

Design Basics Mit

A new approach to theory development for practice-driven research, proposing that theory is something made in and through design. Tendencies toward “academization” of traditionally practice-based fields have forced design to articulate itself as an academic discipline, in theoretical terms. In this book, Johan Redström offers a new approach to theory development in design research—one that is driven by practice, experimentation, and making. Redström does not theorize from the outside, but explores the idea that, just as design research engages in the making of many different kinds of things, theory might well be one of those things it is making. Redström proposes that we consider theory not as stable and constant but as something unfolding—something acted as much as articulated, inherently fluid and transitional. Redström describes three ways in which theory, in particular formulating basic definitions, is made through design: the use of combinations of fluid terms to articulate issues; the definition of more complex concepts through practice; and combining sets of definitions made through design into “programs.” These are the building blocks for creating conceptual structures to support design. Design seems to thrive on the complexities arising from dichotomies: form and function, freedom and method, art and science. With his idea of transitional theory, Redström departs from the traditional academic imperative to pick a side—theory or practice, art or science. Doing so, he opens up something like a design

space for theory development within design research. A book that lays out the fundamental concepts of design culture and outlines a design-driven way to approach the world. Humans did not discover fire—they designed it. Design is not defined by software programs, blueprints, or font choice. When we create new things—technologies, organizations, processes, systems, environments, ways of thinking—we engage in design. With this expansive view of design as their premise, in *The Design Way* Harold Nelson and Erik Stolterman make the case for design as its own culture of inquiry and action. They offer not a recipe for design practice or theorizing but a formulation of design culture's fundamental core of ideas. These ideas—which form “the design way”—are applicable to an infinite variety of design domains, from such traditional fields as architecture and graphic design to such nontraditional design areas as organizational, educational, interaction, and healthcare design. The text of this second edition is accompanied by new detailed images, “schemas” that visualize, conceptualize, and structure the authors' understanding of design inquiry. The text itself has been revised and expanded throughout, in part in response to reader feedback. An introduction to the field of applied ontology with examples derived particularly from biomedicine, covering theoretical components, design practices, and practical applications. In the era of “big data,” science is increasingly information driven, and the potential for computers to store, manage, and integrate massive amounts of data has given rise to such new disciplinary fields as biomedical informatics. Applied ontology offers

a strategy for the organization of scientific information in computer-tractable form, drawing on concepts not only from computer and information science but also from linguistics, logic, and philosophy. This book provides an introduction to the field of applied ontology that is of particular relevance to biomedicine, covering theoretical components of ontologies, best practices for ontology design, and examples of biomedical ontologies in use. After defining an ontology as a representation of the types of entities in a given domain, the book distinguishes between different kinds of ontologies and taxonomies, and shows how applied ontology draws on more traditional ideas from metaphysics. It presents the core features of the Basic Formal Ontology (BFO), now used by over one hundred ontology projects around the world, and offers examples of domain ontologies that utilize BFO. The book also describes Web Ontology Language (OWL), a common framework for Semantic Web technologies. Throughout, the book provides concrete recommendations for the design and construction of domain ontologies.

Principles of Computer System DesignAn

IntroductionMorgan Kaufmann

Principles of Computer System Design is the first textbook to take a principles-based approach to the computer system design. It identifies, examines, and illustrates fundamental concepts in computer system design that are common across operating systems, networks, database systems, distributed systems, programming languages, software engineering, security, fault tolerance, and architecture. Through carefully

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analyzed case studies from each of these disciplines, it demonstrates how to apply these concepts to tackle practical system design problems. To support the focus on design, the text identifies and explains abstractions that have proven successful in practice such as remote procedure call, client/service organization, file systems, data integrity, consistency, and authenticated messages. Most computer systems are built using a handful of such abstractions. The text describes how these abstractions are implemented, demonstrates how they are used in different systems, and prepares the reader to apply them in future designs. The book is recommended for junior and senior undergraduate students in Operating Systems, Distributed Systems, Distributed Operating Systems and/or Computer Systems Design courses; and professional computer systems designers. Features: Concepts of computer system design guided by fundamental principles. Cross-cutting approach that identifies abstractions common to networking, operating systems, transaction systems, distributed systems, architecture, and software engineering. Case studies that make the abstractions real: naming (DNS and the URL); file systems (the UNIX file system); clients and services (NFS); virtualization (virtual machines); scheduling (disk arms); security (TLS). Numerous pseudocode fragments that provide concrete examples of abstract concepts. Extensive support. The authors and MIT OpenCourseWare provide on-line, free of charge, open educational resources, including additional chapters, course syllabi, board layouts and slides, lecture videos, and an archive of lecture schedules, class assignments,

and design projects.

Describes the LISP programming language, and covers basic procedures, data, and modularity.

An exploration of how design might be led by marginalized communities, dismantle structural inequality, and advance collective liberation and ecological survival. What is the relationship between design, power, and social justice? “Design justice” is an approach to design that is led by marginalized communities and that aims explicitly to challenge, rather than reproduce, structural inequalities. It has emerged from a growing community of designers in various fields who work closely with social movements and community-based organizations around the world. This book explores the theory and practice of design justice, demonstrates how universalist design principles and practices erase certain groups of people—specifically, those who are intersectionally disadvantaged or multiply burdened under the matrix of domination (white supremacist heteropatriarchy, ableism, capitalism, and settler colonialism)—and invites readers to “build a better world, a world where many worlds fit; linked worlds of collective liberation and ecological sustainability.” Along the way, the book documents a multitude of real-world community-led design practices, each grounded in a particular social movement. Design Justice goes beyond recent calls for design for good, user-centered design, and employment diversity in the technology and design professions; it connects design to larger struggles for collective liberation and ecological survival.

Why the Internet was designed to be the way it is, and

how it could be different, now and in the future. How do you design an internet? The architecture of the current Internet is the product of basic design decisions made early in its history. What would an internet look like if it were designed, today, from the ground up? In this book, MIT computer scientist David Clark explains how the Internet is actually put together, what requirements it was designed to meet, and why different design decisions would create different internets. He does not take today's Internet as a given but tries to learn from it, and from alternative proposals for what an internet might be, in order to draw some general conclusions about network architecture. Clark discusses the history of the Internet, and how a range of potentially conflicting requirements—including longevity, security, availability, economic viability, management, and meeting the needs of society—shaped its character. He addresses both the technical aspects of the Internet and its broader social and economic contexts. He describes basic design approaches and explains, in terms accessible to nonspecialists, how networks are designed to carry out their functions. (An appendix offers a more technical discussion of network functions for readers who want the details.) He considers a range of alternative proposals for how to design an internet, examines in detail the key requirements a successful design must meet, and then imagines how to design a future internet from scratch. It's not that we should expect anyone to do this; but, perhaps, by conceiving a better future, we can push toward it.

A pioneering graphic designer shows how to use the

computer as an artistic medium in its own right. Most art and technology projects pair artists with engineers or scientists: the artist has the conception, and the technical person provides the know-how. John Maeda is an artist and a computer scientist, and he views the computer not as a substitute for brush and paint but as an artistic medium in its own right. Design By Numbers is a reader-friendly tutorial on both the philosophy and nuts-and-bolts techniques of programming for artists. Practicing what he preaches, Maeda composed Design By Numbers using a computational process he developed specifically for the book. He introduces a programming language and development environment, available on the Web, which can be freely downloaded or run directly within any JAVA-enabled Web browser. Appropriately, the new language is called DBN (for "design by numbers"). Designed for "visual" people—artists, designers, anyone who likes to pick up a pencil and doodle—DBN has very few commands and consists of elements resembling those of many other languages, such as LISP, LOGO, C/JAVA, and BASIC. Throughout the book, Maeda emphasizes the importance—and delights—of understanding the motivation behind computer programming, as well as the many wonders that emerge from well-written programs. Sympathetic to the "mathematically challenged," he places minimal emphasis on mathematics in the first half of the book. Because computation is inherently mathematical, the book's second half uses intermediate mathematical concepts that generally do not go beyond high-school algebra. The reader who masters the skills so clearly set

out by Maeda will be ready to exploit the true character of digital media design.

In 1951, designer Greta Magnusson Grossman observed that California design was "not a superimposed style, but an answer to present conditions....It has developed out of our own preferences for living in a modern way."

California design influenced the material culture of the entire country, in everything from architecture to fashion. This generously illustrated book, which accompanies a major exhibition at the Los Angeles County Museum of Art, is the first comprehensive examination of California's mid-century modern design. It begins by tracing the origins of a distinctively California modernism in the 1930s by such European migrants as Richard Neutra, Rudolph Schindler, and Kem Weber; it finds other specific design influences and innovations in solid-color commercial ceramics, inspirations from Mexico and Asia, new schools for design training, new concepts about leisure, and the conversion of wartime technologies to peacetime use (exemplified by Charles and Ray Eames's plywood and fiberglass furniture). The heart of California Design is the modern California home, famously characterized by open plans conducive to outdoor living. The layouts of modernist homes by Pierre Koenig, Craig Ellwood, and Raphael Soriano, for example, were intended to blur the distinction between indoors and out. Homes were furnished with products from Heath Ceramics, Van Keppel-Green, and Architectural Pottery as well as other, previously unheralded companies and designers. Many objects were designed to be multifunctional: pool and patio

furniture that was equally suitable indoors, lighting that was both task and ambient, bookshelves that served as room dividers, and bathing suits that would turn into ensembles appropriate for indoor entertainment. California Design includes 350 images, most in color, of furniture, ceramics, metalwork, architecture, graphic and industrial design, film, textiles, and fashion, and ten incisive essays that trace the rise of the California design aesthetic.

An introduction to the basic concepts of game design, focusing on techniques used in commercial game production. This textbook by a well-known game designer introduces the basics of game design, covering tools and techniques used by practitioners in commercial game production. It presents a model for analyzing game design in terms of three interconnected levels--mechanics and systems, gameplay, and player experience--and explains how novice game designers can use these three levels as a framework to guide their design process. The text is notable for emphasizing models and vocabulary used in industry practice and focusing on the design of games as dynamic systems of gameplay.

The operational amplifier ("op amp") is the most versatile and widely used type of analog IC, used in audio and voltage amplifiers, signal conditioners, signal converters, oscillators, and analog computing systems. Almost every electronic device uses at least one op amp. This book is Texas Instruments' complete professional-level tutorial and reference to operational amplifier theory and applications. Among the topics covered are basic op

amp physics (including reviews of current and voltage division, Thevenin's theorem, and transistor models), idealized op amp operation and configuration, feedback theory and methods, single and dual supply operation, understanding op amp parameters, minimizing noise in op amp circuits, and practical applications such as instrumentation amplifiers, signal conditioning, oscillators, active filters, load and level conversions, and analog computing. There is also extensive coverage of circuit construction techniques, including circuit board design, grounding, input and output isolation, using decoupling capacitors, and frequency characteristics of passive components. The material in this book is applicable to all op amp ICs from all manufacturers, not just TI. Unlike textbook treatments of op amp theory that tend to focus on idealized op amp models and configuration, this title uses idealized models only when necessary to explain op amp theory. The bulk of this book is on real-world op amps and their applications; considerations such as thermal effects, circuit noise, circuit buffering, selection of appropriate op amps for a given application, and unexpected effects in passive components are all discussed in detail. *Published in conjunction with Texas Instruments *A single volume, professional-level guide to op amp theory and applications *Covers circuit board layout techniques for manufacturing op amp circuits.

A foundational text that offers a rigorous introduction to the principles of design, specification, modeling, and analysis of cyber-physical systems. A cyber-physical system consists of a collection of computing devices

communicating with one another and interacting with the physical world via sensors and actuators in a feedback loop. Increasingly, such systems are everywhere, from smart buildings to medical devices to automobiles. This textbook offers a rigorous and comprehensive introduction to the principles of design, specification, modeling, and analysis of cyber-physical systems. The book draws on a diverse set of subdisciplines, including model-based design, concurrency theory, distributed algorithms, formal methods of specification and verification, control theory, real-time systems, and hybrid systems, explaining the core ideas from each that are relevant to system design and analysis. The book explains how formal models provide mathematical abstractions to manage the complexity of a system design. It covers both synchronous and asynchronous models for concurrent computation, continuous-time models for dynamical systems, and hybrid systems for integrating discrete and continuous evolution. The role of correctness requirements in the design of reliable systems is illustrated with a range of specification formalisms and the associated techniques for formal verification. The topics include safety and liveness requirements, temporal logic, model checking, deductive verification, stability analysis of linear systems, and real-time scheduling algorithms. Principles of modeling, specification, and analysis are illustrated by constructing solutions to representative design problems from distributed algorithms, network protocols, control design, and robotics. This book provides the rapidly expanding field of cyber-physical systems with a long-needed

foundational text by an established authority. It is suitable for classroom use or as a reference for professionals.

The renowned communications theorist Robert Gallager brings his lucid writing style to the study of the fundamental system aspects of digital communication for a one-semester course for graduate students. With the clarity and insight that have characterized his teaching and earlier textbooks, he develops a simple framework and then combines this with careful proofs to help the reader understand modern systems and simplified models in an intuitive yet precise way. A strong narrative and links between theory and practice reinforce this concise, practical presentation. The book begins with data compression for arbitrary sources. Gallager then describes how to modulate the resulting binary data for transmission over wires, cables, optical fibers, and wireless channels. Analysis and intuitive interpretations are developed for channel noise models, followed by coverage of the principles of detection, coding, and decoding. The various concepts covered are brought together in a description of wireless communication, using CDMA as a case study.

A broad overview of market mechanisms, with an emphasis on the interplay between theory and real-life applications; examples range from eBay auctions to school choice. This book offers an introduction to market design, providing students with a broad overview of issues related to the design and analysis of market mechanisms. It defines a market as a demand and a supply, without specifying a price system or mechanism.

This allows the text to analyze a broad set of situations—including such unconventional markets as college admissions and organ donation—and forces readers to pay attention to details that might otherwise be overlooked. Students often complain that microeconomics is too abstract and disconnected from reality; the study of market design shows how theory can help solve existing, real-life problems. The book focuses on the interplay between theory and applications. To keep the text as accessible as possible, special effort has been made to minimize formal description of the models while emphasizing the intuitive, with detailed explanations and resolution of examples. Appendixes offer general reviews of elements of game theory and mechanism design that are related to the themes explored in the book, presenting the basic concepts with as many explanations and illustrations as possible. The book covers topics including the basics of simple auctions; eBay auctions; Vickrey–Clarke–Groves auctions; keyword auctions, with examples from Google and Facebook; spectrum auctions; financial markets, with discussions of treasury auctions and IPOs; trading on the stock market; the basic matching model; medical match; assignment problems; probabilistic assignments; school choice; course allocation, with examples from Harvard and Wharton; and kidney exchange. New ways to design spaces for online interaction—and how they will change society. Computers were first conceived as “thinking machines,” but in the twenty-first century they have become social machines, online places where people meet friends, play games, and

collaborate on projects. In this book, Judith Donath argues persuasively that for social media to become truly sociable media, we must design interfaces that reflect how we understand and respond to the social world. People and their actions are still harder to perceive online than face to face: interfaces are clunky, and we have less sense of other people's character and intentions, where they congregate, and what they do. Donath presents new approaches to creating interfaces for social interaction. She addresses such topics as visualizing social landscapes, conversations, and networks; depicting identity with knowledge markers and interaction history; delineating public and private space; and bringing the online world's open sociability into the physical world. Donath asks fundamental questions about how we want to live online and offers thought-provoking designs that explore radically new ways of interacting and communicating.

A completely updated and expanded comprehensive treatment of VHDL and its applications to the design and simulation of real, industry-standard circuits. This comprehensive treatment of VHDL and its applications to the design and simulation of real, industry-standard circuits has been completely updated and expanded for the third edition. New features include all VHDL-2008 constructs, an extensive review of digital circuits, RTL analysis, and an unequaled collection of VHDL examples and exercises. The book focuses on the use of VHDL rather than solely on the language, with an emphasis on design examples and laboratory exercises. The third edition begins with a detailed review of digital circuits

(combinatorial, sequential, state machines, and FPGAs), thus providing a self-contained single reference for the teaching of digital circuit design with VHDL. In its coverage of VHDL-2008, it makes a clear distinction between VHDL for synthesis and VHDL for simulation. The text offers complete VHDL codes in examples as well as simulation results and comments. The significantly expanded examples and exercises include many not previously published, with multiple physical demonstrations meant to inspire and motivate students. The book is suitable for undergraduate and graduate students in VHDL and digital circuit design, and can be used as a professional reference for VHDL practitioners. It can also serve as a text for digital VLSI in-house or academic courses.

The power of design to create a life worth living even in a refugee camp: designs, inventions, and artworks from the Azraq Refugee Camp in Jordan. This book shows how, even in the most difficult conditions--forced displacement, trauma, and struggle--design can help create a life worth living. Design to Live documents designs, inventions, and artworks created by Syrian refugees living in the Azraq Refugee Camp in Jordan. Through these ingenious and creative innovations--including the vertical garden, an arrangement necessitated by regulations that forbid planting in the ground; a front hall, fashioned to protect privacy; a baby swing made from recycled desks; and a chess set carved from a broomstick--refugees defy the material scarcity, unforgiving desert climate, and cultural isolation of the camp. Written in close collaboration with

the residents of the camp, with text in both English and Arabic, *Design to Live*, reflects two perspectives on the camp: people living and working in Azraq and designers reflecting on humanitarian architecture within the broader field of socially engaged art and design. Architectural drawings, illustrations, photographs, narratives, and stories offer vivid testimony to the imaginative and artful ways that residents alter and reconstruct the standardized humanitarian design of the camp--and provide models that can be replicated elsewhere. The book is the product of a three-year project undertaken by MIT Future Heritage Lab, researchers and students with Syrian refugees at the Azraq Refugee Camp, CARE, Jordan, and the German-Jordanian University. Copublication with Future Heritage Lab, MIT Computer Systems Organization -- general.

A rigorous introduction to optimal control theory, with an emphasis on applications in economics. This book bridges optimal control theory and economics, discussing ordinary differential equations, optimal control, game theory, and mechanism design in one volume. Technically rigorous and largely self-contained, it provides an introduction to the use of optimal control theory for deterministic continuous-time systems in economics. The theory of ordinary differential equations (ODEs) is the backbone of the theory developed in the book, and chapter 2 offers a detailed review of basic concepts in the theory of ODEs, including the solution of systems of linear ODEs, state-space analysis, potential functions, and stability analysis. Following this, the book covers the main results of optimal control theory, in

particular necessary and sufficient optimality conditions; game theory, with an emphasis on differential games; and the application of control-theoretic concepts to the design of economic mechanisms. Appendixes provide a mathematical review and full solutions to all end-of-chapter problems. The material is presented at three levels: single-person decision making; games, in which a group of decision makers interact strategically; and mechanism design, which is concerned with a designer's creation of an environment in which players interact to maximize the designer's objective. The book focuses on applications; the problems are an integral part of the text. It is intended for use as a textbook or reference for graduate students, teachers, and researchers interested in applications of control theory beyond its classical use in economic growth. The book will also appeal to readers interested in a modeling approach to certain practical problems involving dynamic continuous-time models. The essential reference to SuperCollider, a powerful, flexible, open-source, cross-platform audio programming language. SuperCollider is one of the most important domain-specific audio programming languages, with potential applications that include real-time interaction, installations, electroacoustic pieces, generative music, and audiovisuals. The SuperCollider Book is the essential reference to this powerful and flexible language, offering students and professionals a collection of tutorials, essays, and projects. With contributions from top academics, artists, and technologists that cover topics at levels from the introductory to the specialized, it will be a valuable

sourcebook both for beginners and for advanced users. SuperCollider, first developed by James McCartney, is an accessible blend of Smalltalk, C, and further ideas from a number of programming languages. Free, open-source, cross-platform, and with a diverse and supportive developer community, it is often the first programming language sound artists and computer musicians learn. The SuperCollider Book is the long-awaited guide to the design, syntax, and use of the SuperCollider language. The first chapters offer an introduction to the basics, including a friendly tutorial for absolute beginners, providing the reader with skills that can serve as a foundation for further learning. Later chapters cover more advanced topics and particular topics in computer music, including programming, sonification, spatialization, microsound, GUIs, machine listening, alternative tunings, and non-real-time synthesis; practical applications and philosophical insights from the composer's and artist's perspectives; and "under the hood," developer's-eye views of SuperCollider's inner workings. A Web site accompanying the book offers code, links to the application itself and its source code, and a variety of third-party extras, extensions, libraries, and examples. An impassioned look at games and game design that offers the most ambitious framework for understanding them to date. As pop culture, games are as important as film or television—but game design has yet to develop a theoretical framework or critical vocabulary. In *Rules of Play* Katie Salen and Eric Zimmerman present a much-needed primer for this emerging field. They offer a

unified model for looking at all kinds of games, from board games and sports to computer and video games. As active participants in game culture, the authors have written *Rules of Play* as a catalyst for innovation, filled with new concepts, strategies, and methodologies for creating and understanding games. Building an aesthetics of interactive systems, Salen and Zimmerman define core concepts like "play," "design," and "interactivity." They look at games through a series of eighteen "game design schemas," or conceptual frameworks, including games as systems of emergence and information, as contexts for social play, as a storytelling medium, and as sites of cultural resistance. Written for game scholars, game developers, and interactive designers, *Rules of Play* is a textbook, reference book, and theoretical guide. It is the first comprehensive attempt to establish a solid theoretical framework for the emerging discipline of game design. Key ideas in programming language design and implementation explained using a simple and concise framework; a comprehensive introduction suitable for use as a textbook or a reference for researchers. Hundreds of programming languages are in use today—scripting languages for Internet commerce, user interface programming tools, spreadsheet macros, page format specification languages, and many others. Designing a programming language is a metaprogramming activity that bears certain similarities to programming in a regular language, with clarity and simplicity even more important than in ordinary programming. This comprehensive text uses a simple

and concise framework to teach key ideas in programming language design and implementation. The book's unique approach is based on a family of syntactically simple pedagogical languages that allow students to explore programming language concepts systematically. It takes as premise and starting point the idea that when language behaviors become incredibly complex, the description of the behaviors must be incredibly simple. The book presents a set of tools (a mathematical metalanguage, abstract syntax, operational and denotational semantics) and uses it to explore a comprehensive set of programming language design dimensions, including dynamic semantics (naming, state, control, data), static semantics (types, type reconstruction, polymorphism, effects), and pragmatics (compilation, garbage collection). The many examples and exercises offer students opportunities to apply the foundational ideas explained in the text. Specialized topics and code that implements many of the algorithms and compilation methods in the book can be found on the book's Web site, along with such additional material as a section on concurrency and proofs of the theorems in the text. The book is suitable as a text for an introductory graduate or advanced undergraduate programming languages course; it can also serve as a reference for researchers and practitioners. How recent research in cognitive science offers new ways to understand the interaction of people and computers and develops a new literacy for well-informed, sensitive software design. The evolution of the concept of mind in cognitive science over the past 25 years

creates new ways to think about the interaction of people and computers. New ideas about embodiment, metaphor as a fundamental cognitive process, and conceptual integration--a blending of older concepts that gives rise to new, emergent properties--have become increasingly important in software engineering (SE) and human-computer interaction (HCI). If once computing was based on algorithms, mathematical theories, and formal notations, now the use of stories, metaphors, and blends can contribute to well-informed, sensitive software design. In *Designing with Blends*, Manuel Imaz and David Benyon show how these new metaphors and concepts of mind allow us to discover new aspects of HCI-SE. After 60 years, digital technology has come of age, but software design has not kept pace with technological sophistication; people struggle to understand and use their computers, cameras, phones, and other devices. Imaz and Benyon argue that the dominance of digital media in our lives demands changes in HCI-SE based on advances in cognitive science. The idea of embodied cognition, they contend, can change the way we approach design by emphasizing the figurative nature of interaction. Imaz and Benyon offer both theoretical grounding and practical examples that illustrate the advantages of applying cognitive concepts to software design. A new view of cognition, they argue, will develop a cognitive literacy in software and interaction design that helps designers understand the opportunities of digital technology and provides people with a more satisfying interactive experience.

The role of design, both expert and nonexpert, in the ongoing wave of social innovation toward sustainability. In a changing world everyone designs: each individual person and each collective subject, from enterprises to institutions, from communities to cities and regions, must define and enhance a life project. Sometimes these projects generate unprecedented solutions; sometimes they converge on common goals and realize larger transformations. As Ezio Manzini describes in this book, we are witnessing a wave of social innovations as these changes unfold—an expansive open co-design process in which new solutions are suggested and new meanings are created. Manzini distinguishes between diffuse design (performed by everybody) and expert design (performed by those who have been trained as designers) and describes how they interact. He maps what design experts can do to trigger and support meaningful social changes, focusing on emerging forms of collaboration. These range from community-supported agriculture in China to digital platforms for medical care in Canada; from interactive storytelling in India to collaborative housing in Milan. These cases illustrate how expert designers can support these collaborations—making their existence more probable, their practice easier, their diffusion and their convergence in larger projects more effective. Manzini draws the first comprehensive picture of design for social innovation: the most dynamic field of action for both expert and nonexpert designers in the coming decades.

Processing simple forms of data - Processing arbitrarily large data - More on processing arbitrarily large data -

Abstracting designs - Generative recursion - Changing the state of variables - Changing compound values.

Unlike books currently on the market, this book attempts to satisfy two goals: combine circuits and electronics into a single, unified treatment, and establish a strong connection with the contemporary world of digital systems. It will introduce a new way of looking not only at the treatment of circuits, but also at the treatment of introductory coursework in engineering in general. Using the concept of "abstraction," the book attempts to form a bridge between the world of physics and the world of large computer systems. In particular, it attempts to unify electrical engineering and computer science as the art of creating and exploiting successive abstractions to manage the complexity of building useful electrical systems. Computer systems are simply one type of electrical systems. +Balances circuits theory with practical digital electronics applications. +Illustrates concepts with real devices. +Supports the popular circuits and electronics course on the MIT OpenCourse Ware from which professionals worldwide study this new approach. +Written by two educators well known for their innovative teaching and research and their collaboration with industry. +Focuses on contemporary MOS technology.

How design is calculating with shapes: formal details and design applications.

Highly effective thinking is an art that engineers and scientists can be taught to develop. By presenting actual experiences and analyzing them as they are described, the author conveys the developmental thought

processes employed and shows a style of thinking that leads to successful results is something that can be learned. Along with spectacular successes, the author also conveys how failures contributed to shaping the thought processes. Provides the reader with a style of thinking that will enhance a person's ability to function as a problem-solver of complex technical issues. Consists of a collection of stories about the author's participation in significant discoveries, relating how those discoveries came about and, most importantly, provides analysis about the thought processes and reasoning that took place as the author and his associates progressed through engineering problems.

An introduction to a broad range of topics in deep learning, covering mathematical and conceptual background, deep learning techniques used in industry, and research perspectives. “Written by three experts in the field, Deep Learning is the only comprehensive book on the subject.” —Elon Musk, cochair of OpenAI; cofounder and CEO of Tesla and SpaceX Deep learning is a form of machine learning that enables computers to learn from experience and understand the world in terms of a hierarchy of concepts. Because the computer gathers knowledge from experience, there is no need for a human computer operator to formally specify all the knowledge that the computer needs. The hierarchy of concepts allows the computer to learn complicated concepts by building them out of simpler ones; a graph of these hierarchies would be many layers deep. This book introduces a broad range of topics in deep learning. The text offers mathematical and conceptual

background, covering relevant concepts in linear algebra, probability theory and information theory, numerical computation, and machine learning. It describes deep learning techniques used by practitioners in industry, including deep feedforward networks, regularization, optimization algorithms, convolutional networks, sequence modeling, and practical methodology; and it surveys such applications as natural language processing, speech recognition, computer vision, online recommendation systems, bioinformatics, and videogames. Finally, the book offers research perspectives, covering such theoretical topics as linear factor models, autoencoders, representation learning, structured probabilistic models, Monte Carlo methods, the partition function, approximate inference, and deep generative models. Deep Learning can be used by undergraduate or graduate students planning careers in either industry or research, and by software engineers who want to begin using deep learning in their products or platforms. A website offers supplementary material for both readers and instructors.

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.

Two distinguished neuroscientists distil general principles from more than a century of scientific study, “reverse engineering” the brain to understand its design. Neuroscience research has exploded, with more than fifty thousand neuroscientists applying increasingly advanced methods. A mountain of new facts and

mechanisms has emerged. And yet a principled framework to organize this knowledge has been missing. In this book, Peter Sterling and Simon Laughlin, two leading neuroscientists, strive to fill this gap, outlining a set of organizing principles to explain the whys of neural design that allow the brain to compute so efficiently. Setting out to “reverse engineer” the brain—disassembling it to understand it—Sterling and Laughlin first consider why an animal should need a brain, tracing computational abilities from bacterium to protozoan to worm. They examine bigger brains and the advantages of “anticipatory regulation”; identify constraints on neural design and the need to “nanofy”; and demonstrate the routes to efficiency in an integrated molecular system, phototransduction. They show that the principles of neural design at finer scales and lower levels apply at larger scales and higher levels; describe neural wiring efficiency; and discuss learning as a principle of biological design that includes “save only what is needed.” Sterling and Laughlin avoid speculation about how the brain might work and endeavor to make sense of what is already known. Their distinctive contribution is to gather a coherent set of basic rules and exemplify them across spatial and functional scales. From one of the authors of *The Unwritten Laws of Engineering* and *The Unwritten Laws of Business*, this concise and readable book is an excellent primer or refresher for any professional interested in the basic principles and practices of good mechanical design. In this handy and unique volume the author uses his own experience, along with input from other expert designers, to explicitly state design principles and practices. Readers will not have to

discover these principles on their own and will be able to apply these fundamental concepts throughout their designs. This book provides a structured treatment of the key principles and techniques for enabling efficient processing of deep neural networks (DNNs). DNNs are currently widely used for many artificial intelligence (AI) applications, including computer vision, speech recognition, and robotics. While DNNs deliver state-of-the-art accuracy on many AI tasks, it comes at the cost of high computational complexity. Therefore, techniques that enable efficient processing of deep neural networks to improve key metrics—such as energy-efficiency, throughput, and latency—without sacrificing accuracy or increasing hardware costs are critical to enabling the wide deployment of DNNs in AI systems. The book includes background on DNN processing; a description and taxonomy of hardware architectural approaches for designing DNN accelerators; key metrics for evaluating and comparing different designs; features of DNN processing that are amenable to hardware/algorithm co-design to improve energy efficiency and throughput; and opportunities for applying new technologies. Readers will find a structured introduction to the field as well as formalization and organization of key concepts from contemporary work that provide insights that may spark new ideas.

Applying the principles of human-centered design to real-world health care challenges, from drug packaging to early detection of breast cancer. This book makes a case for applying the principles of design thinking to real-world health care challenges. As health care systems around the globe struggle to expand access, improve outcomes, and control costs, Health Design Thinking offers a human-centered approach for designing health care products and services, with examples and case studies that range from drug packaging and exam rooms to internet-connected devices for

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early detection of breast cancer. Written by leaders in the field—Bon Ku, a physician and founder of the innovative Health Design Lab at Sidney Kimmel Medical College, and Ellen Lupton, an award-winning graphic designer and curator at Cooper Hewitt Smithsonian Design Museum—the book outlines the fundamentals of design thinking and highlights important products, prototypes, and research in health design. Health design thinking uses play and experimentation rather than a rigid methodology. It draws on interviews, observations, diagrams, storytelling, physical models, and role playing; design teams focus not on technology but on problems faced by patients and clinicians. The book's diverse case studies show health design thinking in action. These include the development of PillPack, which frames prescription drug delivery in terms of user experience design; a credit card–size device that allows patients to generate their own electrocardiograms; and improved emergency room signage. Drawings, photographs, storyboards, and other visualizations accompany the case studies. Copublished with Cooper Hewitt, Smithsonian Design Museum

A guide to innovative spreadsheet implementation technology, accompanied by a free software platform for experimentation.

The book covers all aspects of teaching Web design, from optimal class size and classroom configuration to peer review of completed projects. It uses many examples from the Web design course taught by the authors at MIT.

The authors of Thoughtful Interaction Design go beyond the usual technical concerns of usability and usefulness to consider interaction design from a design perspective. The shaping of digital artifacts is a design process that influences the form and functions of workplaces, schools, communication, and culture; the successful interaction designer must use both ethical and aesthetic judgment to

create designs that are appropriate to a given environment. This book is not a how-to manual, but a collection of tools for thought about interaction design. Working with information technology—called by the authors "the material without qualities"—interaction designers create not a static object but a dynamic pattern of interactivity. The design vision is closely linked to context and not simply focused on the technology. The authors' action-oriented and context-dependent design theory, drawing on design theorist Donald Schön's concept of the reflective practitioner, helps designers deal with complex design challenges created by new technology and new knowledge. Their approach, based on a foundation of thoughtfulness that acknowledges the designer's responsibility not only for the functional qualities of the design product but for the ethical and aesthetic qualities as well, fills the need for a theory of interaction design that can increase and nurture design knowledge. From this perspective they address the fundamental question of what kind of knowledge an aspiring designer needs, discussing the process of design, the designer, design methods and techniques, the design product and its qualities, and conditions for interaction design. An engaging, illustrated collection of insights revealing the practices and principles that expert software designers use to create great software. What makes an expert software designer? It is more than experience or innate ability. Expert software designers have specific habits, learned practices, and observed principles that they apply deliberately during their design work. This book offers sixty-six insights, distilled from years of studying experts at work, that capture what successful software designers actually do to create great software. The book presents these insights in a series of two-page illustrated spreads, with the principle and a short explanatory text on one page, and a drawing on the facing page. For example, "Experts generate alternatives" is

illustrated by the same few balloons turned into a set of very different balloon animals. The text is engaging and accessible; the drawings are thought-provoking and often playful. Organized into such categories as “Experts reflect,” “Experts are not afraid,” and “Experts break the rules,” the insights range from “Experts prefer simple solutions” to “Experts see error as opportunity.” Readers learn that “Experts involve the user”; “Experts take inspiration from wherever they can”; “Experts design throughout the creation of software”; and “Experts draw the problem as much as they draw the solution.” One habit for an aspiring expert software designer to develop would be to read and reread this entertaining but essential little book. The insights described offer a guide for the novice or a reference for the veteran—in software design or any design profession. A companion web site provides an annotated bibliography that compiles key underpinning literature, the opportunity to suggest additional insights, and more.

An argument that operational urban planning can be improved by the application of the tools of urban economics to the design of regulations and infrastructure. Urban planning is a craft learned through practice. Planners make rapid decisions that have an immediate impact on the ground—the width of streets, the minimum size of land parcels, the heights of buildings. The language they use to describe their objectives is qualitative—“sustainable,” “livable,” “resilient”—often with no link to measurable outcomes. Urban economics, on the other hand, is a quantitative science, based on theories, models, and empirical evidence largely developed in academic settings. In this book, the eminent urban planner Alain Bertaud argues that applying the theories of urban economics to the practice of urban planning would greatly improve both the productivity of cities and the welfare of urban citizens. Bertaud explains

that markets provide the indispensable mechanism for cities' development. He cites the experience of cities without markets for land or labor in pre-reform China and Russia; this "urban planners' dream" created inefficiencies and waste. Drawing on five decades of urban planning experience in forty cities around the world, Bertaud links cities' productivity to the size of their labor markets; argues that the design of infrastructure and markets can complement each other; examines the spatial distribution of land prices and densities; stresses the importance of mobility and affordability; and critiques the land use regulations in a number of cities that aim at redesigning existing cities instead of just trying to alleviate clear negative externalities. Bertaud concludes by describing the new role that joint teams of urban planners and economists could play to improve the way cities are managed.

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