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Undergraduate research (UR) is widely believed to enhance the learning experience of students in science, technology, engineering, and mathematics programs. This is the first comprehensive, practical, research-based book on undergraduate research. It addresses how the benefits to UR participants arise; compares the benefits of UR with other types of educational activities or experience; the long-term value of UR; and more. Intended to assist both existing and new UR practitioners with program design and evaluation needs, the book will also be useful to the wider community of academics, policy-makers, and funders of UR programs. Essays examining the ways in which the Victorian periodical press presented the scientific developments of the time to general and specialized audiences. Nineteenth-century Britain saw an explosion of periodical literature, with the publication of over 100,000 different magazines and newspapers for a growing market of eager readers. The Victorian periodical press became an important medium for the dissemination of scientific ideas. Every major scientific advance in the nineteenth century was trumpeted and analyzed in periodicals ranging from intellectual quarterlies such as the Edinburgh Review to popular weeklies like the Mirror of Literature, from religious periodicals such as the Evangelical Magazine to the atheistic Oracle of Reason. Scientific articles appeared side by side with the latest fiction or political reporting, while articles on nonscientific topics and serialized novels invoked scientific theories or used analogies drawn from science.The essays collected in Science Serialized examine the variety of ways in which the nineteenth-century periodical press represented science to both general and specialized readerships. They explore the role of scientific controversy in the press and the cultural politics of publication. Subject range from the presentation of botany in women's magazines to the highly public dispute between Darwin and Samuel Butler, and from discussions of the mind-body problem to those of energy physics. Contributors include leading scholars in the fields of history of science and literature: Ann B. Shteir, Jonathan Topham, Frank A. J. L. James, Roger Smith, Graeme Gooday, Crosbie Smith, Ian Higginson, Gillian Beer, Bernard Lightman, Helen Small, Gowan Dawson, Jonathan Smith, James G. Paradis, and Harriet Ritvo What is a popular image of science and where does it come from? Little is known about the formation of science images and their transformation into popular images of science. In this anthology, contributions from two areas of expertise: image theory and history and the sociology of the sciences, explore techniques of constructing science images and transforming them into highly ambivalent images that represent the sciences. The essays, most of them with illustrations, present evidence that popular images of the sciences are based upon abstract theories rather than facts, and, equally, images of scientists are stimulated by imagination rather than historical knowledge. This collection of papers contains historical case studies, systematic contributions of a general nature, and applications to specific sciences. The bibliographies of the contributions contain references to all central items from the traditions that are relevant today. While providing access to contemporary views on the issue, the papers illustrate the wide variety of functions of metaphors and analogies, as well as the many connections between the study of some of these functions and other subjects and disciplines. Although the Scientific Revolution has long been regarded as the beginning of modern science, there has been little consensus about its true character. While the application of mathematics to the study of the natural world has always been recognized as an important factor, the role of experiment has been less clearly understood. Peter Dear investigates the nature of the change that occurred during this period, focusing particular attention on evolving notions of experience and how these developed into the experimental work that is at the center of modern science. He examines seventeenth-century mathematical sciences—astronomy, optics, and mechanics—not as abstract ideas, but as vital enterprises that involved practices related to both experience and experiment. Dear illuminates how mathematicians and natural philosophers of the period—Mersenne, Descartes, Pascal, Barrow, Newton, Boyle, and the Jesuits—used experience in their argumentation, and how and why these approaches changed over the course of a century. Drawing on mathematical texts and works of natural philosophy from all over Europe, he describes a process of change that was gradual, halting, sometimes contradictory—far from the sharp break with intellectual tradition implied by the term "revolution." This groundbreaking, open access volume analyses and compares data practices across several fields through the analysis of specific cases of data journeys. It brings together leading scholars in the philosophy, history and social studies of science to achieve two goals: tracking the travel of data across different spaces, times and domains of research practice; and documenting how such journeys affect the use of data as evidence and the knowledge being produced. The volume captures the opportunities, challenges and concerns involved in making data move from the sites in which they are originally produced to sites where they can be integrated with other data, analysed and re-used for a variety of purposes. The in-depth study of data journeys provides the necessary ground to examine disciplinary, geographical and historical differences and similarities in data management, processing and interpretation, thus identifying the key conditions of possibility for the widespread data sharing associated with Big and Open Data. The chapters are ordered in sections that broadly correspond to different stages of the journeys of data, from their generation to the legitimisation of their use for specific purposes. Additionally, the preface to the volume provides a variety of alternative “roadmaps” aimed to serve the different interests and entry points of readers; and the introduction provides a substantive overview of what data journeys can teach about the methods and epistemology of research. What is science? Is social science a science? Why are more and more so-called scientific discoveries being exposed as outright frauds? Henry Bauer tackles these and many more intriguing questions that are emerging from within the academic and scientific communities and attracting attention from the popular media and the general public. Whether one is a specialist or generalist, scientist or humanist, thinker or activist, it is important to understand the place of science and technology in modern life. Popular views about the nature of science and scientific activity contain serious misconceptions that were discarded decades ago by most historians and philosophers of science. The perpetuation of these misconceptions usually surface in the form of frustrating and unproductive discussions about everything from setting policy and defining technical matters to whether one individual's point of view is ''right'' because it is supported by ''scientific facts.'' According to Bauer, the most serious and widespread misconceptions are that ''science'' can be discussed as though all sciences share a great deal in common and as though ''the scientific method'' characterizes all sciences. ''Science,'' argues Bauer, ''can be understood only if one recognizes it as a quest by fallible human beings who have evolved ways of interacting that help them gain relatively objective knowledge.'' In other words, science is a social activity, not simply the result of impersonal methods. Concern has recently arisen over the quality of American education and our declining scientific and research orientation. Debates are emerging about what direction public universities should be taking as we head into the twenty-fist century. Why and to what extent should society support basic scientific research? What should everyone in a democratic society know about science? This book will help readers come to an informed understanding about the place of science and technology in today's world.''Provocative. . . . Bauer argues that science does not proceed by the scientific method. If it did, experiments would inspire hypotheses which would then be tested until they generated reliable theories. As Watson and Crick's work [on DNA] shows, an elegant idea is often a headier lure than mere facts.''--Newsweek ''Sound, sensible . . . and very easy to read. . . . I would strongly recommend this book to anyone who hasn't yet heard that the scientific method is a myth.''--Science ''This is a book that every science teacher should read and consider. It will certainly affect their views of what science really is and influence their teaching.''--The Science Teacher How the NSF became an important yet controversial patron for the social sciences, influencing debates over their scientific status and social relevance. In the early Cold War years, the U.S. government established the National Science Foundation (NSF), a civilian agency that soon became widely known for its dedication to supporting first-rate science. The agency's 1950 enabling legislation made no mention of the social sciences, although it included a vague reference to "other sciences." Nevertheless, as Mark Solovey shows in this book, the NSF also soon became a major--albeit controversial--source of public funding for them. An introduction to category theory as a rigorous, flexible, and coherent modeling language that can be used across the sciences. Category theory was invented in the 1940s to unify and synthesize different areas in mathematics, and it has proven remarkably successful in enabling powerful communication between disparate fields and subfields within mathematics. This book shows that category theory can be useful outside of mathematics as a rigorous, flexible, and coherent modeling language throughout the sciences. Information is inherently dynamic; the same ideas can be organized and reorganized in countless ways, and the ability to translate between such organizational structures is becoming increasingly important in the sciences. Category theory offers a unifying framework for information modeling that can facilitate the translation of knowledge between disciplines. Written in an engaging and straightforward style, and assuming little background in mathematics, the book is rigorous but accessible to non-mathematicians. Using databases as an entry to category theory, it begins with sets and functions, then introduces the reader to notions that are fundamental in mathematics: monoids, groups, orders, and graphs—categories in disguise. After explaining the “big three” concepts of category theory—categories, functors, and natural transformations—the book covers other topics, including limits, colimits, functor categories, sheaves, monads, and operads. The book explains category theory by examples and exercises rather than focusing on theorems and proofs. It includes more than 300 exercises, with solutions. Category Theory for the Sciences is intended to create a bridge between the vast array of mathematical concepts used by mathematicians and the models and frameworks of such scientific disciplines as computation, neuroscience, and physics. This collection demonstrates the use and variety of applications of time use methodology from multidisciplinary, multinational, and multicultural perspectives. A distinguished roster of contributors from such fields as psychology, occupational therapy, sociology, economics, and architecture examines the complex relationship between human time utilization and health and well-being and evaluates the future of time use analysis as a research tool in the social sciences. This volume is the first systematic and thorough attempt to investigate the relation and the possible applications of mereology to contemporary science. It gathers contributions from leading scholars in the field and covers a wide range of scientific theories and practices such as physics, mathematics, chemistry, biology, computer science and engineering. Throughout the volume, a variety of foundational issues are investigated both from the formal and the empirical point of view. The first section looks at the topic as it applies to physics. The section addresses questions of persistence and composition within quantum and relativistic physics and concludes by scrutinizing the possibility to capture continuity of motion as described by our best physical theories within gunky space times. The second part tackles mathematics and shows how to provide a foundation for point-free geometry of space switching to fuzzy-logic. The relation between mereological sums and set-theoretic suprema is investigated and issues about different mereological perspectives such as classical and natural Mereology are thoroughly discussed. The third section in the volume looks at natural science. Several questions from biology, medicine and chemistry are investigated. From the perspective of biology, there is an attempt to provide axioms for inferring statements about part hood between two biological entities from statements about their spatial relation. From the perspective of chemistry, it is argued that classical mereological frameworks are not adequate to capture the practices of chemistry in that they consider neither temporal nor modal parameters. The final part introduces computer science and engineering. A new formal mereological framework in which an indeterminate relation of part hood is taken as a primitive notion is constructed and then applied to a wide variety of disciplines from robotics to knowledge engineering. A formal framework for discrete mereotopology and its applications is developed and finally, the importance of mereology for the relatively new science of domain engineering is also discussed. How the way we hold knowledge about the past—in books, in file folders, in databases—affects the kind of stories we tell about the past. The way we record knowledge, and the web of technical, formal, and social practices that surrounds it, inevitably affects the knowledge that we record. The ways we hold knowledge about the past—in handwritten manuscripts, in printed books, in file folders, in databases—shape the kind of stories we tell about that past. In this lively and erudite look at the relation of our information infrastructures to our information, Geoffrey Bowker examines how, over the past two hundred years, information technology has converged with the nature and production of scientific knowledge. His story weaves a path between the social and political work of creating an explicit, indexical memory for science—the making of infrastructures—and the variety of ways we continually reconfigure, lose, and regain the past. At a time when memory is so cheap and its recording is so protean, Bowker reminds us of the centrality of what and how we choose to forget. In Memory Practices in the Sciences he looks at three "memory epochs" of the nineteenth, twentieth, and twenty-first centuries and their particular reconstructions and reconfigurations of scientific knowledge. The nineteenth century's central science, geology, mapped both the social and the natural world into a single time package (despite apparent discontinuities), as, in a different way, did mid-twentieth-century cybernetics. Both, Bowker argues, packaged time in ways indexed by their information technologies to permit traffic between the social and natural worlds. Today's sciences of biodiversity, meanwhile, "database the world" in a way that excludes certain spaces, entities, and times. We use the tools of the present to look at the past, says Bowker; we project onto nature our modes of organizing our own affairs. During the nineteenth century, much of the modern scientific enterprise took shape: scientific disciplines were formed, institutions and communities were founded, and unprecedented applications to and interactions with other aspects of society and culture occurred. In this book, eleven leading historians of science assess what their field has taught us about this exciting time and identify issues that remain unexamined or require reconsideration. They treat both scientific disciplines—biology, physics, chemistry, the earth sciences, mathematics, and the social sciences—in their specific intellectual and sociocultural contexts as well as the broader topics of science and medicine; science and religion; scientific institutions and communities; and science, technology, and industry. Providing a much-needed overview and analysis of a rapidly expanding field, From Natural Philosophy to the Sciences will be essential for historians of science, but also of great interest to scholars of all aspects of nineteenth-century life and culture. Contributors: Bernadette Bensaude-Vincent, Jed Z. Buchwald, David Cahan, Joseph Dauben, Frederick Gregory, Michael Hagner, Sungook Hong, David R. Oldroyd, Theodore M. Porter, Robert J. Richards, Ulrich Wengenroth Ample evidence has been provided that women historically have suffered numerous social, political, and institutional barriers to their entrance and success in the sciences. The articles in this anthology refocus the discussion and reflect the interdisciplinary nature of the issues surrounding women in the sciences. While the barriers that women have faced as researchers, subjects of research, students of science, and theorists have been well documented, this anthology breaks new ground. It presents the ways women succeed in the sciences, overcome these historical barriers, and contribute to the social practice of science and the philosophy of science in both theory and practice. A book about metals, plants, animals, and planets. What is the origin of our universe? What are dark matter and dark energy? What is our role in the universe as human beings capable of knowledge? What makes us intelligent cognitive agents seemingly endowed with consciousness? Scientific research across both the physical and cognitive sciences raises fascinating philosophical questions. Philosophy and the Sciences For Everyone introduces these questions and more. It begins by asking what good is philosophy for the sciences before examining the following questions: The origin of our universe Dark matter and dark energy Anthropic reasoning in philosophy and cosmology Evolutionary theory and the human mind What is consciousness? Intelligent machines and the human brain Embodied Cognition. Each chapter includes an introduction, summary and study questions and there is a glossary of technical terms. Designed to be used on the corresponding Philosophy and the Sciences online course offered by the University of Edinburgh this book is also a superb introduction to central topics in philosophy of science and popular science. This book, published in 2000, examines the intersection between science and books from early medieval times to the nineteenth century. Can two scientists work and live together? Marie and Pierre Curie proved that it was indeed possible to have a happy marriage and do brilliant research together. This collection of seventeen original essays explores the interplay between marriage and scientific work in the lives of two dozen couples in the nineteenth and twentieth century. It is the first book to discuss the professional and personal lives of scientific couples. For much of this period, marriage was the only acceptable way a woman could gain access to the tools, space, and colleagues indispensable to doing science. Yet, collaboration with her husband could also mean the denial of full credit for her work, inability to move to better jobs, and the juggling of domestic and scientific responsibilities. For the husband, collaboration with his skilled, unpaid wife could bring greater achievements than he might have achieved alone, but also meant the suspicion of his professional peers and the necessity of supporting the household. The creative couples described in this volume range from Nobel Prize winners and world-renowned social scientists to obscure field biologists. The essays describe marriages and scientific collaborations that were a joy to both partners, as well as those that proved disastrous. In addition to the editors, the contributors are Marianne Gosztonyi Ainley, Barbara J. Becker, Bernadette Bensaude-Vincent, Mildred Cohn, Janet Bell Garber, Christiane Groeben, Joy Harvey, Susan Hoecker-Drysdale, Pamela M. Henson, Maureen J. Julian, Sylvia W. McGrath, Marilyn Bailey Ogilvie, John Stachel, Linda Tucker, and Sylvia Wiegand. They provide unique insights into the nature of cross-gender collaboration and intimacy. This volume will be of enormous interest to contemporary scientists, to historians of science, and to anyone interested in the ways women and men share marriage and work. In this book the author challenges the position of statistical analysis as the main quantitative tool used in social sciences. It will of interest to social science students, researchers, and methodologists. Are you applying for graduate school and feeling overwhelmed by the choices available to you and the complexity of the application process? This informative and humorous guide for life and earth science students offers comprehensive advice to help you prepare and increase your chances of success. Adopting a step-by-step approach, you will be guided through the entire application process, from undergraduate preparation and choice of graduate program, to funding, applying, scheduling a visit, and finally deciding which offer to accept. Based extensively on a comprehensive survey of graduate admissions programs across the United States, the advice offered is evidence-based and specific to the natural sciences. This jargon-free text ensures that prospective students are well prepared and make best use of all available resources to convince graduate programs and advisors that you are the best candidate. The Sciences of the Artificialreveals the design of an intellectual structure aimed at accommodating those empirical phenomena that are "artificial" rather than "natural." The goal is to show how empirical sciences of artificial systems are possible, even in the face of the contingent and teleological character of the phenomena, their attributes of choice and purpose. Developing in some detail two specific examples—human psychology and engineering design—Professor Simon describes the shape of these sciences as they are emerging from developments of the past 25 years. "Artificial" is used here in a very specific sense: to denote systems that have a given form and behavior only because they adapt (or are adapted), in reference to goals or purposes, to their environment. Thus, both man-made artifacts and man himself, in terms of his behavior, are artificial. Simon characterizes an artificial system as an interface between two environments—inner and outer. These environments lie in the province of "natural science," but the interface, linking them, is the realm of "artificial science." When an artificial system adapts successfully, its behavior shows mostly the shape of the outer environment and reveals little of the structure or mechanisms of the inner. The inner environment becomes significant for behavior only when a system reaches the limits of its rationality and adaptability, and contingency degenerates into necessity. Over the past century, educational psychologists and researchers have posited many theories to explain how individuals learn, i.e. how they acquire, organize and deploy knowledge and skills. The 20th century can be considered the century of psychology on learning and related fields of interest (such as motivation, cognition, metacognition etc.) and it is fascinating to see the various mainstreams of learning, remembered and forgotten over the 20th century and note that basic assumptions of early theories survived several paradigm shifts of psychology and epistemology. Beyond folk psychology and its naïve theories of learning, psychological learning theories can be grouped into some basic categories, such as behaviorist learning theories, connectionist learning theories, cognitive learning theories, constructivist learning theories, and social learning theories. Learning theories are not limited to psychology and related fields of interest but rather we can find the topic of learning in various disciplines, such as philosophy and epistemology, education, information science, biology, and – as a result of the emergence of computer technologies – especially also in the field of computer sciences and artificial intelligence. As a consequence, machine learning struck a chord in the 1980s and became an important field of the learning sciences in general. As the learning sciences became more specialized and complex, the various fields of interest were widely spread and separated from each other; as a consequence, even presently, there is no comprehensive overview of the sciences of learning or the central theoretical concepts and vocabulary on which researchers rely. The Encyclopedia of the Sciences of Learning provides an up-to-date, broad and authoritative coverage of the specific terms mostly used in the sciences of learning and its related fields, including relevant areas of instruction, pedagogy, cognitive sciences, and especially machine learning and knowledge engineering. This modern compendium will be an indispensable source of information for scientists, educators, engineers, and technical staff active in all fields of learning. More specifically, the Encyclopedia provides fast access to the most relevant theoretical terms provides up-to-date, broad and authoritative coverage of the most important theories within the various fields of the learning sciences and adjacent sciences and communication technologies; supplies clear and precise explanations of the theoretical terms, cross-references to related entries and up-to-date references to important research and publications. The Encyclopedia also contains biographical entries of individuals who have substantially contributed to the sciences of learning; the entries are written by a distinguished panel of researchers in the various fields of the learning sciences. To the scientists and philosophers of our time, Hegel has been either a ne glected or a provocative thinker, a source of irrelevant dark metaphysics or of complex but insightful analysis. His influence upon the work of natural scientists has seemed minimal, in the main; and his stimulus to the nascent sciences of society and to psychology has seemed to be as often an obstacle as an encouragement. Nevertheless his philosophical analysis of knowledge and the knowing process, of concepts and their evolutionary formation, of rationality in its forms and histories, of the stages of empirical awareness and human practice, all set within his endless inquiries into cultural formations from the entire sweep of human experience, must, we believe, be confronted by anyone who wants to understand the scientific consciousness. Indeed, we may wish to situate the changing theories of nature, and of humankind in nature, within a philosophical account of men and women as social practi tioners and as sensing, thinking, feeling centers of privacy; and then we will see the work of Hegel as a major effort to mediate between the purest of epistemological investigations and the most practical of the political and the religious. This book, long delayed to our deep regret, derives from a Symposium on Hegel and the Sciences which was sponsored jointly by the Hegel Society of America and the Boston University Center for Philosophy and History of Science a decade ago. The work published by Einstein, Podolsky and Rosen (EPR) in 1935 is a classic in modern physics. It discusses, for the first time, the central feature of the quantum theory: entanglement. In general, systems are intertwined with each other in nature; that is, they have only one common, non-divisible state. This fact is responsible for all the oddities commonly associated with quantum theory, including the famous thought experiments with Schrödinger’s cat and Wigner’s friend. The entanglement of quantum mechanics plays a central role in experiments with atoms and photons (Nobel Prize 2012 for Haroche and Wineland) and the planned construction of quantum computers. This book presents EPR’s original work amplified with a detailed commentary, which examines both the historical context and all aspects of entanglement. In particular, it focuses on the interpretation of quantum theory and its consequences for a basic understanding of nature. Creating a Culture of Accessibility in the Sciences provides insights and advice on integrating students with disabilities into the STEM fields. Each chapter features research and best practices that are interwoven with experiential narratives. The book is reflective of the diversity of STEM disciplines (life and physical sciences, engineering, and mathematics), and is also reflective of cross-disability perspectives (physical, sensory, learning, mental health, chronic medical and developmental disabilities). It is a useful resource for STEM faculty and university administrators working with students with disabilities, as well as STEM industry professionals interested in accommodating employees with disabilities. Offers a global perspective on making research or work spaces accessible for students with disabilities in the STEM fields Discusses best practices on accommodating and supporting students and demonstrates how these practices can be translated across disciplines Enhances faculty knowledge of inclusive teaching practices, adaptive equipment, accessibility features, and accommodations in science laboratories, which would enable the safe participation of students with disabilities Provides advice for students with disabilities on disclosure and mentoring This rhetorical, multi-disciplinary guide discusses the major genres of science writing including research reports, grant proposals, conference presentations, and a variety of forms of public communication. Writing in the Sciences combines a descriptive approach helping students to recognize distinctive features of common genres in their fields with a rhetorical focus helping them to analyze how, why, and for whom texts are created by scientists. Multiple samples from real research cases illustrate a range of scientific disciplines and audiences for scientific research along with the corresponding differences in focus, arrangement, style, and other rhetorical dimensions. Comparisons among disciplines provide the opportunity for students to identify common conventions in science and investigate variation across fields. "The Sciences: An Integrated Approach, 9th Edition by James Trefil and Robert Hazen recognizes that science forms a seamless web of knowledge about the universe. This text fully integrates physics, chemistry, astronomy, Earth sciences, and biology and emphasizes general principles and their application to real world situations. The goal of the text is to help students achieve scientific literacy. Applauded by students and instructors for its easy-to-read style and detail appropriate for non-science majors, the ninth edition has been updated to bring the most up-to-date coverage to the students in all areas of science, with increased emphasis on climate change, sustainability, viruses and public health, and an extensively updated chapter on the importance of bioengineering"-- Clear and concise, this guide describes the basic elements of scientific writing, from lab reports to research essays to articles, as well as the grammar and punctuation fundamental to all writing.128 pp. Herbert Simon's classic work on artificial intelligence in the expanded and updated third edition from 1996, with a new introduction by John E. Laird. Herbert Simon's classic and influential The Sciences of the Artificial declares definitively that there can be a science not only of natural phenomena but also of what is artificial. Exploring the commonalities of artificial systems, including economic systems, the business firm, artificial intelligence, complex engineering projects, and social plans, Simon argues that designed systems are a valid field of study, and he proposes a science of design. For this third edition, originally published in 1996, Simon added new material that takes into account advances in cognitive psychology and the science of design while confirming and extending the book's basic thesis: that a physical symbol system has the necessary and sufficient means for intelligent action. Simon won the Nobel Prize for Economics in 1978 for his research into the decision-making process within economic organizations and the Turing Award (considered by some the computer science equivalent to the Nobel) with Allen Newell in 1975 for contributions to artificial intelligence, the psychology of human cognition, and list processing. The Sciences of the Artificial distills the essence of Simon's thought accessibly and coherently. This reissue of the third edition makes a pioneering work available to a new audience. Why do ideas of how mechanisms relate to causality and probability differ so much across the sciences? Can progress in understanding the tools of causal inference in some sciences lead to progress in others? This book tackles these questions and others concerning the use of causality in the sciences.