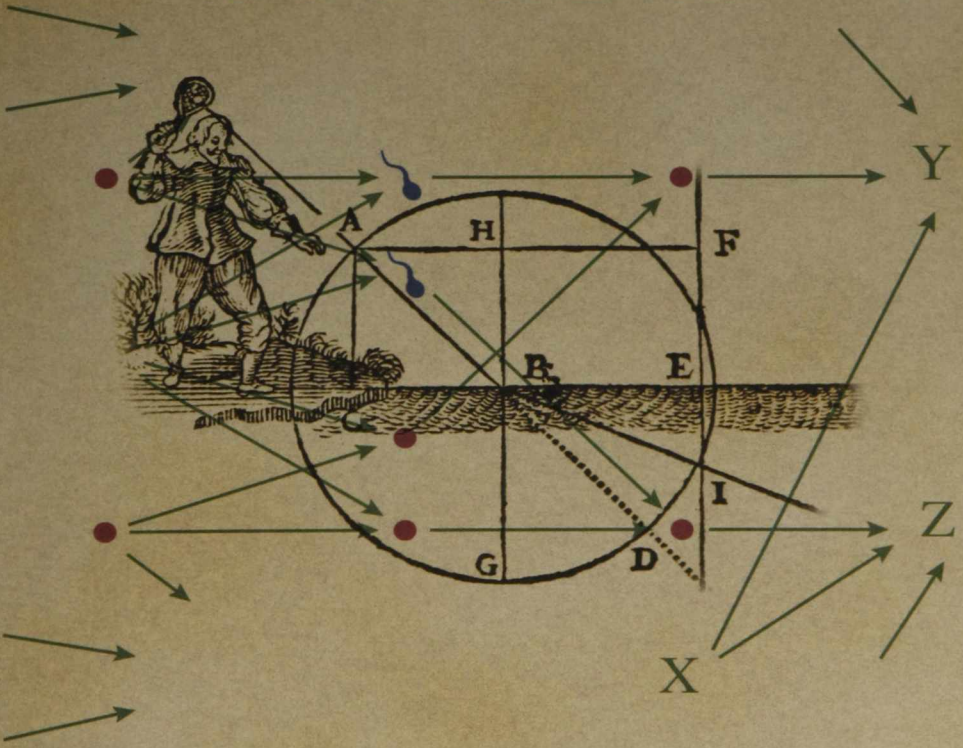
CAUSALITY

MODELS, REASONING, AND INFERENCE



JUDEA PEARL

Written by one of the preeminent researchers in the field, this book provides a comprehensive exposition of modern analysis of causation. It shows how causality has grown from a nebulous concept into a mathematical theory with significant applications in the fields of statistics, artificial intelligence, philosophy, cognitive science and the health and social sciences.

The author presents and unifies the probabilistic, manipulative, counterfactual, and structural approaches to causation, and he devises simple mathematical tools for studying the relationships between causal connections and statistical associations. The book will open the way for including causal analysis in the standard curricula of statistics, artificial intelligence, business, epidemiology, social science and economics. Students in these areas will find natural models, simple inferential procedures, and precise mathematical definitions of causal concepts that traditional texts have tended to evade or make unduly complicated.

Causality will be of interest to students and professionals in a wide variety of fields. Anyone who wishes to elucidate meaningful relationships from data, predict effects of actions and policies, assess explanations of reported events, or form theories of causal understanding and causal speech will find this book stimulating and invaluable.

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Judea Pearl is Professor of Computer Science and Statistics and Director of the Cognitive Systems Laboratory at the University of California, Los Angeles. He is the author of *Heuristics* (1984) and *Probabilistic Reasoning in Intelligent Systems* (1988), and he has published close to 200 articles on various aspects of automated reasoning, learning, and inference. A Member of the National Academy of Engineering and a Fellow of the IEEE and the AAAI, Pearl is the recipient of the IJCAI Research Excellence Award in Artificial Intelligence (1999) "for his fundamental work on heuristic search, reasoning under uncertainty, and causality."

Additional Commendation for *Causality*

"Judea Pearl's previous book, ***Probabilistic Reasoning in Intelligent Systems,*** was arguably the most influential book in Artificial Intelligence in the past decade, setting the stage for much of the current activity in probabilistic reasoning. In this book, Pearl turns his attention to causality, boldly arguing for the primacy of a notion long ignored in statistics and misunderstood and mistrusted in other disciplines, from physics to economics. He demystifies the notion, clarifies the basic concepts in terms of graphical models, and explains the source of many misunderstandings. This book should prove invaluable to researchers in artificial intelligence, statistics, economics, epidemiology, and philosophy, and, indeed, all those interested in the fundamental notion of causality. It may well prove to be one of the most influential books of the next decade."

—Joseph Halpern, Computer Science Department, Cornell University

"This lucidly written book is full of inspiration and novel ideas that bring clarity to areas where confusion has prevailed, in particular concerning causal interpretation of structural equation systems, but also on concepts such as counterfactual reasoning and the general relation between causal thinking and graphical models. Finally the world can get a coherent exposition of these ideas that Judea Pearl has developed over a number of years and presented in a flurry of controversial yet illuminating articles."

—Steffen L. Lauritzen, Department of Mathematics, Aalborg University

"Judea Pearl's new book, *Causality: Models, Reasoning, and Inference,* is an outstanding contribution to the causality literature. It will be especially useful to students and practitioners of economics interested in policy analysis."

— Halbert White, Professor of Economics, University of California, San Diego

"This book fulfills a long-standing need for a rigorous yet accessible treatise on the mathematics of causal inference. Judea Pearl has done a masterful job of describing the most important approaches and displaying their underlying logical unity. The book deserves to be read by all statisticians and scientists who use nonexperimental data to study causation, and would serve well as a graduate or advanced undergraduate course text."

— Sander Greenland, School of Public Health, University of California, Los Angeles

"Judea Pearl has written an account of recent advances in the modeling of probability and cause, substantial parts of which are due to him and his co-workers. This is essential reading for anyone interested in causality."

— Brian Skryms, Department of Philosophy, University of California, Irvine

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Models, Reasoning, and Inference

Judea Pearl
University of California, Los Angeles

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Development of Western science is based on two great achievements: the invention of the formal logical system (in Euclidean geometry) by the Greek philosophers, and the discovery of the possibility to find out causal relationships by systematic experiment (during the Renaissance).

Albert Einstein (1953)