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SARAI RANDY

Portraits in Silicon

National Geographic Books

Explorations of the many ways of being material in the digital age. In his oracular 1995 book *Being Digital*, Nicholas Negroponte predicted that social relations, media, and commerce would move from the realm of “atoms to bits”—that human affairs would be increasingly untethered from the material world. And yet in 2019, an age dominated by the digital, we have not quite left the material world behind. In *Being Material*, artists and technologists explore the relationship of the digital to the material, demonstrating that processes that seem wholly immaterial function within material constraints. Digital technologies themselves, they remind us, are material things—constituted by atoms of gold, silver, silicon, copper, tin, tungsten, and more. The contributors explore five modes of being material: programmable, wearable, livable, invisible, and audible. Their

contributions take the form of reports, manifestos, philosophical essays, and artist portfolios, among other configurations. The book's cover merges the possibilities of paper with those of the digital, featuring a bookmark-like card that, when “seen” by a smartphone, generates graphic arrangements that unlock films, music, and other dynamic content on the book's website. At once artist's book, digitally activated object, and collection of scholarship, this book both demonstrates and chronicles the many ways of being material. Contributors Christina Agapakis, Azra Akšamija, Sandy Alexandre, Dewa Alit, George Barbastathis, Maya Beiser, Marie-Pier Boucher, Benjamin H. Bratton, Hussein Chalayan, Jim Cybulski, Tal Danino, Deborah G. Douglas, Arnold Dreyblatt, M. Amah Edoh, Michelle Tolini Finamore, Team Foldscope and Global Foldscope community, Ben Fry, Victor Gama, Stefan Helmreich, Hyphen-Labs, Leila Kinney, Rebecca Konte, Winona LaDuke, Brendan Landis, Grace Leslie, Bill Maurer, Lucy McRae, Tom Özden-Schilling, Trevor Paglen, Lisa Parks, Nadya

Peek, Claire Pentecost, Manu Prakash, Casey Reas, Paweł Romańczuk, Natasha D. Schüll, Nick Shapiro, Skylar Tibbits, Rebecca Uchill, Evan Ziporyn Book Design: E Roon Kang Electronics, interactions, and product designer: Marcelo Coelho
Invisible Gardens MIT Press

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.

[How I Became One of the Invisible](#) MIT Press

The power of images to represent the unseeable: stunning visualizations of science, from the microscopic to the incredibly vast. We live among patterns of delicate beauty and exquisite chaos that our eyes can't detect; we are surrounded by invisible particles and shifting fields of matter that permeate all of space. Our very cells are intricate molecular machines, and the story of our origins stretches back through an unimaginable amount of time. How can we see the richness of what lies beyond our sensory perception? Scientists have developed

visualization tools that can make the invisible visible. This bountifully illustrated book demonstrates the power of images to represent the unseeable, offering stunning visualizations of science that range from the microscopic to the incredibly vast. With more than 200 color images and an engaging text by leading science writer Jack Challoner, *Seeing Science* explains and illustrates the techniques by which scientists create visualizations of their discoveries. We see the first detection of a black hole as represented by an image from an X-ray telescope, get a direct view of DNA through an electron microscope, and much more. Visualizations are also used to make sense of an avalanche of data—concisely presenting information from the 20,000 or so human genes, for example. Scientists represent complex theories in computer models, which take on a curious beauty of their own. And scientists and artists collaborate to create art from science visualizations, with intriguing results.

[The MIT Press Series in Computer Science](#) MIT Press

The experience of digital art and how it is relevant to information technology. In *Windows and Mirrors: Interaction Design, Digital Art, and the Myth of Transparency*, Jay David Bolter and Diane Gromala argue that, contrary to Donald Norman's famous dictum, we do not always want our computers to be invisible "information appliances." They say that a computer does not feel like a toaster or a vacuum cleaner; it feels like a medium that is now taking its place beside other media like printing, film, radio, and television. The computer as medium creates new forms and genres for artists and designers; Bolter and Gromala want to show what digital art has to offer to Web designers, education technologists, graphic artists, interface designers, HCI experts, and, for that matter, anyone interested in the cultural implications of the digital revolution. In the early 1990s, the World Wide Web began to shift from purely verbal representation to an experience for the user in which form and content were thoroughly integrated. Designers brought their skills and sensibilities to the Web, as well as a belief that a

message was communicated through interplay of words and images. Bolter and Gromala argue that invisibility or transparency is only half the story; the goal of digital design is to establish a rhythm between transparency—made possible by mastery of techniques—and reflection—as the medium itself helps us understand our experience of it. The book examines recent works of digital art from the Art Gallery at SIGGRAPH 2000. These works, and their inclusion in an important computer conference, show that digital art is relevant to technologists. In fact, digital art can be considered the purest form of experimental design; the examples in this book show that design need not deliver information and then erase itself from our consciousness but can engage us in an interactive experience of form and content.

Software Studies MIT Press

Statistical approaches to processing natural language text have become dominant in recent years. This foundational text is the first comprehensive

introduction to statistical natural language processing (NLP) to appear. The book contains all the theory and algorithms needed for building NLP tools. It provides broad but rigorous coverage of mathematical and linguistic foundations, as well as detailed discussion of statistical methods, allowing students and researchers to construct their own implementations. The book covers collocation finding, word sense disambiguation, probabilistic parsing, information retrieval, and other applications.

Machine Learners MIT Press

Technology scholars declare an emergency: attention must be paid to the inequality, marginalization, and biases woven into our technological systems. This book sounds an alarm: we can no longer afford to be lulled into complacency by narratives of techn-utopianism, or even techno-neutrality. We should not be reassured by such soothing generalities as "human error," "virtual reality," or "the cloud." We need to realize that nothing is virtual: everything that

"happens online," "virtually," or "autonomously" happens offline first, and often involves human beings whose labor is deliberately kept invisible. Everything is IRL. In *Your Computer Is on Fire*, technology scholars train a spotlight on the inequality, marginalization, and biases woven into our technological systems.

Foundations of Statistical Natural Language Processing MIT Press

A rich collection of essays tracing the relationship between art and sound. In the 1970s David Toop became preoccupied with the possibility that music was no longer bounded by formalities of audience: the clapping, the booing, the short attention span, the demand for instant gratification. Considering sound and listening as foundational practices in themselves leads music into a thrilling new territory: stretched time, wilderness, video monitors, singing sculptures, weather, meditations, vibration and the interior resonance of objects, interspecies communications, instructional texts, silent actions, and performance art. Toop sought to

document the originality and unfamiliarity of this work from his perspective as a practitioner and writer. The challenge was to do so without being drawn back into the domain of music while still acknowledging the vitality and hybridity of twentieth-century musics as they moved toward art galleries, museums, and site-specificity. Toop focused on practitioners, whose stories are as compelling as the theoretical and abstract implications of their works. *Inflamed Invisible* collects more than four decades of David Toop's essays, reviews, interviews, and experimental texts, drawing us into the company of artists and their concerns, not forgetting the quieter, unsung voices. The volume is an offering, an exploration of strata of sound that are the crossing points of sensory, intellectual, and philosophical preoccupations, layers through which objects, thoughts and air itself come alive as the inflamed invisible. [Computer Science Logo Style](#) MIT Press
How art makes visible what had been invisible—the effects of

radiation, the lives of atomic bomb survivors, and the politics of the atomic age. The effects of radiation are invisible, but art can make it and its effects visible. Artwork created in response to the events of the nuclear era allow us to see them in a different way. In *Invisible Colors*, Gabrielle Decamous explores the atomic age from the perspective of the arts, investigating atomic-related art inspired by the work of Marie Curie, the bombings of Hiroshima and Nagasaki, the disaster at Fukushima, and other episodes in nuclear history. Decamous looks at the “Radium Literature” based on the work and life of Marie Curie; “A-Bomb literature” by Hibakusha (bomb survivor) artists from Nagasaki and Hiroshima; responses to the bombings by Western artists and writers; art from the irradiated landscapes of the Cold War—nuclear test sites and uranium mines, mainly in the Pacific and some African nations; and nuclear accidents in Fukushima, Chernobyl, and Three Mile Island. She finds that the artistic voices of the East are often drowned out by those of the West.

Hibakusha art and Japanese photographs of the bombing are little known in the West and were censored; poetry from the Marshall Islands and Moruroa is also largely unknown; Western theatrical and cinematic works focus on heroic scientists, military men, and the atomic mushroom cloud rather than the aftermath of the bombings. Emphasizing art by artists who were present at these nuclear events—the “global Hibakusha”—rather than those reacting at a distance, Decamous puts Eastern and Western art in dialogue, analyzing the aesthetics and the ethics of nuclear representation.

The Invisible Link MIT Press

An account of how young people in Ghana's capital city adopt and adapt digital technology in the margins of the global economy. The urban youth frequenting the Internet cafés of Accra, Ghana, who are decidedly not members of their country's elite, use the Internet largely as a way to orchestrate encounters across distance and amass foreign ties—activities once limited to the wealthy, university-educated classes. The Internet,

accessed on second-hand computers (castoffs from the United States and Europe), has become for these youths a means of enacting a more cosmopolitan self. In *Invisible Users*, Jenna Burrell offers a richly observed account of how these Internet enthusiasts have adopted, and adapted to their own priorities, a technological system that was not designed with them in mind. Burrell describes the material space of the urban Internet café and the virtual space of push and pull between young Ghanaians and the foreigners they encounter online; the region's famous 419 scam strategies and the rumors of “big gains” that fuel them; the influential role of churches and theories about how the supernatural operates through the network; and development rhetoric about digital technologies and the future viability of African Internet cafés in the region. Burrell, integrating concepts from science and technology studies and African studies with empirical findings from her own field work in Ghana, captures the interpretive flexibility of technology by users in the margins but

also highlights how their invisibility puts limits on their full inclusion into a global network society. [The Invisible Computer](#) MIT Press

A new way of thinking about data science and data ethics that is informed by the ideas of intersectional feminism. Today, data science is a form of power. It has been used to expose injustice, improve health outcomes, and topple governments. But it has also been used to discriminate, police, and surveil. This potential for good, on the one hand, and harm, on the other, makes it essential to ask: Data science by whom? Data science for whom? Data science with whose interests in mind? The narratives around big data and data science are overwhelmingly white, male, and techno-heroic. In *Data Feminism*, Catherine D'Ignazio and Lauren Klein present a new way of thinking about data science and data ethics—one that is informed by intersectional feminist thought. Illustrating data feminism in action, D'Ignazio and Klein show how challenges to the male/female binary can help challenge other hierarchical (and empirically wrong)

classification systems. They explain how, for example, an understanding of emotion can expand our ideas about effective data visualization, and how the concept of invisible labor can expose the significant human efforts required by our automated systems. And they show why the data never, ever “speak for themselves.” *Data Feminism* offers strategies for data scientists seeking to learn how feminism can help them work toward justice, and for feminists who want to focus their efforts on the growing field of data science. But *Data Feminism* is about much more than gender. It is about power, about who has it and who doesn't, and about how those differentials of power can be challenged and changed. [Invisible Users](#) MIT Press

A lively, unorthodox look at economics, business, and public policy told in the form of a novel. A love story that embraces the business and economic issues of the day? The *Invisible Heart* takes a provocative look at business, economics, and regulation through the eyes of Sam Gordon and Laura Silver, teachers at the exclusive Edwards School in Washington,

D.C. Sam lives and breathes capitalism. He thinks that most government regulation is unnecessary or even harmful. He believes that success in business is a virtue. He believes that our humanity flourishes under economic freedom. Laura prefers Wordsworth to the Wall Street Journal. Where Sam sees victors, she sees victims. She wants the government to protect consumers and workers from the excesses of Sam's beloved marketplace. While Sam and Laura argue about how to make the world a better place, a parallel story unfolds across town. Erica Baldwin, the crusading head of a government watchdog agency, tries to bring Charles Krauss, a ruthless CEO, to justice. How are these two dramas connected? Why is Sam under threat of dismissal? Will Erica Baldwin find the evidence she needs? Can Laura love a man with an Adam Smith poster on his wall? The answers in *The Invisible Heart* give the reader a richer appreciation for how business and the marketplace transform our lives. [Hidden in Plain Sight](#) MIT Press

In 1936, when he was just twenty-four years old, Alan Turing wrote a remarkable paper in which he outlined the theory of computation, laying out the ideas that underlie all modern computers. This groundbreaking and powerful theory now forms the basis of computer science. In *Turing's Vision*, Chris Bernhardt explains the theory, Turing's most important contribution, for the general reader. Bernhardt argues that the strength of Turing's theory is its simplicity, and that, explained in a straightforward manner, it is eminently understandable by the nonspecialist. As Marvin Minsky writes, "The sheer simplicity of the theory's foundation and extraordinary short path from this foundation to its logical and surprising conclusions give the theory a mathematical beauty that alone guarantees it a permanent place in computer theory." Bernhardt begins with the foundation and systematically builds to the surprising conclusions. He also views Turing's theory in the context of mathematical history, other views of

computation (including those of Alonzo Church), Turing's later work, and the birth of the modern computer. In the paper, "On Computable Numbers, with an Application to the Entscheidungsproblem," Turing thinks carefully about how humans perform computation, breaking it down into a sequence of steps, and then constructs theoretical machines capable of performing each step. Turing wanted to show that there were problems that were beyond any computer's ability to solve; in particular, he wanted to find a decision problem that he could prove was undecidable. To explain Turing's ideas, Bernhardt examines three well-known decision problems to explore the concept of undecidability; investigates theoretical computing machines, including Turing machines; explains universal machines; and proves that certain problems are undecidable, including Turing's problem concerning computable numbers. [Programmed Visions](#) MIT Press
Stories behind essential microfluidic devices, from

the inkjet printer to DNA sequencing chip. Hidden from view, microfluidics underlies a variety of devices that are essential to our lives, from inkjet printers to glucometers for the monitoring of diabetes. Microfluidics—which refers to the technology of miniature fluidic devices and the study of fluids at submillimeter levels—is invisible to most of us because it is hidden beneath ingenious user interfaces. In this book, Albert Folch, a leading researcher in microfluidics, describes the development and use of key microfluidic devices. He explains not only the technology but also the efforts, teams, places, and circumstances that enabled these inventions. Folch reports, for example, that the inkjet printer was one of the first microfluidic devices invented, and traces its roots back to nineteenth-century discoveries in the behavior of fluid jets. He also describes how rapid speed microfluidic DNA sequencers have enabled the sequencing of animal, plant, and microbial species genomes; organs on chips facilitate direct tests of drugs on human tissue, leapfrogging over

the usual stage of animal testing; at-home pregnancy tests are based on clever microfluidic principles; microfluidics can be used to detect cancer cells in the early stages of metastasis; and the same technology that shoots droplets of ink on paper in inkjet printers enables 3D printers to dispense layers of polymers. Folch tells the stories behind these devices in an engaging style, accessible to nonspecialists. More than 100 color illustrations show readers amazing images of microfluids under the microscope. *The Invisible Heart* MIT Press

A tour through a world too small to see with a microscope: air, ice, diamonds, aspirin, fuel cells, and other structures viewed and described in the scale of nanometers. The world is made up of structures too small to see with the naked eye, too small to see even with an electron microscope. Einstein established the reality of atoms and molecules in the early 1900s. How can we see a world measured in fractions of nanometers? (Most atoms are less than one nanometer, less than one-billionth of a meter, in diameter.) This beautiful

and fascinating book gives us a tour of the invisible nanoscale world. It offers many vivid color illustrations of atomic structures, each accompanied by a short, engagingly written essay. The structures advance from the simple (air, ice) to the complex (supercapacitor, rare earth magnet). Each subject was chosen not in search of comprehensiveness but because it illustrates how atomic structure creates a property (such as hardness, color, or toxicity), or because it has a great story, or simply because it is beautiful. Thus we learn how diamonds ride volcanoes to the earth's surface (if they came up more slowly, they'd be graphite, as in pencils); what form of carbon is named after Buckminster Fuller; who won in the x-ray vs. mineralogy professor smackdown; how a fuel cell works; when we use spinodal decomposition in our daily lives (it involves hot water and a package of Jell-O), and much more. The amazing color illustrations by Stephen Deffeyes are based on data from x-ray diffraction (a method used in crystallography). They are not just pretty pictures

but visualizations of scientific data derived directly from those data. Together with Kenneth Deffeyes's witty commentary, they offer a vivid demonstration of the diversity and beauty found at the nanometer scale.

Data Feminism National Geographic Books
A compact and accessible history, from punch cards and calculators to UNIVAC and ENIAC, the personal computer, Silicon Valley, and the Internet. The history of computing could be told as the story of hardware and software, or the story of the Internet, or the story of "smart" hand-held devices, with subplots involving IBM, Microsoft, Apple, Facebook, and Twitter. In this concise and accessible account of the invention and development of digital technology, computer historian Paul Ceruzzi offers a broader and more useful perspective. He identifies four major threads that run throughout all of computing's technological development: digitization—the coding of information, computation, and control in binary form, ones and zeros; the convergence of multiple streams of techniques,

devices, and machines, yielding more than the sum of their parts; the steady advance of electronic technology, as characterized famously by “Moore's Law”; and the human-machine interface. Ceruzzi guides us through computing history, telling how a Bell Labs mathematician coined the word “digital” in 1942 (to describe a high-speed method of calculating used in anti-aircraft devices), and recounting the development of the punch card (for use in the 1890 U.S. Census). He describes the ENIAC, built for scientific and military applications; the UNIVAC, the first general purpose computer; and ARPANET, the Internet's precursor. Ceruzzi's account traces the world-changing evolution of the computer from a room-size ensemble of machinery to a “minicomputer” to a desktop computer to a pocket-sized smart phone. He describes the development of the silicon chip, which could store ever-increasing amounts of data and enabled ever-decreasing device size. He visits that hotbed of innovation, Silicon Valley, and brings the story up to the present with the Internet, the World Wide Web, and social

networking.

The Elements of Computing Systems MIT Press

If machine learning transforms the nature of knowledge, does it also transform the practice of critical thought? Machine learning—programming computers to learn from data—has spread across scientific disciplines, media, entertainment, and government. Medical research, autonomous vehicles, credit transaction processing, computer gaming, recommendation systems, finance, surveillance, and robotics use machine learning. Machine learning devices (sometimes understood as scientific models, sometimes as operational algorithms) anchor the field of data science. They have also become mundane mechanisms deeply embedded in a variety of systems and gadgets. In contexts from the everyday to the esoteric, machine learning is said to transform the nature of knowledge. In this book, Adrian Mackenzie investigates whether machine learning also transforms the practice of critical thinking. Mackenzie focuses on machine learners—either humans and machines or

human-machine relations—situated among settings, data, and devices. The settings range from fMRI to Facebook; the data anything from cat images to DNA sequences; the devices include neural networks, support vector machines, and decision trees. He examines specific learning algorithms—writing code and writing about code—and develops an archaeology of operations that, following Foucault, views machine learning as a form of knowledge production and a strategy of power. Exploring layers of abstraction, data infrastructures, coding practices, diagrams, mathematical formalisms, and the social organization of machine learning, Mackenzie traces the mostly invisible architecture of one of the central zones of contemporary technological cultures. Mackenzie's account of machine learning locates places in which a sense of agency can take root. His archaeology of the operational formation of machine learning does not unearth the footprint of a strategic monolith but reveals the local tributaries of force that feed into the

generalization and plurality of the field. Researching Internet Governance MIT Press

A reflection on, and an extension of, the ideas laid out seven years ago in *The Coming Insurrection*. The Invisible Committee's *The Coming Insurrection* was a phenomenon, celebrated in some quarters and inveighed against in others, publicized in media that ranged from campus bulletin boards to Fox News. Seven years later, *The Invisible Committee* follows up their premonitory manifesto with a new book, *To Our Friends*. From *The Invisible Committee*: In 2007 we published *The Coming Insurrection* in France. It must be acknowledged that a number of assertions by the Invisible Committee have since been confirmed, starting with the first and most essential: the sensational return of the insurrectionary phenomenon. Who would have bet a kopeck, seven years ago, on the overthrow of Ben Ali or Mubarak through street action, on the revolt of young people in Quebec, on the political awakening of Brazil, on the fires set French-style in the English

or Swedish banlieues, on the creation of an insurrectionary commune in the very heart of Istanbul, on a movement of plaza occupations in the United States, or on the rebellion that spread throughout Greece in December of 2008? During the seven years that separate *The Coming Insurrection* from *To Our Friends*, the agents of the Invisible Committee have continued to fight, to organize, to transport themselves to the four corners of the world, to wherever the fires were lit, and to debate with comrades of every tendency and every country. Thus *To Our Friends* is written at the experiential level, in connection with that general movement. Its words issue from the turmoil and are addressed to those who still believe sufficiently in life to fight as a consequence. *To Our Friends* is a report on the state of the world and of the movement, a piece of writing that's essentially strategic and openly partisan. Its political ambition is immodest: to produce a shared understanding of the epoch, in spite of the extreme confusion of the present.

Turing's Vision MIT

Press

Invisible Gardens is a composite history of the individuals and firms that defined the field of landscape architecture in America from 1925 to 1975, a period that spawned a significant body of work combining social ideas of enduring value with landscapes and gardens that forged a modern aesthetic. The major protagonists include Thomas Church, Roberto Burle Marx, Isamu Noguchi, Luis Barragan, Daniel Urban Kiley, Stanley White, Hideo Sasaki, Ian McHarg, Lawrence Halprin, and Garrett Eckbo. They were the pioneers of a new profession in America, the first to offer alternatives to the historic landscape and the park tradition, as well as to the suburban sprawl and other unplanned developments of twentieth-century cities and institutions. The work is described against the backdrop of the Great Depression, the Second World War, the postwar recovery, American corporate expansion, and the environmental revolution. The authors look at unbuilt schemes as well as actual gardens, ranging from tiny backyards and play spaces to urban plazas

and corporate villas. Some of the projects discussed already occupy a canonical position in modern landscape architecture; others deserve a similar place but are less well known. The result is a record of landscape architecture's cultural contribution - as distinctly different in history, intent, and procedure from its sister fields of architecture and planning - during the

years when it was acquiring professional status and struggling to define a modernist aesthetic out of the startling changes in postwar America. The Metainterface MIT Press
This collection of short expository, critical and speculative texts offers a field guide to the cultural, political, social and aesthetic impact of software. Experts from a

range of disciplines each take a key topic in software and the understanding of software, such as algorithms and logical structures.

Programmed Inequality
MIT Press

The book contains clearly written thumbnail sketches of 31 people who were of paramount importance in the conception and creation of the computer industry

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