Math on Trial: How Numbers Get Used and Abused in the Courtroom

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In the wrong hands, math can be deadly. Even the simplest numbers can become powerful forces when manipulated by politicians or the media, but in the case of the law, your liberty—and your life—can depend on the right calculation.

In *Math on Trial*, mathematicians Leila Schneps and Coralie Colmez describe ten trials spanning from the nineteenth century to today, in which mathematical arguments were used—and disastrously misused—as evidence. They tell the stories of Sally Clark, who was accused of murdering her children by a doctor with a faulty sense of calculation; of nineteenth-century tycoon Hetty Green, whose dispute over her aunt's will became a signal case in the forensic use of mathematics; and of the case of Amanda Knox, in which a judge's misunderstanding of probability led him to discount critical evidence—which might have kept her in jail. Offering a fresh angle on cases from the nineteenth-century Dreyfus affair to the murder trial of Dutch nurse Lucia de Berk, Schneps and Colmez show how the improper application of mathematical concepts can mean the difference between walking free and life in prison.

A colorful narrative of mathematical abuse, *Math on Trial* blends courtroom drama, history, and math to show that legal expertise isn't always enough to prove a person innocent.

Math on Trial: How Numbers Get Used and Abused in the Courtroom Details

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From Reader Review Math on Trial: How Numbers Get Used and Abused in the Courtroom for online ebook

John J. Camilleri says

Overall the book was enjoyable to read, although the majority of it goes into explaining the background story in each case rather than the mathematical mistake themselves. Each chapter reads like you're watching some show on Investigation Discovery. The actual math involved is not complicated, and I was vaguely disappointed that the book covers the same handful of mistakes that occur in different guises.

Lenore Riegel says

Crime buff? Like your news ripped from the headlines?
Math buff? Enjoy testing your mind against experts?
Statistics buff? Know how to use them to your advantage?
History buff? Enjoy the inside story behind major events?
Or does Handwriting Analysis intrigue you?

If you answered yes to any of the above, you should read Math on Trial.
If you answered yes to more than one - what are you waiting for?

Ray says

So this book is basically chasing after bad math...with more bad math.

NOTE: This review contains a trigger warning due to material I've decided to keep in order to make a point about introducing personal bias into statistical math, particularly when, as the book's tag line says, "when math becomes a matter of life and death, you better check your sums."

Now this is pretty obviously a book about math (well not quite, which should be evident even from its title to say the least of its cover design or other clues...but more into that later). This book is supposed to appeal to not only people with a good understanding of math (where it'll either be preaching to the choir or be exposed and discredited for trying to push bad math as good...oh more on that later too!) but people who might not understand math as well but would like a better understanding. As such, for a lot of people, they might feel no choice but to simply take the math at face value and put their faith and trust in it. And as such, reviewing a book like this is at least slightly less conventional than with most novels or creative nonfiction where narrative concerns have to coexist with or even take a backseat to the validity of the math presented.

As such it might be a little hard for a "conventional" book reviewer to really go through and fairly and accurately evaluate this book and its accuracy in turn, especially if that book reviewer mostly has a literary background as opposed to a mathematical background. I've seen a few reviews where the reviewer mentions a math background, for example. Or take myself for example - I would consider myself very well-equipped from a literary perspective having read at this point literally thousands of books with a number of literature college credits, secondary education field experience in English and Literature and even graduate credits

related to literature so I might be a little under-equipped...oh wait I forgot to mention my undergraduate degree which is in, oh wait, AEROSPACE ENGINEERING.

Hey I heard that Aerospace Engineering is a thing that uses math a lot!

One "issue" of this book that might not be all that big of an issue but still worth pointing out - it's a lot easier to disprove a falsity than to prove a positive hit - in fact the book doesn't even make any attempt whatsoever towards the latter. I get that, that's not the premise of the book, the entire premise is centered around strictly false positives - but in keeping with the cover's own byline, "when math becomes a matter of life and death, you better check your sums" - it's only a matter of fairness to extend the same courtesies granted to those you believe falsely accused as to those you want to point accusatory fingers to.

This is especially apparent in the chapter where the book really lost me and ensured topping out at 3-stars - "Math Error #6: The Case of Meredith Kercher [better known as the Amanda Knox case] - the Test That Wasn't Done." In mathematics, especially in statistical mathematics (which the vast majority of this book is about, this chapter absolutely not being an exception), there is a concept called "bias." You're probably quite familiar with this concept already, in various forms such as "response bias" or even in being biased towards a foregone conclusion. Bias has a negative connotation because, in short, bias in statistical mathematics is bad - it's one of the most assured one-way tickets towards a place called "discreditation-town." Well apparently, Discreditation-town's population includes Leila Schneps and her daughter Coralie Colmez because bias exists in spades here - along with an extremely poor understanding criminal investigation aside from the raw statistical basics (including committing a number of sins they themselves rail against - even in the very next chapter, when making reference to this chapter no less) and even just becoming outright obsolete in face of new facts.

Why do I feel so confident in this? Well my own understanding of mathematics aside I've read a few books about the Amanda Knox case myself. You can almost say this is the Year of Foxy Knoxy (or not because that sounds cringey on second thought). Namely, The Fatal Gift of Beauty and Knox's own memoir, Waiting to be Heard. The former is absolutely well-researched and I feel more unbiased than Math on Trial's take.

And it's bias that really unravels MoT's take here. It lists as its main source the 427-page "motivations report" issued as the original verdict by Giancarlo Massei, the presiding judge over the case. If you've read The Fatal Gift of Beauty or a bevy of other reports, you'll understand that this is a biased verdict influenced by any number of biased sources and therefore should come under suspicion - which, may I remind you, IS ONE OF THE MAIN THESES OF THIS WHOLE BOOK TO BEGIN WITH! Another source it cites is the book written by Meredith Kercher's father which, I can assure you, cannot possibly be biased at all (I hope you understand this is sarcasm). In fact (and rather understandably) the Kerchers are rather infamously biased about this case and would probably make for a poor primary source when trying to do scientifically-based unbiased reporting on this case (https://www.independent.co.uk/news/wo...). Neither The Fatal Gift of Beauty or Knox's memoir which precedes this book in publication are referenced at all, and in fact the vast majority of titles referenced seem almost hopelessly biased against Knox.

In fact this whole chapter - and arguably the whole book as this is along with a rather superfluous chapter on the inventor of the Ponzi scheme - seems to mostly be about expressing a chip on the authors' shoulders against Knox for some reason, with the rest of the book being wrapped around it in a case of "uhhh well we don't have enough material to justify a whole book so quick let's look up a bunch of other stuff!" The presentation of Knox, especially in contrast to other parties presented in other "cases" in the book are clearly and obviously biased, painting a definitive picture of a young woman putting on an innocent face and in fact giddy with getting away with murder - which I hope I don't need to tell you is not exactly a hallmark of

credible statistical math. The entire justification of even including this chapter in this book revolves around an almost bizarre obsession with the handling of the DNA test on the knife found at the murder scene, which is once again also covered in The Fatal Gift of Beauty, where the authors are almost flaunting in their language, oooohhhhh, if those incompetent Italian prosecutors just only knew what they were doing, if only they'd watch more CSI, then they'd known that that DNA evidence is the smoking gun, that the DNA on the knife matches perfectly to Meredith Kercher and if they hadn't been so dismissive then that Foxy Knoxy would've got what was coming to her, being stuck in an Italian prison her entire life where she gets to be raped by prison guards, prison doctors and forced into dangerous situations with cellmates chosen strictly on who they think are most likely to mutually lesbian-rape each other just like what she really deserves!*

Well in the immortal words of my favorite YouTuber, Franklin "Coop772" Cooper, Le Whoops!

https://www.telegraph.co.uk/news/worl...
https://abcnews.go.com/International/...
https://www.independent.co.uk/news/wo...

So much for being so sure of yourselves, eh Schneps and Colmez?

And with that, the march of science utterly destroys the entire premise of one of this book's central chapters.

I could go on through most of the chapters - for the most part the chapters are actually pretty sound although the chapter more or less dismissing sex discrimination at Berekley is also suspect - but that right there highlights the biggest glaring problems with this book. And again, in statistical math and science, one aberration out of an entire population sample isn't necessarily worrisome - unless you promote that aberration front-and-center without any regard towards how your own personal bias or future developments might change the outcome.

* oh yeah and that's another thing that's discussed in The Fatal Gift of Beauty and Waiting to be Heard that's completely ignored (understandably as the book isn't about that) in Math on Trial - yeah, Amanda Knox was raped by prison guards, threatened by prison guards when she wouldn't "let" them rape her, raped and sexually assaulted by prison doctors under the guise of "health examinations" and put into dangerous situations with other prisoners in the specific hopes that these female prisoners would rape each other for the benefit and entertainment of the prison guards, reinforced by attitudes such as "all women in prison are lesbians." It also highlights how lesbianism is a de facto crime in Italy, with lesbians/gay women frequently being thrown into prison on trumped-up charges, or even women who are just suspected of being lesbian or even where certain law enforcement personel would *wish* were lesbian. Not to mention painting a picture of how the women's incarceration system in culture in Italy is something literally out of a dystopian novel (think Grace and Fury, another book I love) and exists in large part strictly to fulfill the sexual fantasies of the judicial patriarchy - if you can invent any charge to throw a woman in jail, you can pretty much condemn her to be your own personal sexual wish fulfillment sex toy, at least from afar, and that yes you bet your sweet bippie a lot of people feel this was a major motivation for why they wanted Amanda Knox arrested.

So, yeah, there's that. And oh yeah that also highlights that while statistical math is a major component, it's not the only overriding factor in social justice (another thing Schneps and Colmez more or less poo-poo on).

So yeah after writing all that, I'm now forced to even downgrade to a two star.

Farhana says

This is good but not overwhelmingly good! It's kind of entertaining but goes a bit faster both on the crime stories and corresponding mathematical errors. And the cases are presented very shortly. So, the suspense, thrill, and revelations are jumbled together within a limited space that they don't get enough time to hold on to their effects. At least the topic is interesting. How statistics get exploited in media or in politics is quite known but how they get exploited in criminal investigations and in court-rooms and how they jeopardize lives of many innocent people - that's really something!

Doris says

I picked up Math On Trial (from the library as is my habit) because it was mentioned in a couple of footnotes in University of Wisconsin-Madison mathematics professor Jordan Ellenberg's How Not To Be Wrong which I had just finished reading. You won't find the title or the authors listed in his index however ... apparently footnotes aren't indexed.

Math on Trial scrutinizes 10 cases where statistics were misunderstood or misused in courts of law. A Cold Hit Analysis case had the prosecution's calculations implying that there was only a 1 in 1.1 million chance that someone other than the accused had left the DNA sample, while the defense used the same basic information to calculate that there was a 1 in 3 chance that it was someone else! So which was it? According to the authors, neither side was actually calculating the probability of the accused's innocence; the authors' estimate of the true probability of innocence, not a simple calculation, was about 1 in 70.

By the end of the book, they present the opinion of Harvard Law School professor Laurence Tribe who, as a young legal aide, successfully unraveled some incorrect mathematical evidence in a case before the Supreme Court of California, resulting in the reversal of a conviction. Tribe's passionate opinion was that statistical mathematics shouldn't even be used in jury trials, because the kind of thinking it requires to be properly understood is so different from the intuitive approach that jurors must use to evaluate evidence. The authors however realize that the new age of DNA is frequently bringing mathematical evidence before juries, and they urge the establishment of criteria for its use.

Even though I consider myself somewhat of a math and science buff, my main take-away from the book is that understanding how to properly use statistics is hard!

Megan Hill says

You have to have a baseline understanding of probability to understand this book. Pretty thought-provoking in terms of DNA evidence.

Mark Flowers says

I really liked this for about 100 pages, and then it kind of fell off a cliff, for two reasons: 1) just based on the nature of how math is used in court, it got really repetitive--it's basically just about understanding

probabilities, over and over, 2) the last two chapters were weirdly out of context--one on Charles Ponzi, which has to do with math but not court, and one on the Dreyfus Affair which has to do with court, but not (or very very little) to do with math. Interesting stories, both, but for a different book.

Batgirl13 says

Good combo of court cases, forensic science, and statistics. It was a little long in parts but a good introduction to some of the problems math can pose in the wrong hands, or even the right misguided hands. Should be required reading for statistics and forensic scientists.

Fabbi says

A really fascinating book. Couldn't put it down.

Abigail Tarttelin says

This review was originally posted on the Huffington Post - I am not paid for any comments and all opinions are my own! Math On Trial is a study of several criminal cases where flaws in mathematical and statistical calculations and their analysis led to incorrect verdicts of guilt or innocence. I was surprised how much I enjoyed this book!

This may surprise some to note, but I was good with numbers in school, gaining an A* in both Statistics and Mathematics at GCSE level. That, however, is where my entanglements with numeric education ended. Bored with the subject, I gave it up; my major complaint being that it could not, did not, apply to the reality of a person's life.

This assumption may have been correct about filling a litany of workbooks with meaningless problems, but Math On Trial proves I was absolutely not right about the application of mathematics to real world problems.

Taking a series of riveting cases, including murders, rapes and sex discrimination, Schneps and Colmez both chart the history of the use of math in court, and clearly reveal common fallacies in its use. And it is un-put-down-able stuff.

Never have I been this enlivened by mathematics! I found myself tearing through the book, finishing within a few hours, and was particularly struck by several landmark cases that I had glimpsed in the news but not paid much attention to before.

An accusation of murder by Munchausens Syndrome by Proxy leveled against Sally Clark, whose first two infant children died seemingly of SIDS (cot death), is quite irrefutably repudiated by the authors, and the chapter, like all those in the book, is presented in a style that paints a clear picture of the context of the case, so as a reader I felt I had enough knowledge of the entire situation to be able to draw my own conclusions about the verdict.

The book, however, is not unbiased, and does not pretend to be so, highlighting instead bias in the original

cases and statistics. The point of view of Math on Trial then, could be said to be biased towards unbias! With this in mind, one of the strengths of the book is how gripping and emotional it is, for a work of non-fiction. I was saddened by the impossibly heartbreaking situation of Sally Clark; I was horrified by the mistakes made in the case of the several rape/murder trials discussed in the book; throughout the reading, I was induced to continue because of my attachment to protagonists and horror at the injustice.

Undoubtedly the most famous case Math On Trial studies, and certainly the one that may well attract the most attention, is the death of Meredith Kercher, and the overturned verdict of guilty for Raffaele Sollecito and Amanda Knox. Using simple probability calculations, the authors make a brilliant case for allowing specific DNA testing into evidence, which had previously rejected by a Judge in appeal court in 2011.

On an entirely separate note, I must mention the design of the book: a lovely hardback, with beautiful paper stock and a gorgeous cover designed to look like a retro thriller. 'Props' to the publishers at Basic Books for several extremely good choices!

Already garnering attention, I think this could be the start of an interesting career for Schneps and Colmez, and look forward to seeing more from them. I would recommend too for parents trying to support teenagers in their studies of mathematics - or in fact, law - as the book, although written at an adult level, puts complex concepts very simply and does not show anything brutal in pictures or go into more disturbing details than you might find on the news.

To sum up, Math On Trial is more than the sum of its parts: when you add it up it's a great little number. You can count on this one being a good one. In addition, it goes well with N mugs of tea and a slice of Pi...

...my apologies.

Seriously, a very worthwhile read. I mean, you do the math.

Deborah says

I have a love-hate relationship with statistics and probability that is subject to alteration pending how well I do on my final exam next week. :-) Still, the concepts and applications are intriguing and the law and math combine for a read that is hard to put down. (I *should* have been studying!) This book is the horrifying recount of people wrongly convicted by bad math, as well as an interesting lesson in criminal history and a reasoned call for standardized applications similar to those placed on other forensic sciences.

Gail Jones says

Brilliant book! Interesting, well-written and easily understood by the non-mathematician like me! It certainly raises questions about the use of probability and statistics in criminal trials.

Kristian says

Good

Shazzt says

The book lost its focus on maths towards the end but it was fascinating to see how mathematics had been used (or more accurately, misused) in criminal trials. The cases were interesting, some well known, others less so, and it was rather depressing to see how poorly the justice system works in many cases. Not a heavy read and no prior maths knowledge required.

Kirsty Darbyshire says

As a mathematician I really enjoyed reading most of this book. I'm someone who jumps up and down and gets annoyed when I notice statistics being misused in the news and especially in legally binding situations: typically when something like "1 in x million" is used to mean "so unlikely that it couldn't happen" which it certainly doesn't mean[*]. I'm not a statistician though and I'm sure plenty of number-misuse gets past me too, and I was pleased to read this and add a few more tools to my news-busting mathematical arsenal.

The format of the book is to point out a mathematical error and then go into the detail of a legal case that rested on that mathematical error. My only complaint is that some of the legal case details went on a bit and went far beyond what was needed to see the maths problem. That possibly makes it a better book for a general readership though - it's not constant bashing you over the head with maths - but basically I thought some of it was better written than other bits; the opening chapters better polished than later ones. It was nice to see cases from all over the world included and for the most part you didn't need to have any prior knowledge of the cases to follow the book although some of them are pretty well known.

It has been proposed in the past that probabilistic evidence should not be admissible in court, basically most people (lawyers, judges, juries) don't understand it and it is easily twisted to give a damning result by someone who does (or thinks they do) understand it. Even as a mathematician who thinks we all ought to be more numerate I can see that there is sense in that argument. In the age of DNA profiling though we are only going to see more number based evidence turning up in courtrooms. I'm sure the authors will have no trouble in finding material for a follow up book!

[*] I'm pleased to see the authors used my standard comeback to explain this fallacy: With a "1 in 14 million chance" of winning the lottery we would all be hugely surprised if we ourselves won the lottery, but it doesn't surprise us at all that *someone* wins it almost every week.