The dust jacket of Margolis's book shows what looks like a chimney receding upwards from the observer. The colouring is blue, giving it a rather abstract, surreal appearance.

By contrast, the jacket of Peter Bernstein's *Against the Gods* shows Rembrandt's *Storm on the Sea of Galilee*, suggesting that we might be in for a tale of man pitted against the forces of nature, in which only divine intervention is certain to save us. Well, not really. It is more a case of man trying to survive the vagaries of the gambling tables and storms of the stock market with the help of mathematicians and economists.

The main theme of the book is a history of probability and statistics — Pascal's triangle, the normal distribution, Bayesian statistics, regression to the mean, chaos and game theory are all included. The narrative sweeps along, often breathlessly and sprinkled with superlatives: breakthroughs are "stunning", intellectual advances are "astonishing" and discoveries are "extraordinary". How much of the mathematics and statistics will be intelligible to the uninitiated is hard to say, and parts could certainly be made clearer. For example, although the normal distribution is referred to a great deal, there is no diagram of it.

But there are lots of good anecdotes, some of them amusing. My favourite is the one about the air force weather forecaster during the Second World War who realized that long-range forecasts were no better than numbers pulled out of a hat. On being told this, the commanding officer replied that he was "well aware that the forecasts are no good". However, he needed them "for planning purposes".

The historical journey with Bernstein is fast and exhilarating at times, but the landscape that we see seems to lack depth, with many more prices than values, and utility invariably in the foreground. In the end, though, we seem to have arrived at much the same viewpoint as that described by the rather maligned social scientists, albeit by a rather different route — despite the heroic efforts of man and computer, human beings do not always behave as economic theorists believe they should.

As John Maynard Keynes said: "Human decisions affecting the future, whether personal or political or economic, cannot depend upon strict mathematical expectation, since the bases for making such calculations do not exist."

So will there be a serious accident in the Channel Tunnel within, say, the next decade?

Personally I'll risk it. But I wouldn't bet on it. □

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Foray beyond Fourier

Francois G. Meyer

The World According to Wavelets: The Story of a Mathematical Technique in the Making. By Barbara Burke Hubbard. *A. K. Peters: 1996. Pp. 264. £26, $38.*

MANY natural phenomena can be interpreted as hierarchical superpositions of more elementary phenomena that occur at different scales or resolutions. The large-scale distribution of galaxies in the Universe can be described as a hierarchy of clusters and super-clusters, for instance. Another example is the study of turbulence, where different structures appear at very different scales.

In the physical sciences as well as in biology or medicine, many signals need to be analysed and interpreted at different resolutions. Indeed, singularities such as spikes, transients or abrupt changes are often more important than the general trend of the signal studied. Multiresolution analysis allows a signal to be described as the superposition of a very smooth average, which gives the trend, and a sequence of finer and finer details.

Until recently engineers and physicists did not have access to a mathematical theory for the multiresolution representation of functions. A function could only be studied either in its natural domain (space or time) or in the frequency domain using a Fourier transform. The Fourier transform is adequate for analysing signals whose statistical properties are stationary in time. But the Fourier representation is ill suited for other signals, such as seismic data, a speech signal or an electrocardiogram. Indeed it is difficult to characterize the local properties of a function in terms of the Fourier coefficients.

In the past ten years, a mathematical theory of multiresolution has been developed, and new building blocks called wavelets now make it possible to represent a signal in terms of small oscillating waveforms. Wavelets allow a signal to be observed at different resolutions, and its local behaviour to be analysed as well as its general trend.

As Barbara Burke Hubbard explains in her book, wavelet theory is a unification of ideas from different fields: engineering (image and speech compression), physics (coherent states, renormalization groups) and pure mathematics (Littlewood–Paley analysis, and study of Calderon-Zygmund operators).

The success of wavelets stems from the fact that they bring a new mathematical language to analyse and represent functions and signals. Wavelets lend themselves to efficient computational algorithms. They are being used successfully in a wide variety of fields: signal processing, numerical analysis, statistics, computer vision and computer graphics.

This is not a textbook or review volume but a very original work that provides a self-contained introduction to the basic ideas of wavelets for scientists with little competence in mathematics. It is in two main parts. The first offers an accessible and enthralling introduction to wavelets including a review of Fourier analysis, a history of the various origins of wavelets and a description of wavelet techniques and their applications.

The reader travels a fascinating journey inside the world of mathematicians and physicists, and encounters the difficulties, frustrations and joys of research. The first part concludes with a general summary of wavelets and future directions of research in the field. The author keeps the style light, with a stress on intuition and clarity. There are many quotations from leading wavelet researchers.

The second part provides a self-contained mathematical description of Fourier analysis and wavelet analysis. This part emphasizes the comprehension of concepts rather than the simple acquisition of mathematical formulas. It can serve as an introduction for readers interested in using wavelets. It also offers the nonspecialist insight into the beauty and power of wavelet analysis. □

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New in paperback

Soul Searching: Human Nature and Supernatural Belief by Nicholas Humphrey. Vintage, £6.99. "Humphrey is good at teasing out the contradictions and tensions in parapsychologists' claims. He also does a good job of underlining the curious (and inexplicable) banality of the supposed psi-phenomena", Tim Crane, *Nature* **379,** 685 (1996).

Inevitable Illusions: How Mistakes of Reason Rule Our Minds by Massimo Piattelli-Palmarini. Wiley, $15.95, £12.99. "Delightful, informal... the best popular book in this field", Martin Gardner, *Nature* **374,** 25 (1995).

Entropy and the Magic Flute by Harold J. Morowitz. Oxford University Press, $13.95. An experimental biologist and acclaimed essayist reflects on a diverse range of topics from litmus paper to the hippopotamus.

The Great Human Diasporas: The History of Diversity and Evolution by L. L. Cavalli-Sforza. Helix, $15, £12.95. Reviewed by Robert Foley in *Nature* **377,** 493 (1996).