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BOOK REVIEWS

A mathematical theory of evidence, by Glenn Shafer, Princeton Univ. Press, Princeton, New Jersey, 1976, xiii + 297 pp., $17.50 (cloth) and $8.95 (paper).

This is an aptly titled effort to supplement probability theory as developed for chance/aleatory devices by a parallel, but distinct, epistemically oriented quantitative theory of evidence for, and evidential support of, our opinions, judgements of facts, and beliefs. That probability takes its meaning from and is used to describe such diverse phenomena as propensities for physical behavior, propositional attitudes of belief, logical relations of inductive support, and experimental outcomes under prescribed conditions of unlinked repetitions, has long been the source of much of the controversy and vitality in the development and application of probability theory and its associated concepts. Ian Hacking in his recent book *The emergence of probability* [**1**] attempted to trace and explain this intertwining of belief/knowledge and physical (objective) behavior in terms of a conceptual transformation of the categories of knowledge and opinion that was mainly completed by the early 18th century. Hacking's historical/philosophical analysis aims to explain what he holds to be our present dualistic conception of probability as being jointly epistemic (oriented towards assessment of knowledge/belief) and aleatory (oriented towards the objective description of the outcomes of 'random' experiments) with most of the present-day emphasis on the latter. Historically, however, the epistemic component was initially dominant in conceptions of probability.

Probability through the Renaissance applied only to opinions/beliefs and was based upon authoritative testimony in support of these opinions/beliefs. The 19 year-old Leibniz writing in 1665 wished to formalize the evidential support for beliefs by a numerical assignment on a scale of [0, 1] of what he referred to as 'degrees of proof'. The object of this exercise was to be a rationalized jurisprudence. Key to such assignments was an analysis into equally possible (likely) cases.

The growth of an aleatory notion of probability concerning inductive relations between physical signs and physical phenomena starts in the Renaissance. The extent to which the aleatory notion was dependent upon the epistemic notion (there was also a strong converse dependence) is apparent in the posthumously published (1713) *Ars conjectandi* of J. Bernoulli. In Part IV of the *Ars* [**2**] we find the first statement and proof of a law of large numbers, the first firm step on the road to the frequentist/aleatory concepts dominant today. Significantly though, J. Bernoulli was not a frequentist. For Bernoulli, frequency of occurrence was only a clue to the enumeration of the equally possible cases that was the basis of quantitative epistemic probability. Much