

Discovering Complexity

Decomposition and Localization as Strategies
in Scientific Research

William Bechtel and Robert C. Richardson



Discovering Complexity Decomposition And Localization As Strategies In Scientific Research

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Discovering Complexity Decomposition And Localization As Strategies In Scientific Research:

Discovering Complexity William Bechtel, Robert C. Richardson, 2010-08-06 An analysis of two heuristic strategies for the development of mechanistic models illustrated with historical examples from the life sciences In *Discovering Complexity* William Bechtel and Robert Richardson examine two heuristics that guided the development of mechanistic models in the life sciences decomposition and localization Drawing on historical cases from disciplines including cell biology cognitive neuroscience and genetics they identify a number of choice points that life scientists confront in developing mechanistic explanations and show how different choices result in divergent explanatory models Describing decomposition as the attempt to differentiate functional and structural components of a system and localization as the assignment of responsibility for specific functions to specific structures Bechtel and Richardson examine the usefulness of these heuristics as well as their fallibility the sometimes false assumption underlying them that nature is significantly decomposable and hierarchically organized When *Discovering Complexity* was originally published in 1993 few philosophers of science perceived the centrality of seeking mechanisms to explain phenomena in biology relying instead on the model of nomological explanation advanced by the logical positivists a model Bechtel and Richardson found to be utterly inapplicable to the examples from the life sciences in their study Since then mechanism and mechanistic explanation have become widely discussed In a substantive new introduction to this MIT Press edition of their book Bechtel and Richardson examine both philosophical and scientific developments in research on mechanistic models since 1993

Discovering Complexity William Bechtel, 1993-01-01 **Advances in Experimental Philosophy of Science** Daniel A. Wilkenfeld, Richard Samuels, 2019-09-19 This volume gathers together leading philosophers of science and cognitive scientists from around the world to provide one of the first book length studies of this important and emerging field Specific topics considered include learning and the nature of scientific knowledge the cognitive consequences of exposure to explanations climate change and mechanistic reasoning and abstraction Chapters explore how experimental methods can be applied to questions about the nature of science and show how to fruitfully theorize about the nature and role of science with well grounded empirical research *Advances in Experimental Philosophy of Science* presents a new direction in the philosophical exploration of science and paves a path for those who might seek to pursue research in experimental philosophy of science **The Routledge**

Handbook of Mechanisms and Mechanical Philosophy Stuart Glennan, Phyllis Illari, 2017-07-06 Scientists studying the burning of stars the evolution of species DNA the brain the economy and social change all frequently describe their work as searching for mechanisms Despite this fact for much of the twentieth century philosophical discussions of the nature of mechanisms remained outside philosophy of science *The Routledge Handbook of Mechanisms and Mechanical Philosophy* is an outstanding reference source to the key topics problems and debates in this exciting subject and is the first collection of its kind Comprising over thirty chapters by a team of international contributors the Handbook is divided into four Parts

Historical perspectives on mechanisms The nature of mechanisms Mechanisms and the philosophy of science Disciplinary perspectives on mechanisms Within these Parts central topics and problems are examined including the rise of mechanical philosophy in the seventeenth century what mechanisms are made of and how they are organized mechanisms and laws and regularities how mechanisms are discovered and explained dynamical systems theory and disciplinary perspectives from physics chemistry biology biomedicine ecology neuroscience and the social sciences Essential reading for students and researchers in philosophy of science the Handbook will also be of interest to those in related fields such as metaphysics philosophy of psychology and history of science *The Multiple Realization Book* Thomas W. Polger, Lawrence A. Shapiro, 2016 Thomas W Polger and Lawrence A Shapiro offer the first full investigation of multiple realization the idea that minds can be realized in ways other than the human brain They cast doubt on the hypothesis and offer an alternative framework for understanding explanations in the cognitive sciences and in chemistry biology and related fields

Mechanism and Causality in Biology and Economics Hsiang-Ke Chao, Szu-Ting Chen, Roberta L. Millstein, 2013-07-31 This volume addresses fundamental issues in the philosophy of science in the context of two most intriguing fields biology and economics Written by authorities and experts in the philosophy of biology and economics Mechanism and Causality in Biology and Economics provides a structured study of the concepts of mechanism and causality in these disciplines and draws careful juxtapositions between philosophical apparatus and scientific practice By exploring the issues that are most salient to the contemporary philosophies of biology and economics and by presenting comparative analyses the book serves as a platform not only for gaining mutual understanding between scientists and philosophers of the life sciences and those of the social sciences but also for sharing interdisciplinary research that combines both philosophical concepts in both fields The book begins by defining the concepts of mechanism and causality in biology and economics respectively The second and third parts investigate philosophical perspectives of various causal and mechanistic issues in scientific practice in the two fields These two sections include chapters on causal issues in the theory of evolution experiments and scientific discovery representation of causal relations and mechanism by models in economics The concluding section presents interdisciplinary studies of various topics concerning extrapolation of life sciences and social sciences including chapters on the philosophical investigation of conjoining biological and economic analyses with respectively demography medicine and sociology *The Mechanical World* Beate Krickel, 2019-01-04 This monograph examines the metaphysical commitments of the new mechanistic philosophy a way of thinking that has returned to center stage It challenges a variant of reductionism with regard to higher level phenomena which has crystallized as a default position among these so called New Mechanists Furthermore it opposes those philosophers who reject the possibility of interlevel causation Contemporary philosophers believe that the explanation of scientific phenomena requires the discovery of relevant mechanisms As a result new mechanists are in the main concerned solely with epistemological questions But the author argues their most central claims

rely on metaphysical assumptions Thus they must also take into account metaphysics a system of thought concerned with explaining the fundamental nature of being and the world around it This branch of philosophy does indeed matter to the empirical sciences The chapters investigate the nature of mechanisms their components and the ways in which they can bring about different phenomena In addition the author develops a novel account of causation in terms of activities The analysis provides the basis for many further research projects on mechanisms and their relations to for example the mind body problem realization multiple realization natural kinds causation laws of nature counterfactuals and scientific levels

Levels of Organization in the Biological Sciences Daniel S. Brooks, James DiFrisco, William C. Wimsatt, 2021-08-24 Scientific philosophers examine the nature and significance of levels of organization a core structural principle in the biological sciences This volume examines the idea of levels of organization as a distinct object of investigation considering its merits as a core organizational principle for the scientific image of the natural world It approaches levels of organization roughly the idea that the natural world is segregated into part whole relationships of increasing spatiotemporal scale and complexity in terms of its roles in scientific reasoning as a dynamic open ended idea capable of performing multiple overlapping functions in distinct empirical settings The contributors scientific philosophers with longstanding ties to the biological sciences discuss topics including the philosophical and scientific contexts for an inquiry into levels whether the concept can actually deliver on its organizational promises the role of levels in the development and evolution of complex systems conditional independence and downward causation and the extension of the concept into the sociocultural realm Taken together the contributions embrace the diverse usages of the term as aspects of the big picture of levels of organization Contributors Jan Baedke Robert W Batterman Daniel S Brooks James DiFrisco Markus I Eronen Carl Gillett Sara Green James Griesemer Alan C Love Angela Potochnik Thomas Reydon Ilya T mkin Jon Umerez William C Wimsatt James Woodward

The Complexity Challenge Robert W. Rycroft, Don E. Kash, 1999 This book investigates the fundamental rethinking required by the transition to a production system whose guiding intelligence is self organizing networks Utilizing an exploding literature in the science of complexity and evolutionary economics plus six detailed case studies of complex technologies that have experienced repeated innovation this study identifies distinct innovation patterns and explores what happens when changes in these patterns occur This volume also identifies the conditions that signal the approach of such changes and investigates the appropriate strategy and policy responses used to deal with them

Thinking Complexity Paul Cilliers, 2007 This volume examines the impact of complexity theory on various disciplines especially the area of philosophy Philosophy

Visual Representations and Scientific Knowledge Laura Therese Perini, 2002

The Quarterly Journal of Experimental Psychology, 2002

The Journal of Philosophy, 2000

Canadian Journal of Experimental Psychology, 1998

Futurics, 1992

On the Nature of Consciousness Antti Revonsuo, 1995

Semiotica, 2000

Proceedings and Addresses of the American Philosophical Association American Philosophical

Association, 2010 List of members in v 1 The Memory Process Suzanne Nalbantian, Paul M. Matthews, James L. McClelland, 2011 The Memory Process offers a groundbreaking interdisciplinary approach to the understanding of human memory with contributions from both neuroscientists and humanists The first book to link the neuroscientific study of memory to the investigation of memory in the humanities it connects the latest findings in memory research with insights from philosophy literature theater art music and film Chapters from the scientific perspective discuss both fundamental concepts and ongoing debates from genetic and epigenetic approaches functional neuroimaging connectionist modeling dream analysis and neurocognitive studies The humanist analyses offer insights about memory from outside the laboratory a taxonomy of memory gleaned from modernist authors including Virginia Woolf James Joyce and William Faulkner the organization of memory seen in drama ranging from Hamlet to The Glass Menagerie procedural memory and emotional memory in responses to visual art music s dependence on the listener s recall and the vivid renderings of memory and forgetting in such films as Memento and Eternal Sunshine of the Spotless Mind The chapters from the philosophical perspective serve as the bridge between science and the arts The volume s sweeping introduction offers an integrative merging of neuroscientific and humanistic findings **The Philosophical Review** Jacob Gould Schurman, James Edwin Creighton, Frank Thilly, Gustavus Watts Cunningham, 2011 An international journal of general philosophy

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