Scientific Explanation And The Causal Structure Of The World

Did mandatory busing programs in the 1970s increase the school achievement of disadvantaged minority youth? Does obtaining a college degree increase an individual's labor market earnings? Did the use of the butterfly ballot in some Florida counties in the 2000 presidential election cost Al Gore votes? If so, was the number of miscast votes sufficiently large to have altered the election outcome? At their core, these types of questions are simple cause-and-effect questions. Simple cause-and-effect questions are the motivation for much empirical work in the social sciences. This book presents a model and set of methods for causal effect estimation that social scientists can use to address causal questions such as these. The essential features of the counterfactual model of causality for observational data analysis are presented with examples from sociology, political science, and economics.

As Aristotle stated, scientific explanation is based on deductive argument--yet, Wesley C. Salmon points out, not all deductive arguments are qualified explanations. The validity of the explanation must itself be examined. "Four Decades of Scientific Explanation" provides a comprehensive account of the developments in scientific explanation that transpired in the last four decades of the twentieth century. It continues to stand as the most comprehensive treatment of the writings on the subject during these years. Building on the historic 1948 essay by Carl G. Hempel and Paul Oppenheim, "Studies in the Logic of Explanation," which introduced the deductive-nomological (D-N) model on which most work on scientific explanation was based for the following four decades, Salmon goes beyond this model's inherent basis of describing empirical knowledge to tells us "not only "what, " but also "why."" Salmon examines the predominant models in chronological order and describes their development, refinement, and criticism or rejection. "Four Decades of Scientific Explanation" underscores the need for a consensus of approach and ongoing evaluations of methodology in scientific explanation, with the goal of providing a better understanding of natural phenomena.

The causal problem has become topical once again. While we are no longer causalists or believers in the universal truth of the causal principle we continue to think of causes and effects, as well as of causal and noncausal relations among them. Instead of becoming indeterminists we have enlarged determinism to include noncausal categories. And we are still in the process of characterizing our basic concepts and principles concerning causes and effects with the help of exact tools. This is because we want to explain, not just describe, the ways of things. The causal principle is not the only means of understanding the world but it is one of them.The demand for a fourth edition of this distinguished book on the subject of causality is clear evidence that this principle continues to be an important and popular area of philosophic enquiry. Non-technical and clearly written, this book focuses on the ontological problem of causality, with specific emphasis on the place of the causal principle in modern science. Mario Bunge first defines the terminology employed and describes various formulations of the causal principle. He then examines the two primary critiques of causality, the empiricist and the romantic, as a prelude to the detailed explanation of the actual assertions of causal determinism.Bunge analyzes the function of the causal principle in science, touching on such subjects as scientific law, scientific explanation, and scientific prediction. In so doing, he offers an education to layman and specialist alike on the history of a concept and its opponents. Professor William A. Wallace, author of Causality and Scientific Explanation said of an earlier edition of this work: "I regard it as a truly seminal work in this field."

Drawing on the rich resources of the ten-volume series of The Oxford Handbooks of Political Science, this one-volume distillation provides a comprehensive overview of all the main branches of contemporary political science: political theory; political institutions; political behavior; comparative politics; international relations; political economy; law and politics; public policy; contextual political analysis; and political methodology. Sixty-seven of the top political scientists worldwide survey recent developments in those fields and provide penetrating introductions to exciting new fields of study. Following in the footsteps of the New Handbook of Political Science edited by Robert Goodin and Hans-Dieter Klingemann a decade before, this Oxford Handbook will become an indispensable guide to the scope and methods of political science as a whole. It will serve as the reference book of record for political scientists and for those following their work for years to come.

Scientific and philosophical literature on causality has become highly specialised. It is hard to find suitable access points for students, young researchers, or professionals outside this domain. This book provides a guide to the complex literature, explains the scientific problems of causality and the philosophical tools needed to address them.

Proposes a theory of scientific explanation and understanding that overhauls and augments the familiar causal approach to explanation.

The philosophical theory of scientific explanation proposed here involves a radically new treatment of causality that accords with the pervasively statistical character of contemporary science. Wesley C. Salmon describes three fundamental conceptions of scientific explanation--the epistemic, modal, and ontic. He argues that the prevailing view (a version of the epistemic conception) is untenable and that the modal conception is scientifically out-dated. Significantly revising aspects of his earlier work, he defends a causal/mechanical theory that is a version of the ontic conception. Professor Salmon's theory furnishes a robust argument for scientific realism akin to the argument that convinced twentieth-century physical scientists of the existence of atoms and molecules. To do justice to such notions as irreducibly statistical laws and statistical explanation, he offers a novel account of physical randomness. The transition from the "reviewed view" of scientific explanation (that explanations are arguments) to the causal/mechanical model requires fundamental rethinking of basic explanatory concepts.

Scientific Explanation was first published in 1962. Minnesota Archive Editions uses digital technology to make long-unavailable books once again accessible, and are published unaltered from the original University of Minnesota Press editions. Is a new consensus emerging in the philosophy of science? The nine distinguished contributors to this volume apply that question to the realm of scientific explanation and, although their conclusions vary, they agree in one respect: there definitely was an old consensus. Co-editor Wesley Salmon's opening essay, "Four Decades of Scientific Explanation," grounds the entire discussion. His point of departure is the founding document of the old consensus: a 1948 paper by Carl G. Hempel and Paul Oppenheim, "Studies in the Logic of Explanation," that set forth, with remarkable clarity, a mode of argument that came to be known as the deductive-nomological model. This approach, holding that explanation dies not move beyond the sphere of empirical knowledge, remained dominant during the hegemony of logical empiricism from 1950 to 1975. Salmon traces in detail the rise and breakup of the old consensus, and examines the degree to which there is, if not a new consensus, at least a kind of reconciliation on this issue among contemporary philosophers of science and clear agreement that science can indeed tell us why. The other contributors, in the order of their presentations, are: Peter Railton, Matti Sintonen, Paul W. Humphreys, David Papineau, Nancy Cartwright, James Woodward, Merrilee H. Salmon, and Philip Kitcher.

What forms does explanation take if it is not based on causation? Fifteen leading philosophers explore this hot topic, arising from a shift in philosophical understanding of the nature of explanation which reflects actual explanatory practices in science, mathematics, and philosophy.

According to modern physics, many objectively improbable events actually occur, such as the spontaneous disintegration of radioactive atoms. Because of high levels of improbability, scientists are often at a loss to explain such phenomena. In this main essay of this book, Wesley Salmon offers a solution to scientific explanation based on the concept of statistical relevance (the S-R model). In this vein, the other two essays herein discuss “Statistical Relevance vs. Statistical Inference,” and “Explanation and Information.”

This investigation into causal modelling presents the rationale of causality, i.e. the notion that guides causal reasoning in causal modelling. It is argued that causal models are regimented by a rationale of variation, nor of regularity neither invariance, thus breaking down the dominant Human paradigm. The notion of variation is shown to be embedded in the scheme of reasoning behind various causal models. It is also shown to be latent – yet fundamental – in many philosophical accounts. Moreover, it has significant consequences for methodological issues: the warranty of the causal interpretation of causal models, the levels of causation, the characterisation of mechanisms, and the interpretation of probability. This book offers a novel philosophical and methodological approach to causal reasoning in causal modelling and provides the reader with the tools to be up to date about various issues causality rises in social science.

Woodward's long awaited book is an attempt to construct a comprehensive account of causation explanation that applies to a wide variety of causal and explanatory claims in different areas of science and everyday life. The book engages some of the relevant literature from other disciplines, as Woodward weaves together examples, counterexamples, criticisms, defenses, objections, and replies into a convincing defense of the core of his theory, which is that we can analyze causation by appeal to the notion of manipulation.

In Making Things Happen, James Woodward develops a new and ambitious comprehensive theory of causation and explanation that draws on literature from a variety of disciplines and which applies to a wide variety of claims in science and everyday life. His theory is a manipulationist account, proposing that causal and explanatory relationships are relationships that are potentially exploitable for purposes of manipulation and control. This account has its roots in the commonsense idea that causes are means for bringing about effects; but it also draws on a long tradition of work in experimental design, econometrics, and statistics. Woodward shows how these ideas may be generalized to other areas of science from the social scientific and biomedical contexts for which they were originally designed. He also provides philosophical foundations for the manipulationist approach, drawing out its implications, comparing it with alternative approaches, and defending it from common criticisms. In doing so, he shows how the manipulationist account both illuminates important features of successful causal explanation in the natural and social sciences, and avoids the counterexamples and difficulties that infect alternative approaches, from the deductive-nomological model onwards. Making Things Happen will interest philosophers working in the philosophy of science, the philosophy of social science, and metaphysics, and as well as anyone interested in causation, explanation, and scientific methodology.

"A comprehensive book on methods for mediation and interaction. The only book to approach this topic from the perspective of causal inference. Numerous software tools provided. Easy-to-read and accessible. Examples drawn from diverse fields. An essential reference for anyone conducting empirical research in the biomedical or social sciences"--

After its publication in 1967, The Foundations of Scientific Inference taught a generation of students and researchers about the problem of induction, the interpretation of probability, and confirmation theory. Fifty years later, Wesley C. Salmon’s book remains one of the clearest introductions to these fundamental problems in the philosophy of science. With The Foundations of Scientific Inference, Salmon presented a coherent vision of the nature of scientific reasoning, explored the philosophical underpinnings of scientific investigation, and introduced readers to key movements in epistemology and to leading philosophers of the twentieth century—such as Karl Popper, Rudolf Carnap, and Hans Reichenbach—offering a critical assessment and developing his own distinctive views on topics that are still of central importance today. This anniversary edition of Salmon’s foundational work in the philosophy of science features a detailed introduction by Christopher Hitchcock, which examines the book’s origins, influences, and major themes, its impact and enduring effects, the disputes it raised, and its place in current studies, revisiting Salmon’s ideas for a new audience of philosophers, historians, scientists, and students.

Is the appropriate form of human action explanation causal or rather teleological? While this is a central question in analytic philosophy of action, it also has implications for questions about the differences between methods of explanation in the sciences on the one hand and in the humanities and the social sciences on the other. Additionally, this question bears on the problem of the appropriate form of explanations of past human actions, and therefore it is prominently discussed by analytic philosophers of historiography. This volume brings together causalists and anti-causalists to address enduring philosophical questions at the heart of this debate, as well as their implications for the practice of historiography. Part I considers the quarrel between causalism and anti-causalism in recent developments in the philosophy of action. Part II presents papers by causalists and anti-causalists that are more narrowly focused on the philosophy of historiography.

Symposium held at Purdue Univ. in June 4-5, 2010.

The Greco-Roman mathematician Claudius Ptolemy is one of the most significant figures in the history of science. He is remembered today for his astronomy, but his philosophy is almost entirely lost to history. This groundbreaking book is the first to reconstruct Ptolemy’s general philosophical system—including his metaphysics, epistemology, and ethics—and to explore its relationship to astronomy, harmonics, element theory, astrology, cosmology, psychology, and theology. In this stimulating intellectual history, Jacqueline Feke uncovers references to a complex and sophisticated philosophical agenda scattered among Ptolemy’s technical studies in the physical and mathematical sciences. She shows how he developed a philosophy that was radical and even subversive, appropriating ideas and turning them against the very philosophers from whom he drew influence. Feke reveals how Ptolemy’s unique system is at once a critique of prevailing philosophical trends and a conception of the world in which mathematics reigns supreme. A compelling work of scholarship, Ptolemy’s Philosophy demonstrates how Ptolemy situated mathematics at the very foundation of all philosophy—theoretical and practical—and advanced the mathematical way of life as the true path to human perfection.

A Turing Award-winning computer scientist and statistician shows how understanding causality has revolutionized science and will revolutionize artificial intelligence "Correlation is not causation." This mantra, chanted by scientists for more than a century, has led to a virtual prohibition on causal talk. Today, that taboo is dead. The causal revolution, instigated by Judea Pearl and his colleagues, has cut through a century of confusion and established causality -- the study of cause and effect -- on a firm scientific basis. His work explains how we can know easy things, like whether it was rain or a sprinkler that made a sidewalk wet; and how to answer hard questions, like whether a drug cured an illness. Pearl's work enables us to know not just whether one thing causes another: it lets us explore the world that is and the worlds that could have been. It shows us the essence of human thought and key to artificial intelligence. Anyone who wants to understand either needs The Book of Why.

How do cognitive neuroscientists explain phenomena like memory or language processing? This book examines the different kinds of experiments and manipulative research strategies involved in understanding and eventually explaining such phenomena. Against this background, it evaluates contemporary accounts of scientific explanation, specifically the mechanistic and interventionist accounts, and

finds them to be crucially incomplete. Besides, mechanisms and interventions cannot actually be combined in the way usually done in the literature. This book offers solutions to both these problems based on insights from experimental practice. It defends a new reading of the interventionist account, highlights the importance of non-interventionist studies for scientific inquiry, and supplies a taxonomy of experiments that makes it easy to see how the gaps in contemporary accounts of scientific explanation can be filled. The book concludes that a truly empirically adequate philosophy of science must take into account a much wider range of experimental research than has been done to date. With the taxonomy provided, this book serves a stepping-stone leading into a new era of philosophy of science—for cognitive neuroscience and beyond.

Scientific explanation, laws of nature, and causation are crucial and frontier issues in the philosophy of science. This book studies the complex relationship between the three concepts, aiming to achieve a holistic synthesis about explanation–laws–causation. By reviewing Hempel's scientific explanation models and Salmon's three conceptions – the epistemic, modal, and ontic conception – the book suggests that laws are essential to explanation and that our understanding of laws will help solve the problems of the latter. Concerning the nature of laws, this book tackles both the problems of regularity approach and necessitarian approach. It also proposes that the ontological order of explanation should be from events (or processes) to causation, then to regularity (laws), and finally to science system, but the epistemological order should be from science system to laws to explanation and causation. In addition, this book examines the legitimacy of ceteris paribus laws, the connection between explanation and reduction, the relation between explanation and interpretation, and some other issues closely related to explanation–laws–causation. This book will attract scholars and students of philosophy of science, natural sciences, social sciences, etc.

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, economics, philosophy, cognitive science, and the health and social sciences. Judea Pearl presents and unifies the probabilistic, manipulative, counterfactual, and structural approaches to causation and devises simple mathematical tools for studying the relationships between causal connections and statistical associations. Cited in more than 2,100 scientific publications, it continues to liberate scientists from the traditional molds of statistical thinking. In this revised edition, Judea Pearl elucidates thorny issues, answers readers' questions, and offers a panoramic view of recent advances in this field of research. Causality will be of interest to students and professionals in a wide variety of fields. Dr Judea Pearl has received the 2011 Rumelhart Prize for his leading research in Artificial Intelligence (AI) and systems from The Cognitive Science Society.

Michael Strevens makes three claims about rules for inferring physical probability. They are reliable. They constitute a key part of the physical intuition that allows us to navigate the world safely in the absence of scientific knowledge. And they played a crucial role in scientific innovation, from statistical physics to natural selection.

Not all scientific explanations work by describing causal connections between events or the world's overall causal structure. Some mathematical proofs explain why the theorems being proved hold. In this book, Marc Lange proposes philosophical accounts of many kinds of non-causal explanations in science and mathematics. These topics have been unjustly neglected in the philosophy of science and mathematics. One important kind of non-causal scientific explanation is termed explanation by constraint. These explanations work by providing information about what makes certain facts especially inevitable - more necessary than the ordinary laws of nature connecting causes to their effects. Facts explained in this way transcend the hurly-burly of cause and effect. Many physicists have regarded the laws of kinematics, the great conservation laws, the coordinate transformations, and the parallelogram of forces as having explanations by constraint. This book presents an original account of explanations by constraint, concentrating on a variety of examples from classical physics and special relativity. This book also offers original accounts of several other varieties of non-causal scientific explanation. Dimensional explanations work by showing how some law of nature arises merely from the dimensional relations among the quantities involved. Really statistical explanations include explanations that appeal to regression toward the mean and other canonical manifestations of chance. Lange provides an original account of what makes certain mathematical proofs but not others explain what they prove. Mathematical explanation connects to a host of other important mathematical ideas, including coincidences in mathematics, the significance of giving multiple proofs of the same result, and natural properties in mathematics. Introducing many examples drawn from actual science and mathematics, with extended discussions of examples from Lagrange, Desargues, Thomson, Sylvester, Maxwell, Rayleigh, Einstein, and Feynman, Because Without Cause's proposals and examples should set the agenda for future work on non-causal explanation.

Far from being the sole mode of explaining, explanation in terms of - mostly probabilistic - causes has nourished a wide debate addressing diseases, what produces them and how. Focusing on causal explanations involves, in turn, getting deeper into conceptions of causation, modelling, and control, and presents a range of relevant issues for research and clinical contexts. The aim of the volume is two-fold. In the first place, its purpose is to stress core features, differences and interactions between various theories belonging to, on the one hand, the mechanical and neo-mechanical approach to explanation, and, on the other hand, the interventionist approach, testing their suitability in medicine. In the second place, and related to the first, a form of pluralism is advocated which is grounded on a deep analysis of specific features of explanatory contexts in the health sciences, especially in cancer and mental health studies.

Recent arguments concerning the nature of causation in evolutionary theory, now often known as the debate between the 'causalist' and 'statisticalist' positions, have involved answers to a variety of independent questions – definitions of key evolutionary concepts like natural selection, fitness, and genetic drift; causation in multi-level systems; or the nature of evolutionary explanations, among others. This Element offers a way to disentangle one set of these questions surrounding the causal structure of natural selection. Doing so allows us to clearly reconstruct the approach that some of these major competing interpretations of evolutionary theory have to this causal structure, highlighting particular features of philosophical interest within each. Further, those features concern problems not exclusive to the philosophy of biology. Connections between them and, in two case studies, contemporary metaphysics and philosophy of physics demonstrate the potential value of broader collaboration in the understanding of evolution.

Scientific Explanation and the Causal Structure of the WorldPrinceton University Press

The purpose of this essay is to defend the deductive-nomological model of explanation against a number of criticisms that have been made of it. It has traditionally been thought that scientific explanations were causal and that scientific explanations involved deduction from laws. In recent years, however, this three-fold identity has been challenged: there are, it is argued, causal explanations that are not scientific, scientific explanations that are not deductive, deductions from laws that are neither causal explanations nor scientific explanations, and causal explanations that involve no deductions from laws. The aim of the present essay is to defend the traditional identities, and to show that the more recent attempts at invalidating them fail in their object. More specifically, this essay argues that a Humean version of the deductive-nomological model of explanation can be defended as (1) the correct account of scientific explanation of individual facts and processes, and as (2) the correct account of causal explanations of individual facts and processes. The deductive-nomological model holds that to explain an event E, say that a is G, one must find some initial conditions C, say that a is F, and a law or theory T such that T and C jointly entail E, and both are essential to the deduction.

Causal powers are ubiquitous. Electrons are negatively charged; they have the power to repel other electrons. Water is a solvent; it has the power to dissolve salt. We use concepts of causal powers and their relatives-dispositions, capacities, abilities, and so on-to describe the world around us, both in everyday life and in scientific practice. This collection brings together new and important work by both emerging scholars and those whohelped shape the field on the nature of causal powers, and the connections between causal powers and other phenomena within metaphysics, philosophy of science, and philosophy of mind. Contributors discusshow one who takes causal powers to be in some sense irreducible should think about laws of nature, scientific practice, causation, modality, space and time, persistence, and the metaphysics of mind.

Reviews the scope, nature, and applications of the philosophical discipline, focusing on methods for distinguishing between valid and fallacious arguments and inferences

For over two decades Wesley Salmon has helped to shape the course of debate in philosophy of science. He is a major contributor to the philosophical discussion of problems associated with causality and the author of two influential books on scientific explanation. This long-awaited volume collects twenty- six of Salmon's essays, including seven that have never before been published and others difficult to find. Part I comprises five introductory essays that presuppose no formal training in philosophy of science and form a background for subsequent essays. Parts II and III contain Salmon's seminal work on scientific explanation and causality. Part IV offers survey articles that feature advanced material but remain accessible to those outside philosophy of science. Essays in Part V address specific issues in particular scientific disciplines, namely, archaeology and anthropology, astrophysics and cosmology, and physics. Clear, compelling, and essential, this volume offers a superb introduction to philosophy of science for nonspecialists and belongs on the bookshelf of all who carry out work in this exciting field. Wesley Salmon is renowned for his seminal contributions to the philosophy of science. He has powerfully and permanently shaped discussion of such issues as lawlike and probabilistic explanation and the interrelation of explanatory notions to causal notions. This unique volume brings together twenty-six of his essays on subjects related to causality and explanation, written over the period 1971-1995. Six of the essays have never been published before and many others have only appeared in obscure venues. The volume includes a section of accessible introductory pieces, as well as more advanced and technical pieces, and will make essential work in the philosophy of science readily available to both scholars and students.

Causation is the main foundation upon which the possibility of science rests. Without causation, there would be no scientific understanding, explanation, prediction, nor application in new technologies. How we discover causal connections is no easy matter, however. Causation often lies hiddenfrom view and it is vital that we adopt the right methods for uncovering it. The choice of methods will inevitably reflect what one takes causation to be, making an accurate account of causation an even more pressing matter. This enquiry informs the correct norms for an empirical study of the world. In Causation in Science and the Methods of Scientific Discovery, Rani Lill Anjum and Stephen Mumford propose nine new norms of scientific discovery. A number of existing methodological and philosophical orthodoxies are challenged as they argue that progress in science is being held back by an overlysimplistic philosophy of causation.

This volume of articles (most published, some new) is a follow-up to the late Wesley C. Salmon's widely read collection Causality And Explanation (OUP 1998). It contains both published and unpublished articles, and focuses on two related areas of inquiry: First, is science a rational enterprise? Secondly, does science yield objective information about our world, even the aspects that we cannot observe directly? Salmon's own take is that objective knowledge of the world is possible, and his work in these articles centers around proving that this can be so. Salmon's influential standing in the field ensures that this volume will be of interest to both undergraduates and professional philosophers, primarily in the philosophy of science.

Not since Ernest Nagel’s 1939 monograph on the theory of probability has there been a comprehensive elementary survey of the philosophical problems of probablity and induction. This is an authoritative and up-to-date treatment of the subject, and yet it is relatively brief and nontechnical. Hume’s skeptical arguments regarding the justification of induction are taken as a point of departure, and a variety of traditional and contemporary ways of dealing with this problem are considered. The author then sets forth his own criteria of adequacy for interpretations of probability. Utilizing these criteria he analyzes contemporary theories of probability, as well as the older classical and subjective interpretations.