effective ways of presenting physics to the general public.

The Probabilistic Revolution, Volumes 1 and 2

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Volume 1: Ideas in History

Edited by Lorenz Krüger, Lorraine J. Daston and Michael Heidelberger
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Volume 2: Ideas in the Sciences

Edited by Lorenz Krüger, Gerd Gigerenzer and Mary S. Morgan
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Thirty-one American, British, Canadian, Finnish, German and Hungarian scholars, including several well-known historians and philosophers of science, have invented "the probabilistic revolution," a wonderful historical event that took place during the century and a half after 1800. Even though I. Bernard Cohen and Ian Hacking, who specifically address the question "Was There a Probabilistic Revolution 1800–1930?" cannot bring themselves to give an unconditionally affirmative answer, and though Thomas S. Kuhn avoids mentioning it at all in his brief essay on the nature of scientific revolutions, the idea provides an excellent basis for a coherent collection of articles. The three introductory pieces by Kuhn, Cohen and Hacking will appeal to a wide range of readers; the others are intended for specialists.

Some of the authors attempt to define the essential feature of the probabilistic revolution. Perhaps the most appropriate definition (exemplified by the book itself) is a shift in emphasis from statistical uniformity to fluctuations and individual diversity (Theodore M. Porter and Jan von Plato, seemingly contradicted by Hacking). Other proposals, defended with much skill and copious evidence, are the replacement of the subjectivist concept of probability by the frequentist definition (Andreas Kamlah); the introduction of probabilistic statements about the accuracy of measurements (Stephen M. Stigler); the application of probabilistic con-

cepts to many disciplines as distinct from changes in the concepts themselves (Cohen); belief in the lawfulness of vital and social phenomena and in the capacity of statistical methods to uncover this lawfulness (Bernard-Pierre Lécuyer and others); a shift from probability as dealing with *judgments* of an elite of reasonable men to the *behavior* of societies that include irrational members (Lorraine J. Daston); and belief in indeterministic statistical causation growing out of a holistic qualitative causation founded on the political–social ideal of *Gemeinschaft* (M. Norton Wise).

Among the social *causes* of the probabilistic revolution, according to the authors, were population growth and urbanization, leading to the emergence of mass phenomena best described statistically (Karl H. Metz), and the breaking of the connection between gambling and insurance in association with new middle-class attitudes favoring provision for one's family over provision for oneself (Daston).

Some readers will be surprised to find that physics is given only a minor role in this revolution. The thesis that nature possesses a certain amount of indeterminism independent of our own ignorance of it is discussed by Michael Heidelberger and Lorenz Krüger, but the importance of this thesis is explicitly downgraded by John Beatty, Nancy Cartwright, William Coleman, Gerd Gigerenzer and Mary S. Morgan. They argue on the contrary that the revolution was primarily a methodological shift to the attitude that probability must be used to measure and reason about reality, not to characterize its essence. Krüger's statement in volume 2 that "quantum physics has become one of the cornerstones of our present-day probabilism" is contradicted by most of the rest of the book.

A physicist might want to read these two volumes backwards. Start with the last section of volume 2, where, following Krüger's concise survey of the probabilistic revolution in physics, von Plato and Cartwright throw new light on familiar subjects: Albert Einstein's views on probability, the history of ergodic theory, Max Born's interpretation of the wave-function, and the philosophical noncommitments of American quantum physicists. Then turn to the end of volume 1 for Wise's "How Do Sums Count?" an intriguing discussion of the connections among statistical physics, psychology and social theory. Brace yourself for some heavy but valuable analysis of the background of James Clerk Maxwell's philosophy in Krüger's "The Slow Rise of Probabilism." Read or re-read the introductory essays by Kuhn, Cohen and Hacking on how it all fits together, and then decide whether you want to dip into the more specialized essays on the social and biological sciences that make up the bulk of the work.

As a contribution to intellectual history and a provocation to rethink many taken-for-granted assumptions, *The Probabilistic Revolution* is superb, and it will (with high probability) remain the authoritative source on the subject for many years. All the more unfortunate, then, that physics is given so little importance. Perhaps it is true, as Gigerenzer argues, that psychologists used probabilistic thinking to advance the role of determinism and objectivity, explicitly refusing to follow the lead of physics. Perhaps it is historically correct that physics and evolutionary biology are unrepresentative of the sciences in their use of probability as a theoretical tool, as Beatty and others assert in their introduction to volume 2. Even so, I would have thought the notoriety of Heisenberg's principle in modern culture would earn it a more prominent place in such an account. One can only conclude that the human compulsion to impose regularity on the world continues to suppress the evidence for fundamental chaos.

STEPHEN G. BRUSH
University of Maryland, College Park

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