How Computers Work The Evolution Of Technology 10th Edition How It Works

Use your Raspberry Pi to get smart about computing fundamentals In the 1980s, the tech revolution was kickstarted by a flood of relatively inexpensive, highly programmable computers like the Commodore. Now, a second revolution in computing is beginning with the Raspberry Pi. Learning Computer Architecture with the Raspberry Pi is the premier guide to understanding the components of the most exciting tech product available. Thanks to this book, every Raspberry Pi owner can understand how the computer works and how to access all of its hardware and software capabilities. Now, students, hackers, and casual users alike can discover how computers work with Learning Computer Architecture with the Raspberry Pi. This book explains what each and every hardware component does, how they relate to one another, and how they correspond to the components of other computing systems. You'll also learn how programming works and how the operating system relates to the Raspberry Pi's physical components. Co-authored by Eben Upton, one of the creators of the Raspberry Pi, this is a companion volume to the Raspberry Pi User Guide An affordable solution for learning about computer system design considerations and experimenting with low-level programming Understandable descriptions of the functions of memory storage, Ethernet, cameras, processors, and more Gain knowledge of computer design and operation in general by exploring the basic structure of the Raspberry Pi The Raspberry Pi was created to bring forth a new generation of computer scientists, developers, and architects who understand the inner workings of the computers that have become essential to our daily lives. Learning Computer Architecture with the Raspberry Pi is your gateway to the world of computer system design.

"Startling in scope and bravado." —Janet Maslin, The New York Times "Artfully envisions a breathtakingly better world." —Los Angeles Times "Elaborate, smart and persuasive." —The Boston Globe "A pleasure to read." —The Wall Street Journal One of CBS News's Best Fall Books of 2005 • Among St Louis Post-Dispatch's Best Nonfiction Books of 2005 • One of Amazon.com's Best Science Books of 2005 A radical and optimistic view of the future course of human development from the bestselling author of How to Create a Mind and The Singularity is Nearer who Bill Gates calls "the best person I know at predicting the future of artificial intelligence" For over three decades, Ray Kurzweil has been one of the most respected and provocative advocates of the role of technology in our future. In his classic The Age of Spiritual Machines, he argued that computers would soon rival the full range of human intelligence at its best. Now he examines the next step in this inexorable evolutionary process: the union of human and machine, in which the knowledge and skills embedded in our brains will be combined with the vastly greater capacity, speed, and knowledge-sharing ability of our creations.

The late Seventies to the early Nineties was a completely unique period in the history of computing. Long before Microsoft and Intel ruled the PC world, a disparate variety of home computers, from an unlikely array of suppliers, were engaging in a battle that would shape the industry for years to come. Products from established electronics giants clashed with machines which often appeared to have been (or actually were) assembled in a backyard shed by an eccentric inventor. University professors were competing head to head with students in their parents' garages. Compatibility? Forget it! Each of these computers was its own machine and had no intention of talking to anything else. The same could be said of their owners, in fact, who passionately defended their machines with a belief that verged on the religious. This book tells the story behind 40 classic home computers of an infamous decade, from the dreams and inspiration, through passionate inventors and corporate power struggles, to their final inevitable demise. It takes a detailed look at every important computer from the start of the home computer revolution with the MITS Altair, to the NeXT cube, pehaps the last serious challenger in the personal computer marketplace. In the thirteen years between the launch of those systems, there has never been a more frenetic period of technical advance, refinement, and marketing, and this book covers all the important steps made on both sides of the Atlantic. Whether it's the miniaturization of the Sinclair machines, the gaming prowess of the Amiga, or the fermenting war between Apple Computer, "Big Blue," and "the cloners," we've got it covered. Digital Retro is an essential read for anyone who owned a home computer in the Eighties.

This book features stunning four-colour illustrations, taking readers through the inner-workings of wireless.

This latest textbook from bestselling author, Douglas E. Comer, is a class-tested book providing a comprehensive introduction to cloud computing. Focusing on concepts and principles, rather than commercial offerings by cloud providers and vendors, The Cloud Computing Book: The Future of Computing Explained gives readers a complete picture of the advantages and growth of cloud computing, cloud infrastructure, virtualization, automation and orchestration, and cloud-native software design. The book explains real and virtual data center facilities, including computation (e.g., servers, hypervisors, Virtual Machines, and containers), networks (e.g., leaf-spine architecture, VLANs, and VxLAN), and storage mechanisms (e.g., SAN, NAS, and object storage). Chapters on automation and orchestration cover the conceptual organization of systems that automate software deployment and scaling. Chapters on cloud-native software cover parallelism, microservices, MapReduce, controller-based designs, and serverless computing. Although it focuses on concepts and principles, the book uses popular technologies in examples, including Docker containers and Kubernetes. Final chapters explain security in a cloud environment and the use of models to help control the complexity involved in designing software for the cloud. The text is suitable for a one-semester course for software

engineers who want to understand cloud, and for IT managers moving an organization's computing to the cloud.

Ever wonder how your office computer network works? Or how the Ethernet card inside your computer connects you to that network or to the Internet? "How Networks Work" will give you a thorough, detailed explanation of the inner-workings of network systems without getting you caught up in network jargon. Learn the basic principles of networking and how those principles work inside pieces of network equipment. Complete with illustrations to show how things work together, this latest edition also includes information on the newest technologies, including VoIP, wireless networks, broadband and more.

Explains the structure and functions of microchips, hard drives, CD-ROMs, magneto-optical drives, tape drives, keyboards, serial ports, mice, modems, scanners, LANs, and printers

The Red Queen's race -- The exponential nature of technology -- From Maxwell to the Internet -- The universal machine -- The quest for intelligent machines -- Cells, bodies, and brains -- Biology meets computation -- How the brain works -- Understanding the brain -- Brains, minds, and machines -- Challenges and promises -- Speculations

"Abacus to smartphone" examines the evolution of mobile and portable computing from the beginning of time until today's modern devices. Historian and journalist Evan Koblentz focuses on the technological advances that led to where we are now, including many stories never before told.

Astronomers and astrophysicists are making revolutionary advances in our understanding of planets, stars, galaxies, and even the structure of the universe itself. The Decade of Discovery presents a survey of this exciting field of science and offers a prioritized agenda for space- and ground-based research into the twenty-first century. The book presents specific recommendations, programs, and expenditure levels to meet the needs of the astronomy and astrophysics communities. Accessible to the interested lay reader, the book explores: The technological investments needed for instruments that will be built in the next century. The importance of the computer revolution to all aspects of astronomical research. The potential usefulness of the moon as an observatory site. Policy issues relevant to the funding of astronomy and the execution of astronomical projects. The Decade of Discovery will prove valuable to science policymakers, research administrators, scientists, and students in the physical sciences, and interested lay readers. Alternate Selection, Astronomy Book Club

We use software every day to perform all kinds of magical, powerful tasks. It's the force behind stunning CGI graphics, safe online shopping, and speedy Google searches. Software drives the modern world, but its inner workings remain a mystery to many. How Software Works explains how computers perform common-yet-amazing tasks that we take for granted every day. Inside you'll learn: –How data is encrypted –How passwords are used and protected –How computer graphics are created –How video is compressed for streaming and storage –How data is searched (and found) in huge databases –How programs can work together on the same problem without conflict –How data travels over the Internet How Software Works breaks down these processes with

patient explanations and intuitive diagrams so that anyone can understand—no technical background is required, and you won't be reading through any code. In plain English, you'll examine the intricate logic behind the technologies you constantly use but never understood. If you've ever wondered what really goes on behind your computer screen, How Software Works will give you fascinating look into the software all around you.

From the author of the New York Times bestseller The Inevitable— a sweeping vision of technology as a living force that can expand our individual potential In this provocative book, one of today's most respected thinkers turns the conversation about technology on its head by viewing technology as a natural system, an extension of biological evolution. By mapping the behavior of life, we paradoxically get a glimpse at where technology is headed-or "what it wants." Kevin Kelly offers a dozen trajectories in the coming decades for this near-living system. And as we align ourselves with technology's agenda, we can capture its colossal potential. This visionary and optimistic book explores how technology gives our lives greater meaning and is a must-read for anyone curious about the future.

Bits, bytes, RAM, CPUs, hard drives and dvd drives. Master the geeky acronyms and simplify computer hardware & terminology with ease. This book is great for beginners, a basic computing class, or someone looking to buy a computer.

In this remarkable book on computer design, long-known in the field and widely used in manuscript form, Gerrit A. Blaauw and Frederick P. Brooks, Jr. provide a definitive guide and reference for practicing computer architects and for students. The book complements Brooks' recently updated classic, The Mythical Man-Month, focusing here on the design of hardware and there on software, here on the content of computer architecture and there on the process of architecture design. The book's focus on architecture issues complements Blaauw's early work on implementation techniques. Having experienced most of the computer age, the authors draw heavily on their first-hand knowledge, emphasizing timeless insights and observations. Blaauw and Brooks first develop a conceptual framework for understanding computer architecture. They then describe not only what present architectural practice is, but how it came to be so. A major theme is the early divergence and the later reconvergence of computer architectures. They examine both innovations that survived and became part of the standard computer, and the many ideas that were explored in real machines but did not survive. In describing the discards, they also address why these ideas did not make it. The authors' goals are to analyze and systematize familiar design alternatives, and to introduce you to unfamiliar ones. They illuminate their discussion with detailed executable descriptions of both early and more recent computers. The designer's most important study, they argue, is other people's designs. This book's computer zoo will give you a unique resource for precise information about 30 important machines. Armed with the factors pro and con on the various known solutions to design problems, you will be better able to determine the most fruitful architectural course for your own design. 0201105578B04062001

The Closed World offers a radically new alternative to the canonical histories of computers and cognitive science. Arguing that we can make sense of computers as tools only when we simultaneously grasp their roles as metaphors and political icons, Paul Edwards shows how Cold War social and cultural contexts shaped emerging computer technology--and were transformed, in turn,

by information machines. The Closed World explores three apparently disparate histories--the history of American global power, the history of computing machines, and the history of subjectivity in science and culture--through the lens of the American political imagination. In the process, it reveals intimate links between the military projects of the Cold War, the evolution of digital computers, and the origins of cybernetics, cognitive psychology, and artificial intelligence. Edwards begins by describing the emergence of a "closed-world discourse" of global surveillance and control through high-technology military power. The Cold War political goal of "containment" led to the SAGE continental air defense system, Rand Corporation studies of nuclear strategy, and the advanced technologies of the Vietnam War. These and other centralized, computerized military command and control projects--for containing world-scale conflicts--helped closed-world discourse dominate Cold War political decisions. Their apotheosis was the Reagan-era plan for a " Star Wars" space-based ballistic missile defense. Edwards then shows how these military projects helped computers become axial metaphors in psychological theory. Analyzing the Macy Conferences on cybernetics, the Harvard Psycho-Acoustic Laboratory, and the early history of artificial intelligence, he describes the formation of a "cyborg discourse." By constructing both human minds and artificial intelligences as information machines, cyborg discourse assisted in integrating people into the hyper-complex technological systems of the closed world. Finally, Edwards explores the cyborg as political identity in science fiction--from the disembodied, panoptic AI of 2001: A Space Odyssey, to the mechanical robots of Star Wars and the engineered biological androids of Blade Runner--where Information Age culture and subjectivity were both reflected and constructed. Inside Technology series

Traces the history of the computer from its beginnings in the nineteenth century to the present and describes the development of the computer industry

Hundreds of millions of people use social technologies like Wikipedia, Facebook and YouTube every day, but what makes them work? And what is the next step? The Social Design of Technical Systems explores the path from computing revolution to social evolution. Based on the assumption that it is essential to consider social as well as technological requirements, as we move to create the systems of the future, this book explores the ways in which technology fits, or fails to fit, into the social reality of the modern world. Important performance criteria for social systems, such as fairness, synergy, transparency, order and freedom, are clearly explained for the first time from within a comprehensive systems framework, making this book invaluable for anyone interested in socio-technical systems, especially those planning to build social software. This book reveals the social dilemmas that destroy communities, exposes the myth that computers are smart, analyses social errors like the credit meltdown, proposes online rights standards and suggests community-based business models. If you believe that our future depends on merging social virtue and technology power, you should read this book.

Computers are everywhere. Even a smartphone is a mini computer. With digital technologies so prevalent in today's world, it's important for young learners to know how they work. This book introduces kids to the design and function of the hardware and networks that digitally connect us. Utilizing colorful infographics and simple language, this book discusses the history of the first

computers, different types of computers, and the important parts that make a computer run. It makes learning about computers easy for young readers, and it will inspire your budding engineers.

This book thoroughly explains how computers work. It starts by fully examining a NAND gate, then goes on to build every piece and part of a small, fully operational computer. The necessity and use of codes is presented in parallel with the apprioriate pieces of hardware. The book can be easily understood by anyone whether they have a technical background or not. It could be used as a textbook.

Most people are baffled by how computers work and assume that they will never understand them. What they don't realize—and what Daniel Hillis's short book brilliantly demonstrates—is that computers' seemingly complex operations can be broken down into a few simple parts that perform the same simple procedures over and over again. Computer wizard Hillis offers an easy-to-follow explanation of how data is processed that makes the operations of a computer seem as straightforward as those of a bicycle.Avoiding technobabble or discussions of advanced hardware, the lucid explanations and colorful anecdotes in The Pattern on the Stone go straight to the heart of what computers really do. Hillis proceeds from an outline of basic logic to clear descriptions of programming languages, algorithms, and memory. He then takes readers in simple steps up to the most exciting developments in computing today—quantum computing, parallel computing, neural networks, and self-organizing systems.Written clearly and succinctly by one of the world's leading computer scientists, The Pattern on the Stone is an indispensable guide to understanding the workings of that most ubiquitous and important of machines: the computer.

Pulitzer Prize winner Tracy Kidder memorably records the drama, comedy, and excitement of one company's efforts to bring a new microcomputer to market. Computers have changed since 1981, when The Soul of a New Machine first examined the culture of the computer revolution. What has not changed is the feverish pace of the high-tech industry, the go-for-broke approach to business that has caused so many computer companies to win big (or go belly up), and the cult of pursuing mind-bending technological innovations. The Soul of a New Machine is an essential chapter in the history of the machine that revolutionized the world in the twentieth century.

Think you know your computer? You've only scratched the surface until you've experienced this CD-ROM-equipped version of PC/Computing's How Computers Work. One of the bestselling computer books of all time, it features two valuable educational and entertainment resources in one affordable package--a CD-ROM and a colorfully illustrated book.

This title gives students an integrated and rigorous picture of applied computer science, as it comes to play in the construction of a simple yet powerful computer system.

Intelligent readers who want to build their own embedded computer systems-- installed in everything from cell phones to cars to handheld organizers to refrigerators-- will find this book to be the most in-depth, practical, and up-to-date guide on the market. Designing Embedded Hardware carefully steers between the practical and philosophical aspects, so developers can both create their own devices and gadgets and customize and extend off-the-shelf systems. There are hundreds of books to choose from if

you need to learn programming, but only a few are available if you want to learn to create hardware. Designing Embedded Hardware provides software and hardware engineers with no prior experience in embedded systems with the necessary conceptual and design building blocks to understand the architectures of embedded systems. Written to provide the depth of coverage and real-world examples developers need, Designing Embedded Hardware also provides a road-map to the pitfalls and traps to avoid in designing embedded systems. Designing Embedded Hardware covers such essential topics as: The principles of developing computer hardware Core hardware designs Assembly language concepts Parallel I/O Analog-digital conversion Timers (internal and external) UART Serial Peripheral Interface Inter-Integrated Circuit Bus Controller Area Network (CAN) Data Converter Interface (DCI) Low-power operation This invaluable and eminently useful book gives you the practical tools and skills to develop, build, and program your own application-specific computers.

Compiles programming hacks intended to help computer programmers build more efficient software, in an updated edition that covers cyclic redundancy checking and new algorithms and that includes exercises with answers.

The study of the genetic basis for evolution has flourished in this century, as well as our understanding of the evolvability and programmability of biological systems. Genetic algorithms meanwhile grew out of the realization that a computer program could use the biologically-inspired processes of mutation, recombination, and selection to solve hard optimization problems. Genetic and evolutionary programming provide further approaches to a wide variety of computational problems. A synthesis of these experiences reveals fundamental insights into both the computational nature of biological evolution and processes of importance to computer science. Topics include biological models of nucleic acid information processing and genome evolution; molecules, cells, and metabolic circuits that compute logical relationships; the origin and evolution of the genetic code; and the interface with genetic algorithms and genetic and evolutionary programming.

Computers are great-when they work. When they don't, it's an inconvenience at best and a nightmare at worst.How Computers Work and What to Do When They Don't explains, in simple English, how the computer you use every day operates and what you can do when it's not operating the way you want it to.Inside, you will learn about the basic components of computer hardware and software, the Seven Principles of Solving Problems that you can use to solve any computer conundrum, and what you can do today to prevent problems from happening in the first place.You will also learn how to solve many existing issues, including sluggish performance and virus infections. When it's time to buy a new computer, this book explains the different options available and helps you determine what's best for your needs and within your budget.How Computers Work and What to Do When They Don't includes over 30 high-resolution images to explain computer parts, software, and how-to procedures. It also contains two appendices with guides for resolving many

common technical issues and trustworthy resources for resolving additional problems.This book is written for users like you! Whether you want to save money by solving your own tech issues, rejuvenate a lethargic computer, or simply learn more about how computers function, How Computers Work and What to Do When They Don't is an invaluable resource for all things technology!

Classic papers by thinkers ranging from from Aristotle and Leibniz to Norbert Wiener and Gordon Moore that chart the evolution of computer science. Ideas That Created the Future collects forty-six classic papers in computer science that map the evolution of the field. It covers all aspects of computer science: theory and practice, architectures and algorithms, and logic and software systems, with an emphasis on the period of 1936-1980 but also including important early work. Offering papers by thinkers ranging from Aristotle and Leibniz to Alan Turing and Nobert Wiener, the book documents the discoveries and inventions that created today's digital world. Each paper is accompanied by a brief essay by Harry Lewis, the volume's editor, offering historical and intellectual context.

Art is the Queen of all sciences communicating knowledge to all the generations of the world. Leonardo da Vinci Artistic behavior is one of the most valued qualities of the human mind. Although artistic manifestations vary from culture to culture, dedication to artistic tasks is common to all. In other words, artistic behavior is a universal trait of the human species. The current, Western de?nition of art is relatively new. However, a d- ication to artistic endeavors — such as the embellishment of tools, body - namentation, or gathering of unusual, arguably aesthetic, objects — can be traced back to the origins of humanity. That is, art is ever-present in human history and prehistory.

ArtandscienceshareaIongandenduringrelationship.Thebest-known- ample of the explorationof this relationship is probably the work of Leonardo da Vinci. Somewhere in the 19th century art and science grew apart, but the cross-transfer of concepts between the two domains continued to exist. Currently, albeit the need for specialization, there is a growing interest in the exploration of the connections between art and science.

Focusingoncomputerscience,itisinterestingtonoticethatearlypioneers of this discipline such as Ada Byron and Alan Turing showed an interest in using computational devices for art-making purposes. Oddly, in spite of this early interest and the ubiquity of art, it has received relatively little attention fromthe computersciencecommunityingeneral,and,moresurprisingly,from the arti?cial intelligence community.

Includes Pentium III and MMX processors, fingerprint and voice recognition, notebook and palm computers, MP3 music and digital audio ..."

An approachable, hands-on guide to understanding how computers work, from low-level circuits to high-level code. How Computers Really Work is a hands-on guide to the computing ecosystem: everything from circuits to memory and clock

signals, machine code, programming languages, operating systems, and the internet. But you won't just read about these concepts, you'll test your knowledge with exercises, and practice what you learn with 41 optional hands-on projects. Build digital circuits, craft a guessing game, convert decimal numbers to binary, examine virtual memory usage, run your own web server, and more. Explore concepts like how to: • Think like a software engineer as you use data to describe a real world concept • Use Ohm's and Kirchhoff's laws to analyze an electrical circuit • Think like a computer as you practice binary addition and execute a program in your mind, step-by-step The book's projects will have you translate your learning into action, as you: • Learn how to use a multimeter to measure resistance, current, and voltage • Build a half adder to see how logical operations in hardware can be combined to perform useful functions • Write a program in assembly language, then examine the resulting machine code • Learn to use a debugger, disassemble code, and hack a program to change its behavior without changing the source code • Use a port scanner to see which internet ports your computer has open • Run your own server and get a solid crash course on how the web works And since a picture is worth a thousand bytes, chapters are filled with detailed diagrams and illustrations to help clarify technical complexities. Requirements: The projects require a variety of hardware - electronics projects need a breadboard, power supply, and various circuit components; software projects are performed on a Raspberry Pi. Appendix B contains a complete list. Even if you skip the projects, the book's major concepts are clearly presented in the main text.

Evolution since Coding: Cradles, Halos, Barrels, and Wings describes genesis of metabolism, transcription, translation, cell structure, eukaryotic complexity, LUCA (the last universal common (cellular) ancestor), the great divergence of archaea and bacteria, LECA (the last eukaryotic common ancestor), extinction, and cancer in very simple ways. The work (almost) "synthesizes life from scratch" (since coding) and describes the tools for readers to check the author's work. As a result, readers understand living systems and their evolution in a conceptual way and are empowered to utilize powerful but accessible tools in computer-based biology. The work serves as foundational reading for a variety of researchers, academics, and students in life sciences, for example in evolution/evolutionary biology, biochemistry, genetics/molecular genetics, molecular biology, cell biology, and microbiology, as well as disciplines beyond biological science. Its approachable style makes the book accessible for introductory students and educated laypersons. Evolution since Coding is suitable to supplement college courses that mix computers, evolution, and biology from freshman to senior level. Provides a simple, hands-on, conceptual route to understanding ancient evolution and the diversification of life on earth Offers a conceptual understanding of biology, evolution, protein structure, RNA synthesis systems, protein synthesis systems, signaling systems, genesis of the three domains, and cell structures Approaches ancient evolution via code-breaking protein and RNA sequences and motifs

Find out what goes on behind the screen, beneath the keyboard and inside the electronic "brain" of a computer.

The first complete overview of evolutionary computing, the collective name for a range of problem-solving techniques based on principles of biological evolution, such as natural selection and genetic inheritance. The text is aimed directly at lecturers and graduate and undergraduate students. It is also meant for those who wish to apply evolutionary computing to a particular problem or within a given application area. The book contains quick-reference information on the current state-of-the-art in a wide range of related topics, so it is of interest not just to evolutionary computing specialists but to researchers working in other fields.

A guide to the functions and operation of computer software explains how software and hardware work together, discussing operating systems, programming languages, and database, spreadsheet, word processing, graphics, communications, Windows, and utility software products. Original.

I found it a delight to read. The author is not trying to write yet another book on the history of computer developments but rather to show that those developments rely on a long history of humans creating solutions to problems that arose as they became more and more sophisticated in their treatment of concepts of information and its manipulation. In many ways it resembles a work of philosophy more than a technical history, but relies on explaining that technical history to make his points. Michael R. Williams, Department of Computer Sciences, University of Calgary The idea that the digital age has revolutionized our day-to-day experience of the world is nothing new, and has been amply recognized by cultural historians. In contrast, Stephen Robertson's BC: Before Computers is a work which questions the idea that the mid-twentieth century saw a single moment of rupture. It is about all the things that we had to learn, invent, and understand – all the ways we had to evolve our thinking – before we could enter the information technology revolution of the second half of the twentieth century. Its focus ranges from the beginnings of data processing, right back to such originary forms of human technology as the development of writing systems, gathering a whole history of revolutionary moments in the development of information technologies into a single, although not linear narrative. Treading the line between philosophy and technical history, Robertson draws on his extensive technical knowledge to produce a text which is both thought-provoking and accessible to a wide range of readers. The book is wide in scope, exploring the development of technologies in such diverse areas as cryptography, visual art and music, and the postal system. Through all this, it does not simply aim to tell the story of computer developments but to show that those developments rely on a long history of humans creating technologies for increasingly sophisticated methods of manipulating information. Through a clear structure and engaging style, it brings together a wealth of informative and conceptual explorations into the history of human technologies, and avoids assumptions about any prior knowledge on the part of the reader. As such the expert and the general reader alike will find it of interest.

Explains the structure and functions of microprocessors, hard drives, disk drives, tape drives, keyboards, CD-ROM, multimedia sound and video, serial ports, mice, modems, scanners, LANs, and printers.

Ray Kurzweil is the inventor of the most innovative and compelling technology of our era, an international authority on artificial intelligence, and one of our greatest living visionaries. Now he offers a framework for envisioning the twenty-first century--an age in which the marriage of human sensitivity and artificial intelligence fundamentally alters and improves the way we live. Kurzweil's prophetic blueprint for the future takes us through the advances that inexorably result in computers exceeding the memory capacity and computational ability of the human brain by the year 2020 (with human-level capabilities not far behind); in relationships with automated personalities who will be our teachers, companions, and lovers; and in information fed straight into our brains along direct neural pathways. Optimistic and challenging, thought-

provoking and engaging, The Age of Spiritual Machines is the ultimate guide on our road into the next century.

This is the first comprehensive history of human-computer interaction (HCI). Whether you are a user experience professional or an academic researcher, whether you identify with computer science, human factors, information systems, information science, design, or communication, you can discover how your experiences fit into the expanding field of HCI. You can determine where to look for relevant information in other fields—and where you won't find it. This book describes the different fields that have participated in improving our digital tools. It is organized chronologically, describing major developments across fields in each period. Computer use has changed radically, but many underlying forces are constant. Technology has changed rapidly, human nature very little. An irresistible force meets an immovable object. The exponential rate of technological change gives us little time to react before technology moves on. Patterns and trajectories described in this book provide your best chance to anticipate what could come next. We have reached a turning point. Tools that we built for ourselves to use are increasingly influencing how we use them, in ways that are planned and sometimes unplanned. The book ends with issues worthy of consideration as we explore the new world that we and our digital partners are shaping.

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