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From puzzles and paradoxes to concepts in probability.

Chernoff, Egan J. (ed.) et al., Probabilistic thinking. Presenting plural perspectives. Dordrecht: Springer (ISBN 978-94-007-7154-3/hbk; 978-94-007-7155-0/ebook). Advances in Mathematics Education, 35-73 (2014).

Summary: This chapter focuses on how puzzles and paradoxes in probability developed into mathematical concepts. After an introduction to background ideas, we present each paradox, discuss why it is paradoxical, and give a normative solution as well as links to further ideas and teaching; a similar approach is taken to puzzles. After discussing the role of paradoxes, the paradoxes are grouped in topics: equal likelihood, expectation, relative frequencies, and personal probabilities. These cover the usual approaches of the a priori theory (APT), the frequentist theory (FQT), and the subjectivist theory (SJT). From our discussion it should become clear that a restriction to only one philosophical position towards probability – either objectivist or subjectivist – restricts understanding and fails to develop good applications. A section on the central mathematical ideas of probability is included to give an overview for educators to plan a coherent and consistent probability curriculum and conclusions are drawn.

Classification: K50 K60 E20

Keywords: division of stakes; expectation; independence; relative frequencies; subjective (personal) probability; conditional probability; axiomatic probability; random samples; fundamental ideas; d'Alembert; Bayes; Bernoulli; Bertrand; Çinlar; Falk; de Finetti; Huygens; Kolmogorov; von Mises; Székely
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