

The Science of Computing: Shaping a Discipline

The Science of Computing: Shaping a Discipline

Matti Tedre
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The Science of Computing: Shaping a Discipline begins with the premise that while computing itself is an ancient activity, the discipline of computing is a recent and complex field with many ongoing debates about what the discipline of computing is. This book provides readers with a human-centered narrative of those debates and provides an accessible overview of the three major traditions in the discipline of computing: the logico-mathematical tradition, the engineering tradition, and the scientific tradition.

While there have been several reviews that report on the merits of this book from scholarly and historical perspectives [1,2,3,4], I review the book from the perspective of an educational textbook geared towards students interested in computer science. If these ongoing debates create difficulties for computer scientists in terms of understanding their discipline, I assume the difficulty for college-age students considering careers in computer science must be significantly greater—perhaps even a deterrent to entering the field. I suggest that this book, addressing the learning outcomes of ACM's 2013 Curriculum SPYHistory, would be an excellent course text in an introductory computer science class—it will help budding computer scientists understand the rich and interesting narrative of the discipline of computing.

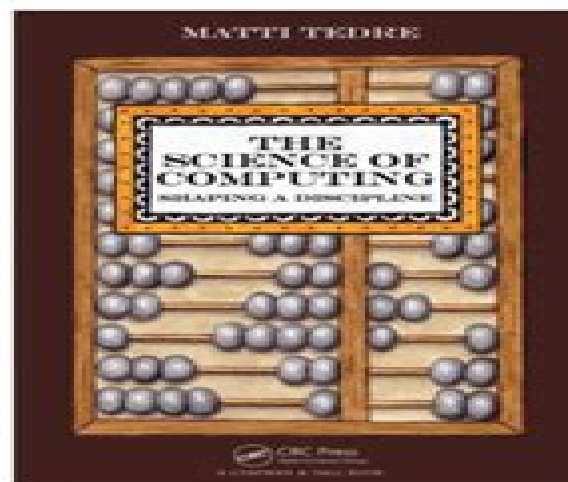
Overview

Excluding the introductory and concluding sections, the organization of *The Science of*

Computing: Shaping a Discipline is broken into three sections—the logico-mathematical tradition, the engineering tradition, and the scientific tradition. In each of those sections, Tedre relates the history of computing as it relates to those fields, the major debates in each of those fields, and the most typical computing activities in those fields.

In the first section, Tedre begins with the notion that, while computing is an ancient phenomenon, the discipline of computing is much more recent phenomenon—in fact, its central narrative takes place within the last century and can be characterized by a series of decades-long debates. Tedre summarizes the core of these debates with five questions:

What are the debates about and what is at stake? Why have the debates not ceased over the 60- or 70-year history of the discipline? Why is it still so difficult to define computing as a discipline? What do people mean when they say that computing is a scientific, mathematical, or engineering discipline? More precisely, what is computing, the academic discipline, about? (p. 5).



These questions, if restated as course objectives, could easily become part of a syllabus for an introductory computer science class.

In the second section, the author tackles the “logical and mathematical ideas that underlie the birth of the discipline.” He narrates the

calamitous story—name-calling and all—of how an “ambivalent relationship” between mathematics and academic computing turned to an “all-out clash” as computing developed its own disciplinary identity. I appreciate that he puts these foundational ideas into a socio-historical context rather than discussing them blandly as precursors to modern computing.

The fall and rise of software engineering is the subject of the third section. He relates the story of the idiosyncratic characters who were responsible for the development of the modern computer, how the ability to program them made computers “the rapidly spreading agents of change in our societies” (p. 112), and how a software crisis emerged as a result. Again, the text is never short on anecdotes that make this meaningful as a social history of the discipline of com-

The Science Of Computing Shaping A Discipline

Raymond Turner



The Science Of Computing Shaping A Discipline:

The Science of Computing Matti Tedre, 2014-12-03 The identity of computing has been fiercely debated throughout its short history Why is it still so hard to define computing as an academic discipline Is computing a scientific mathematical or engineering discipline By describing the mathematical engineering and scientific traditions of computing The Science of Computing Shaping a Discipline *The Science of Computing* Matti Tedre, 2014-12-03 The identity of computing has been fiercely debated throughout its short history Why is it still so hard to define computing as an academic discipline Is computing a scientific mathematical or engineering discipline By describing the mathematical engineering and scientific traditions of computing The Science of Computing Shaping a Discipline presents a rich picture of computing from the viewpoints of the field's champions The book helps readers understand the debates about computing as a discipline It explains the context of computing's central debates and portrays a broad perspective of the discipline The book first looks at computing as a formal theoretical discipline that is in many ways similar to mathematics yet different in crucial ways It traces a number of discussions about the theoretical nature of computing from the field's intellectual origins in mathematical logic to modern views of the role of theory in computing The book then explores the debates about computing as an engineering discipline from the central technical innovations to the birth of the modern technical paradigm of computing to computing's arrival as a new technical profession to software engineering gradually becoming an academic discipline It presents arguments for and against the view of computing as engineering within the context of software production and analyzes the clash between the theoretical and practical mindsets The book concludes with the view of computing as a science in its own right not just as a tool for other sciences It covers the early identity debates of computing various views of computing as a science and some famous characterizations of the discipline It also addresses the experimental computer science debate the view of computing as a natural science and the algorithmization of sciences

On the Foundations of Computing Giuseppe Primiero, 2020 On The Foundations of Computing is a technical historical and conceptual investigation in the three main methodological approaches to the computational sciences mathematical engineering and experimental The first part of the volume explores the background behind the formal understanding of computing originating at the end of the XIX century and it investigates the formal origins and conceptual development of the notions of computation algorithm and program The second part of the volume overviews the construction of physical devices to perform automated tasks and it considers associated technical and conceptual issues We start from the design and construction of the first generation of computing machines explore their evolution and progress in engineering for both hardware and software and investigate their theoretical and conceptual problems The third part of the volume analyses the methods and principles of experimental sciences founded on computational methods We study the use of machines to perform scientific tasks with particular reference to computer models and simulations Each part aims at defining a notion of computational validity according to the

corresponding methodological approach Transdisciplinarity Nima Rezaei, 2022-11-13 This contributed volume book aims at discussing transdisciplinary approaches to address common problems By working transdisciplinarily researchers coming from different disciplines can work jointly using a shared conceptual framework bringing together disciplinary specific theories and concepts There are numerous barriers that can obstruct effective communication between different cultures communities religions and geographies This book shows that through bringing together different disciplines researchers not only can surpass these barriers but can effectively produce new venues of thought that can positively affect the development and evolution of research and education The book discusses new and emerging applications of knowledge produced by transdisciplinary efforts and covers the interplay of many disciplines including agriculture economics mathematics engineering industry information technology marketing nanoscience neuroscience space exploration human animal relationships among others Consequently it also covers the relationship between art and science as one of the most remarkable transdisciplinary approaches that paves the way for new methods in engineering design architecture and many other fields *My Hardcover Book* Saeed Ullah Jan, 2018-01-28 Life in today's world would be unimaginable without computers They have made human lives better and happier There are many computers uses in different fields of work Engineers architects jewelers and filmmakers all use computers to design things Teachers writers and most office workers use computers for research word processing and emailing Small businesses can use computers as a point of sale and for general record keeping Computers are now the major entertainers and the primary pass time machines We can use computers for playing games watching movies listening to music drawing pictures Most of the medical information can now be digitized from the prescription to reports Computation in the field of medicine allows us to offer varied miraculous therapies to the patients ECG's radiotherapy wasn't possible without computers Words and Power Bernadette Longo, 2021-07-26 When viewed through a political lens the act of defining terms in natural language arguably transforms knowledge into values This unique volume explores how corporate military academic and professional values shaped efforts to define computer terminology and establish an information engineering profession as a precursor to what would become computer science As the Cold War heated up U S federal agencies increasingly funded university researchers and labs to develop technologies like the computer that would ensure that the U S maintained economic prosperity and military dominance over the Soviet Union At the same time private corporations saw opportunities for partnering with university labs and military agencies to generate profits as they strengthened their business positions in civilian sectors They needed a common vocabulary and principles of streamlined communication to underpin the technology development that would ensure national prosperity and military dominance investigates how language standardization contributed to the professionalization of computer science as separate from mathematics electrical engineering and physics examines traditions of language standardization in earlier eras of rapid technology development around electricity and radio highlights the importance of the

analogy of the computer is like a human to early explanations of computer design and logic traces design and development of electronic computers within political and economic contexts foregrounds the importance of human relationships in decisions about computer design This in depth humanistic study argues for the importance of natural language in shaping what people come to think of as possible and impossible relationships between computers and humans The work is a key reference in the history of technology and serves as a source textbook on the human level history of computing In addition it addresses those with interests in sociolinguistic questions around technology studies as well as technology development at the nexus of politics business and human relations *Pioneering Israeli Women in Electronic Computing (1953—1970)* Raya

Leviathan,Leo Corry,2025-03-04 This book offers a journey into the history of pioneering Israeli women in electronic computing and explores the impact these women had on the annals of Israeli computing history With the primary setting being the Weizmann Institute of Science where the genesis of computing in Israel took place their stories come to life through the lens of personal narratives and their personal stories provide a unique window into their experiences challenges and triumphs It delves into a compelling narrative of women who defied societal norms and forged their path in a male dominated field Their accounts captivate individuals who are passionate about advocating for gender equality and empowerment as well as those with an interest in the history of computing and the development of information technology in Israel *Handbook of Research on Equity in Computer Science in P-16 Education* Keengwe, Jared,Tran, Yune,2020-11-13

The growing trend for high quality computer science in school curricula has drawn recent attention in classrooms With an increasingly information based and global society computer science education coupled with computational thinking has become an integral part of an experience for all students given that these foundational concepts and skills intersect cross disciplinarily with a set of mental competencies that are relevant in their daily lives and work While many agree that these concepts should be taught in schools there are systematic inequities that exist to prevent students from accessing related computer science skills The Handbook of Research on Equity in Computer Science in P 16 Education is a comprehensive reference book that highlights relevant issues perspectives and challenges in P 16 environments that relate to the inequities that students face in accessing computer science or computational thinking and examines methods for challenging these inequities in hopes of allowing all students equal opportunities for learning these skills Additionally it explores the challenges and policies that are created to limit access and thus reinforce systems of power and privilege The chapters highlight issues perspectives and challenges faced in P 16 environments that include gender and racial imbalances population of growing computer science teachers who are predominantly white and male teacher preparation or lack of faculty expertise professional development programs and more It is intended for teacher educators K 12 teachers high school counselors college faculty in the computer science department school administrators curriculum and instructional designers directors of teaching and learning centers policymakers researchers and students **The Problem with Software** Adam

Barr,2018-10-23 An industry insider explains why there is so much bad software and why academia doesn't teach programmers what industry wants them to know Why is software so prone to bugs So vulnerable to viruses Why are software products so often delayed or even canceled Is software development really hard or are software developers just not that good at it In *The Problem with Software* Adam Barr examines the proliferation of bad software explains what causes it and offers some suggestions on how to improve the situation For one thing Barr points out academia doesn't teach programmers what they actually need to know to do their jobs how to work in a team to create code that works reliably and can be maintained by somebody other than the original authors As the size and complexity of commercial software have grown the gap between academic computer science and industry has widened It's an open secret that there is little engineering in software engineering which continues to rely not on codified scientific knowledge but on intuition and experience Barr who worked as a programmer for more than twenty years describes how the industry has evolved from the era of mainframes and Fortran to today's embrace of the cloud He explains bugs and why software has so many of them and why today's interconnected computers offer fertile ground for viruses and worms The difference between good and bad software can be a single line of code and Barr includes code to illustrate the consequences of seemingly inconsequential choices by programmers Looking to the future Barr writes that the best prospect for improving software engineering is the move to the cloud When software is a service and not a product companies will have more incentive to make it good rather than good enough to ship

Philosophy of Computer Science William J. Rapaport,2023-01-16 A unique resource exploring the nature of computers and computing and their relationships to the world *Philosophy of Computer Science* is a university level textbook designed to guide readers through an array of topics at the intersection of philosophy and computer science Accessible to students from either discipline or complete beginners to both the text brings readers up to speed on a conversation about these issues so that they can read the literature for themselves form their own reasoned opinions and become part of the conversation by contributing their own views Written by a highly qualified author in the field the book looks at some of the central questions in the philosophy of computer science including What is philosophy for readers who might be unfamiliar with it What is computer science and its relationship to science and to engineering What are computers computing algorithms and programs Includes a line by line reading of portions of Turing's classic 1936 paper that introduced Turing Machines as well as discussion of the Church Turing Computability Thesis and hypercomputation challenges to it How do computers and computation relate to the physical world What is artificial intelligence and should we build AIs Should we trust decisions made by computers A companion website contains annotated suggestions for further reading and an instructor's manual *Philosophy of Computer Science* is a must have for philosophy students computer scientists and general readers who want to think philosophically about computer science **Abstractions and Embodiments** Janet Abbate,Stephanie Dick,2022-08-30 This anthology of original historical essays examines how social relations are enacted in and through computing using the

twin frameworks of abstraction and embodiment The book highlights a wide range of understudied contexts and experiences such as computing and disability working mothers as technical innovators race and community formation and gaming behind the Iron Curtain *WEIZAC: An Israeli Pioneering Adventure in Electronic Computing (1945-1963)* Leo Corry, Raya Leviathan, 2019-08-16 The book tells the unique story of WEIZAC an early computer built by a new nation in the early 1950s It was created in Israel even though the feasibility of this project was actually close to null when it was initially conceived in 1946 and unlike most of the early computer projects was privately financed mainly by the Jewish world community The book draws on a wealth of documents and historical insights to reveal the processes and powers that led to the successful completion of the project and as well as its actual impact on scientific activities in Israel and on the rise of a local computing community Based on archival data the book shows how a synergy of personal dedication together with an organizational and national mission that links the Zionist vision with science and technology for the Jewish people helped to achieve a well defined goal The book offers intriguing insights and refreshing perspectives to all readers interested in the Zionist movement or in the history of computing

Informatics in Schools. Fundamentals of Computer Science and Software Engineering Sergei N. Pozdniakov, Valentina Dagienė, 2018-10-10 This book constitutes the proceedings of the 11th International Conference on Informatics in Schools Situation Evolution and Perspectives ISSEP 2018 held in St Petersburg Russia in October 2018 The 29 full papers presented in this volume were carefully reviewed and selected from 74 submissions They were organized in topical sections named role of programming and algorithmics in informatics for pupils of all ages national concepts of teaching informatics teacher education in informatics contests and competitions in informatics socio psychological aspects of teaching informatics and computer tools in teaching and studying informatics

The Routledge Handbook of Philosophy of Information Luciano Floridi, 2016-06-17 Information and communication technology occupies a central place in the modern world with society becoming increasingly dependent on it every day It is therefore unsurprising that it has become a growing subject area in contemporary philosophy which relies heavily on informational concepts The Routledge Handbook of Philosophy of Information is an outstanding reference source to the key topics 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 basic ideas quantitative and formal aspects natural and physical aspects human and semantic aspects Within these sections central issues are examined including probability the logic of information informational metaphysics the philosophy of data and evidence and the epistemic value of information The Routledge Handbook of Philosophy of Information is essential reading for students and researchers in philosophy computer science and communication studies

Birth of Modern Facts James W. Cortada, 2023-01-09 For over twenty years James W Cortada has pioneered research into how information shapes society In this book he tells the story of how information evolved since the mid nineteenth century Cortada argues that information increased in quantity became more

specialized by discipline e.g. mathematics, science, political science and more organized. Information increased in volume due to a series of innovations such as the electrification of communications and the development of computers but also due to the organization of facts and knowledge by discipline making it easier to manage and access. He looks at what major disciplines have done to shape the nature of modern information, devoting chapters to the most obvious ones. Cortada argues that understanding how some features of information evolved is useful for those who work in subjects that deal with their very construct and application such as computer scientists and those exploring social media and most recently history. *The Birth of Modern Facts* builds on Cortada's prior books examining how information became a central feature of modern society, most notably as a sequel to *All the Facts: A History of Information in the United States since 1870* (OUP, 2016) and *Building Blocks of Society: History, Information, Ecosystems, and Infrastructures* (Routledge, 2021). Computer Science Education Sue Sentance, Erik Barendsen, Nicol R. Howard, Carsten Schulte, 2023-02-23. Drawing together the most up-to-date research from experts all across the world, the second edition of *Computer Science Education* offers the most up-to-date coverage available on this developing subject, ideal for building confidence of new pre-service and in-service educators teaching a new discipline. It provides an international overview of key concepts, pedagogical approaches and assessment practices. Highlights of the second edition include: New sections on machine learning and data-driven epistemic programming; A new focus on equity and inclusion in computer science education; Chapters updated throughout including a revised chapter on relating ethical and societal aspects to knowledge-rich aspects of computer science education; A new set of chapters on the learning of programming including design pedagogy and misconceptions; A chapter on the way we use language in the computer science classroom. The book is structured to support the reader with chapter outlines, synopses and key points. Explanations of key concepts, real-life examples and reflective points keep the theory grounded in classroom practice. The book is accompanied by a companion website including online summaries for each chapter, 3-minute video summaries by each author and an archived chapter on taxonomies and competencies from the first edition. *A New History of Modern Computing* Thomas Haigh, Paul E. Ceruzzi, 2021-09-14. How the computer became universal. Over the past fifty years, the computer has been transformed from a hulking scientific supertool and data processing workhorse, remote from the experiences of ordinary people, to a diverse family of devices that billions rely on to play games, shop, stream music and movies, communicate and count their steps. In *A New History of Modern Computing*, Thomas Haigh and Paul Ceruzzi trace these changes. A comprehensive reimagining of Ceruzzi's *A History of Modern Computing*, this new volume uses each chapter to recount one such transformation, describing how a particular community of users and producers remade the computer into something new. Haigh and Ceruzzi ground their accounts of these computing revolutions in the longer and deeper history of computing technology. They begin with the story of the 1945 ENIAC computer, which introduced the vocabulary of programs and programming, and proceed through email, pocket calculators, personal computers, the World Wide Web, videogames, smart

phones and our current world of computers everywhere in phones cars appliances watches and more Finally they consider the Tesla Model S as an object that simultaneously embodies many strands of computing

Writing Computer and Information History William Aspray, 2024-05-14 This is not a book about the history of computing or the history of information Instead it is a meta historical book about the research and writing of these types of history The formal presentation of historical research in the form of a publication often hides the process by which the topic was selected boundaries were drawn evidence was selected analytic approach was chosen and applied results were presented how this work fits into a larger body of scholarship the implicit goals and biases of the author and many other similar issues This process of learning about the various ways to carry out computer history or information history can be enriched by this collection of reflective essays by experienced scholars discussing the craft that they practice This is a book that concerns both computer history and information history The first scholarship in computer history by professionally trained scholars began to appear in the 1970s so we are approaching a half century of research and publication in this area The field has generated numerous pieces of exemplary scholarship from various perspectives such as intellectual history of individual technologies business histories of firms economic histories of market sectors externalist histories of funding and professionalization and so on However the field continues to evolve especially as computing and communication technologies have drawn together in the form of the Internet and social media and with them a new set of scholars is participating drawn not only from the history of science and technology but also from the communication and media studies fields Powerful theories approaches and frameworks are being increasingly drawn more widely from both the humanities and the social sciences to inform the practice of computer history The scholars in this volume look at what s happened what s happening now and where historical scholarship in these disciplines is headed

Computational Artifacts Raymond Turner, 2018-07-11 The philosophy of computer science is concerned with issues that arise from reflection upon the nature and practice of the discipline of computer science This book presents an approach to the subject that is centered upon the notion of computational artefact It provides an analysis of the things of computer science as technical artefacts Seeing them in this way enables the application of the analytical tools and concepts from the philosophy of technology to the technical artefacts of computer science With this conceptual framework the author examines some of the central philosophical concerns of computer science including the foundations of semantics the logical role of specification the nature of correctness computational ontology and abstraction formal methods computational epistemology and explanation the methodology of computer science and the nature of computation The book will be of value to philosophers and computer scientists

Communities of Computing Thomas J. Misa, 2016-11-10 Communities of Computing is the first book length history of the Association for Computing Machinery ACM founded in 1947 and with a membership today of 100 000 worldwide It profiles ACM s notable SIGs active chapters and individual members setting ACM s history into a rich social and

political context The book's 12 core chapters are organized into three thematic sections Defining the Discipline examines the 1960s and 1970s when the field of computer science was taking form at the National Science Foundation Stanford University and through ACM's notable efforts in education and curriculum standards Broadening the Profession looks outward into the wider society as ACM engaged with social and political issues and as members struggled with balancing a focus on scientific issues and awareness of the wider world Chapters examine the social turbulence surrounding the Vietnam War debates about the women's movement efforts for computing and community education and international issues including professionalization and the Cold War Expanding Research Frontiers profiles three areas of research activity where ACM members and ACM itself shaped notable advances in computing including computer graphics computer security and hypertext Featuring insightful profiles of notable ACM leaders such as Edmund Berkeley George Forsythe Jean Sammet Peter Denning and Kelly Gotlieb and honest assessments of controversial episodes the volume deals with compelling and complex issues involving ACM and computing It is not a narrow organizational history of ACM committees and SIGS although much information about them is given All chapters are original works of research Many chapters draw on archival records of ACM's headquarters ACM SIGs and ACM leaders This volume makes a permanent contribution to documenting the history of ACM and understanding its central role in the history of computing

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The Science Of Computing Shaping A Discipline Introduction

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