross-examination. Typically, witnesses who claim to have specific, first-hand knowledge about the facts of a case are cross-examined to find inconsistencies, gaps or other deficiencies in their testimony. The same applies to the testimony of experts whose knowledge in a specialized field is scrutinized together with its relevance for the specific case under trial. But what would cross-examination look like when the evidence consists primarily of quantitative information? Cross-examination, and the adversarial trial more generally, is likely to become a battle between opposing bodies of numerical information.

Knowledge and uncertainty. Several philosophers have argued that the use of statistical evidence at trial is problematic because statistics cannot warrant knowledge. They may warrant a probable belief in the defendant's guilt, but not full-fledged knowledge. I agree that this is the case today, since quantitative information is limited and can only warrant uncertain inferences about someone's guilt. Yet, as quantitive information becomes more easily available and more specific, statistical evidence is poised to become the most reliable source of knowledge. Traditionally, judgments of criminal liability leave room for doubt. The expression 'proof beyond reasonable doubt' indicates that guilt should not be proven with certainty. But statistical evidence, when its full potential is unlocked, promises to overcome the uncertainty inherent in legal decision-making.

Risk imposition. If the promise of infallibility by statistical evidence is real, defendants should no longer fear to be mistakenly convicted. Is this overly optimistic? Probably so. If large amounts of quantitative information are collected about ourselves, our habits, whereabouts, beliefs, etc. there will be incentives to manipulate this information for various purposes. In the traditional

trial, the risk of error depended on deficiencies in single pieces of evidence such as untruthful testimonies by individual witnesses. Since one untruthful witness can affect the outcome of one or few trials at most, errors could be localized. This localization of error would no longer be true when statistical evidence takes a more prominent role at trial. Since quantitative data must be aggregated on a large scale, manipulation of these data may compound errors over many trials and adversely affect large segments of the population. This, perhaps, is the biggest fear. It is an open question how we should rethink the traditional instruments for protecting defendants against mistaken decisions, such as the right to a defense or the right to counsel.

The topic of my book 'Statistics and Big Data in the Criminal Trial' is currently the focus of much attention in the scholarly literature in philosophy. I myself have written a number of peer-reviewed articles on the topic. But there is no monograph in philosophy that discusses in depth the moral and epistemological challenges that statistical evidence poses for the criminal trial. My book will fill this lacuna. In addition, the interest among the general public about Big Data is evident. My book would discuss this topic from the often overlooked perspective of the criminal trial.

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