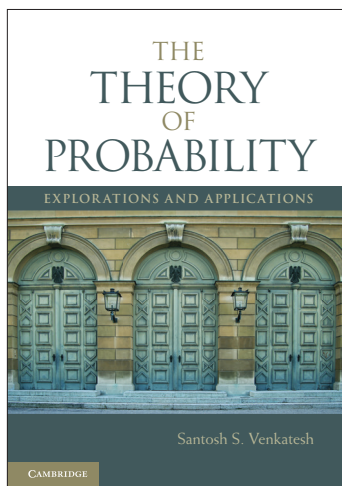# The Theory of Probability: Explorations and Applications

Santosh S. Venkatesh; Cambridge University Press; 805 + xxiv pp.; November 2012; £65.53, $90; ISBN 9781107024472

This is a remarkable book, a theory of probability that succeeds in being both readable and rigorous, both expository and entertaining. One might have thought that there was no space left in the market for books on the fundamentals of probability theory, but this volume provides a refreshing new approach.

Its strength is in taking what the author describes as a "theorem discovery" means of presentation. Instead of resorting to the formulaic "statement–proof" method employed by many textbooks, he presents the material in an engaging prose style by which the theorems develop from a logical flow of ideas, following the thought processes that might have led to their discovery originally. As well as casting a new angle on material that might be familiar to many mathematicians, this has the advantage of showing the student how new results can emerge, rather than being presented as *faits accomplis*.

This approach might not be so successful without the engaging writing style of the author, who makes use of many historical anecdotes and novel examples to illustrate the probabilistic concepts. One chapter ("Probability Sieves") is particularly memorable, bringing probability face to face with prime number and graph theory, and others ("Variations on a Theme of Integration") have characteristically quirky titles. Yet the book lacks for nothing in mathematical detail – this is after all an academic textbook, written not for statisticians but for pure mathematicians and probabilists, and at over 800 pages requires considerable time and reflection on the part of the reader.

It is divided into two sections, named "Elements" and "Foundations". The first introduces the basic nature of probability and the way probability distributions arise from repeated trials, while the second develops these ideas and grounds them more firmly in measure theory. All the topics one would expect in a thorough exploration of the nature of probability are here, as well as many more that are less familiar. More theoretical sections are signposted and can be omitted without disrupting the main narrative, and each of the 20 chapters is well equipped with exercises (albeit without solutions), many of them extremely challenging.

> *A remarkable book, a theory of probability that is both readable and rigorous, both expository and entertaining*

Impressive as this book is, its rigour and sheer breadth of concepts perhaps make it unsuitable for students coming to probability for the first time. Many of the arguments require considerable mathematical maturity, and so it may be better suited for graduate students who want to develop a fuller understanding of the essentials. But it is a magnificent undertaking, impeccably presented, and one that is sure to reward repeated reading.
Tom Fanshawe
Oxford

Spectrums: Our Mind-Boggling Universe, from Infinitesimal to Infinity
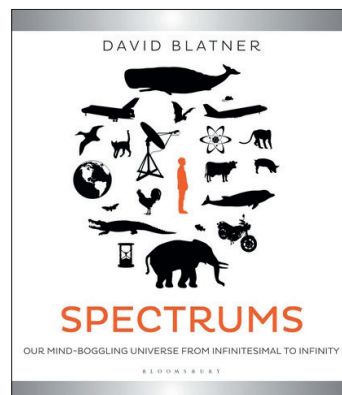
David Blatner; Bloomsbury; 175 + ix pp.; March 2013; £12.99, $17.11; ISBN 9781408838594

"I attempt in this book to provide a sense of scale across six spectrums with which we interact every day: numbers, size, light, sound, heat and time." Thus opens this book. I found it amazingly interesting as a light read, though some of the concepts are actually very deep.

We are comfortable within the range of scales that we live in. We tend to base our sense of reality on our own human scale and ignore the invisible and often surprisingly non-intuitive worlds beyond. This is Blatner's theme. He has previously written *The Joy of π*. Scale provides as many joys and more.

For each of the spectrums, the reader is challenged to understand the accessible part of the spectrum and the parts beyond. For numbers, we can all grasp relatively small numbers of people up to 10 without any real counting strategy. Beyond this, however, we have to start some form of fracturing so that we can assess the numbers. Once we get to numbers over 100 it becomes impossible without great effort. But what of the size of a crowd at a football match? An estimate is given of the number of cells in our bodies – and a comparison given with the estimated number of stars in the local galaxies – and you will have to read the book to find which is greater!

> *We base our sense of reality on our own human scale and ignore the invisible and non-intuitive worlds beyond*

Apart from concepts in the size chapter, as in the other chapters, facts are scattered throughout in margin boxes to enhance the information; poignant quotes are displayed in speech bubbles also in the margins. For example, the shortest adult human is a 72-year-old Nepali at 21.5 inches; the highest mountain in the world is not Everest – but one in the sea! And a quote about time: "The future is something everyone reaches at the rate of 60 minutes per hour whatever he does, whoever he is" – C. S. Lewis was responsible for that one. Fascinating facts on duration are given in a two-page illustration taking the reader from Planck time (the shortest possible duration), through the blink of an eye and Neptune's solar orbit to the duration of time until the stars, the galaxies and virtually all matter in the universe cease to exist.

Information, illustrations and data presentation are generally excellent, though in one table something went awry. The blend of information, facts and even some simple history of science make the book extremely readable and interesting even for those who may not have a very mathematical background. If looking for a present for someone who likes facts, look no further.
Ed Swires-Hennessy
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