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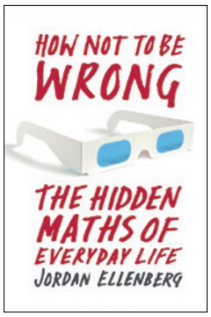

How Not to be Wrong: The Hidden Maths of Everyday Life

By Jordan Ellenberg

ALLEN LANE: 2014. 468 PP. £20

Among the great number of 'Yogiisms' — one-liners attributed to the American baseball player and coach Yogi Berra — a particularly well-known one is "90% of the game is half mental". Many objections can be raised to such a statement. Yet intuitively it is quite clear, and that makes it all the more misleading. A book could be written, one would think, about such statements of a questionable mathematical flavour. In a sense, Jordan Ellenberg has done exactly that.

In *How Not to Be Wrong*, Ellenberg, a professor of mathematics at the University of Wisconsin-Madison, sets out to reveal some of the 'maths of everyday life'. He does so by highlighting the potential of mathematics to mislead, and by explaining how, if done right, mathematics can serve as "an extension of common sense by other means". Many of the broad areas Ellenberg dives into, be they the lottery, stock markets or voting, might be not very surprising. Remarkable, however, is the breadth with which he explores them. The book is filled to the rim with anecdotes and 'good-to-know' facts. And Ellenberg does not shy away from delving deeply into most topics, both in terms of the underlying mathematical concepts and the background material, which he has researched meticulously.

For instance, to drive home the point that correlation does not imply causation, he does not rely on well-known examples (sleeping with your shoes on causes headaches) but instead tells the captivating story of how, in the years and decades following the Second World War when an ever-increasing body of data suggested a link between tobacco consumption and cancer, an unexpected possibility (with the benefit of hindsight) was explored: "It is possible then, that lung cancer […] is one of the causes of smoking cigarettes? I don't think it can be excluded." So wrote the statistician Ronald Fisher in 1958, and at the time he indeed had reasons to wonder about the order of cause and effect in the tobacco–cancer link, as Ellenberg explains.

Breadth is what makes this book so entertaining. When Ellenberg connects, within a single chapter, strategies for playing the lottery (for a rather specific case) and getting rich playing the stock market (more generally) to the development of perspective in Renaissance painting, to the geometry of the Fano plane, to error-correction codes in communication, to artificial languages, to sphere packing and behavioural economics, seriously engaging with each subject as he goes without overwhelming his audience, then readers from both inside and outside the scientific community should rejoice.

> "The natural logarithm is the one you always use if you're a mathematician or if you have e fingers."

Whereas the book may be aimed at a general audience, who wonder how the mathematics they learned at school might ever be useful, there is much on offer for those who have chosen a professional career in the sciences even when the fundamental ideas discussed are not new. It's a bit like walking through a well-curated exhibition of a favoured painter. Many works you know inside out, but the context and the logic of the presentation may offer refreshing new perspectives and insights. Also, the book has its beautifully nerdy moments ("The natural logarithm is the one you always use if you're a mathematician or if you have *e* fingers.") and it makes connections to very recent research, such as Olivia Caramello's current programme of exploring the role of Grothendieck topoi to unify aspects of mathematics and logic, or Yitang Zhang's 2013 breakthrough result on prime-number clusters.

At the same time, Ellenberg makes an honest effort to explain to interested 'outsiders' basic concepts in mathematics and, no less importantly, how it is to be a mathematician. This includes an aside on mathematics and insanity, which is well worth reading. Many of the points arguably apply to physicists, too. For the practising physicist, the book presents plenty of examples of how mathematics has the potential to mislead even if you understand it reasonably well (and more so when you think you do), how dangerous it can be to give in to the temptation of "torturing the data until it confesses", and, more broadly, how "an attention to the mathematical side of life is helpful in avoiding mistakes".

The book has been long in the making — eight years, says Ellenberg — and it shows. The examples are well chosen, well researched and well explained. Ellenberg draws on his considerable experience writing for *Slate* magazine (in his column 'Do the Math') and as a contributor to the *New York Times Magazine*, the *Washington Post* and *Wired*. The only flaw of the book, really, is that it starts with what might be the weakest chapters. That is a pity. But towards the end of the book, its author had managed to put me in a mindset where I started to wonder if I could calculate a number reflecting the amount of 'utils' (a measure of 'utility', as explained in the book) missed should I not have carried on reading, conditional on what my expectations after reading so far were. A bit like extending common sense by quantitative means. Which only means that Ellenberg has done it right, 100%. The rest barely matters. ❐

REVIEWED BY ANDREAS TRABESINGER

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ON OUR BOOKSHELF

Invisible: The Dangerous Allure of the Unseen

By Philip Ball

BODLEY HEAD: 2014. 336PP. £25

A revealing look at how we respond to the idea of going unnoticed. From Plato to Potter, metamaterials to microscopy, Ball marries the occult with the innovative to examine our enduring preoccupation with the prospect of invisibility.