

## Do Dice Play God: The Mathematics of Uncertainty

by Ian Stewart. Reviewed by David Aldous

A mathematician himself, Ian Stewart is more widely known as a prolific author of popular science style (PSS) books on topics relating to mathematics, and in this new book (DDPG) he tackles probability. It may be surprising to learn how many such PSS probability books already exist: your reviewer's list<sup>1</sup> contains around 20 general overviews of probability, but adding those addressing more specific probability-related topics (finance, sports, risks, ...) one finds well over 100 such books. The few overviews written by mathematical probabilists (e.g. Rosenthal's *Struck by Lightning*) tend to display the more interesting parts of college freshman probability and statistics. Books written by science journalists (e.g. Peterson's *The Jungles of Randomness*) naturally tend to focus on modern topics, whereas other writers usually take a historical approach. The current book DDPG follows a loosely historical approach. It has very little explicit mathematics, mostly very elementary. To briefly indicate the chapter topics:

*ancient divination; origins of mathematical probability in gambling; least-squares as best-fit; paradoxes; sampling and correlation; Bayes in the legal system; physical entropy; chaos and the butterfly effect; climate modeling; clinical trials; stock markets; the quantum world; simulating randomness; neural networks and the "Bayesian brain".*

Aside from the last one, these chapter topics overlap substantially with those of many other PSS probability books published over the last generation, so the choice of topics strikes me as rather unimaginative for 2019. There is no distinctive articulation of a big picture, except perhaps the introductory "6 Ages of Uncertainty" classification.

On the positive side, within these familiar topics there are interesting details and examples not seen in comparable books. Three examples: The Schrödinger's cat discussion includes a recent "thought experiment in which physicists use quantum mechanics to model of system of physicists using quantum mechanics". The "Wilson network" for perception is described. A research paper on whether a child is harmed by father taking anti-depressants at the time of conception is described. Overall the book has a comparatively sophisticated expository style, not talking down to the reader, and manages to convey (in addition to the basics) some complex ideas in verbal form.

In summary, DDPG is a solid, well-written account of rather traditional topics with a few modern touches. It is appropriate for a non-mathematician

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<sup>1</sup>[www.stat.berkeley.edu/~aldous/157/books.html](http://www.stat.berkeley.edu/~aldous/157/books.html)

seeking a comparatively serious first look at probability without mathematics, or for someone who has been exposed to introductory mathematical probability and (correctly) observes that the  $X$ 's and  $Y$ 's therein say little about the role of probability outside the textbook. But its historical style lacks the vivid sense of contemporary activity and relevance that one finds (in different contexts) in books like Silver's *The Signal and the Noise*.

To your reviewer's taste, the focus on science in DDPG also leads to a rather limited and unrepresentative picture of the contexts where we actually perceive and seek to deal quantitatively with uncertainty in the 21st century. Let me point out some other contexts. If one starts by asking what probability is *for*, a large part involves decisions under uncertainty. Kahneman's *Thinking, Fast and Slow* handles brilliantly the psychological aspects of this, but concrete issues – how to think about deciding whether one should try to save money by increasing one's insurance deductible – are rarely addressed. *How much* to invest in the stock market (for which the mathematical Kelly criterion gives great insight) is much more relevant to most of us than the Black-Scholes formula in DDPG for option pricing. Following the “show, don't tell” advice to authors, one can *show* how probabilities change over time by exhibiting prediction market data. The friendship paradox (your friends have more friends than you do, on average) is more tangible than the familiar artificial “boy or girl” style paradoxes in DDPG. And it's always amusing to compare the topics in books like this with actual “everyday life” concerns as found in (for instance) search engine queries<sup>2</sup> about “chance of . . . . .” (spoiler alert: there is very little connection).

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<sup>2</sup>[www.stat.berkeley.edu/~aldous/Real\\_World/cover\\_unprompted.html](http://www.stat.berkeley.edu/~aldous/Real_World/cover_unprompted.html)