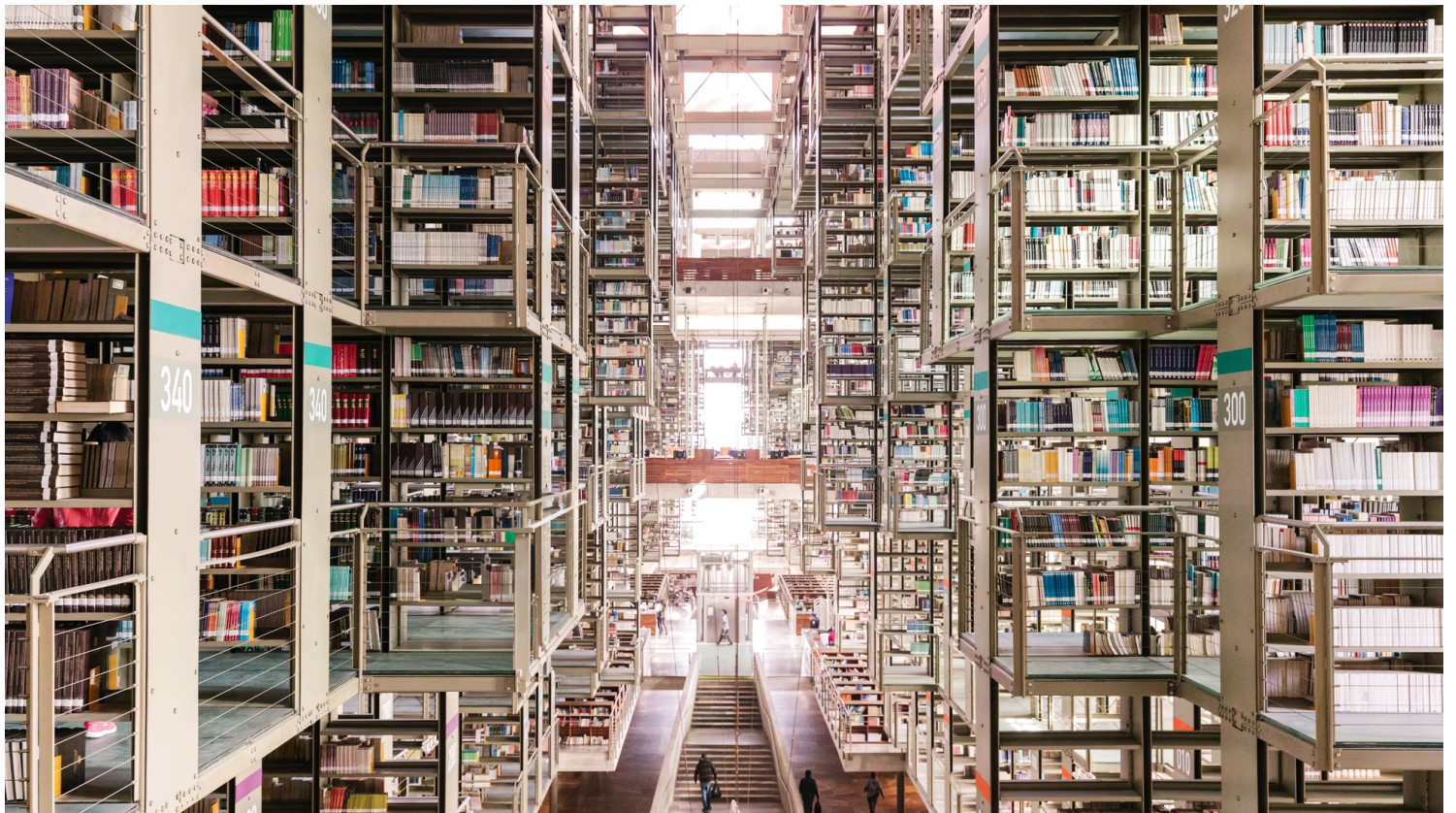


BOOK RECOMMENDATIONS

Eight Books That Explain How the World Works

Technologies such as skyscrapers, airplanes, and sewage systems are fundamental—and confusing. These titles explain how they actually work.

By Chelsea Leu



Jessica Sample / Gallery Stock

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Maybe this sounds familiar: You've stared idly through an airplane's window and wondered, *How exactly does that jet engine work?* Or you've tracked a shipment from across the country, refreshing UPS's website, and realized you have no idea how that package will actually make its way to your door. Or you've been notified that you must boil your tap water after an overnight "loss of pressure"—without knowing what that means, or why it's affecting you.

Modern society has been shaped by, and depends on, many complex, interlocked systems—GPS, the internet, transoceanic shipping. But even the most tech-savvy

person might struggle to get a handle on every detail. And these technological advances come with a strange caveat: The more fundamental and seamless the arrangement is, the less we think about how it operates. As a result, we take our infrastructure for granted—at least until a massive ship gets stuck in the Suez Canal, or a Florida condo building suddenly collapses.

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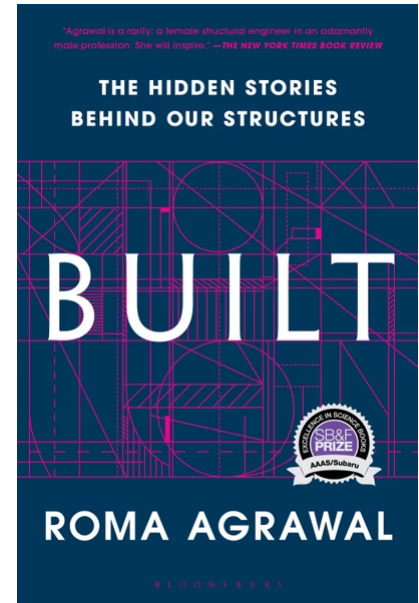


The books in the list below explain our world with much-needed clarity, exposing how marvels such as skyscrapers, computer chips, and the global supply chain are put together. As a group, they also make the case that paying attention to how each works is more important than ever, as pandemics and climate change threaten the smooth

performance we've come to expect. Understanding every aspect of our globalized lives may not be realistic, but these books make the attempt much less daunting.

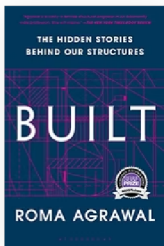
Built, by Roma Agrawal

Structural engineers “develop a kind of X-ray vision” that enables them to see the sturdy skeleton holding up a building, Agrawal writes. Her book briefly grants that superpower to even the least technically inclined. A designer of bridges, apartment buildings, and skyscrapers, including London’s striking Shard, Agrawal outlines how structures handle gravity and the unpredictable effects of wind, earthquakes, and other forces in order to actually stay up, bundling her explanations with helpful hand-drawn diagrams. We learn why reinforced concrete (which contains a network of steel rods) is so strong, and admire modern feats of engineering: the massive pendulum atop the Taipei 101 skyscraper, which decreases sway; the ingenious tubular design of the Burj Khalifa. But Agrawal focuses just as enthusiastically on structures decades or centuries old: She explains why the Pantheon’s concrete dome remains standing despite the crushing forces acting on it, admires brick arches in Pompeii, and retells the dramatic construction of the Brooklyn Bridge, primarily overseen by Emily Warren Roebling after her husband became too ill to complete the work. Agrawal’s perspective invites us to look more closely at the many buildings, both awe-inspiring and humble, around us.



Bloomsbury

Read: The quiet work of a civil engineer



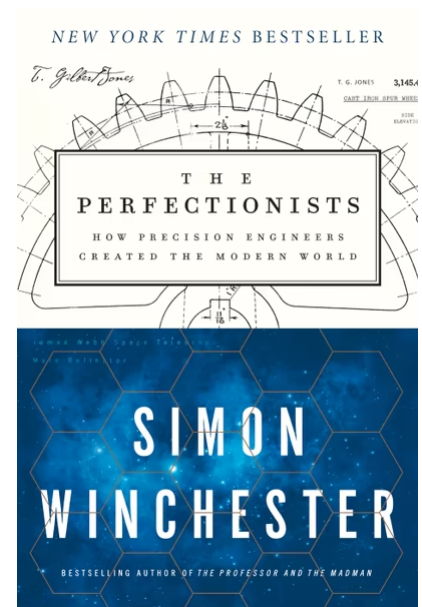
Built - The Hidden Stories Behind our Structures

By Roma Agrawal

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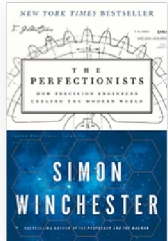
The Perfectionists, by Simon Winchester

The Perfectionists dramatically explores the history of engineers figuring out how to manufacture things—mostly out of metal, glass and other hard materials—into exacting shapes and sizes, making possible our world of cars, jet engines, and microprocessor chips. The story begins, and is intimately bound up, with the Industrial Revolution. John Wilkinson, one of the fathers of precision engineering, devised snug-fitting cylinders for James Watt's steam engine, and the early days of the discipline are similarly full of delightfully specific historical objects: pulleys made for British naval ships, for example, and the fiddly bits of flintlock muskets. But as Winchester steps through the great advancements that pushed this school of engineering to new extremes, he makes clear



Harper Perennial

that we now rely on machines to achieve a perfection unattainable by people, and that this comes with hefty stakes. An improperly machined oil pipe, for instance, caused catastrophic engine failure on a 2010 Qantas flight because it was “about half a millimeter too thin,” he writes. (Thanks to an experienced crew, everyone on board survived.) Perhaps, he suggests, a deeper respect for imperfect human craftsmanship might live alongside our reverence for mechanical technique.



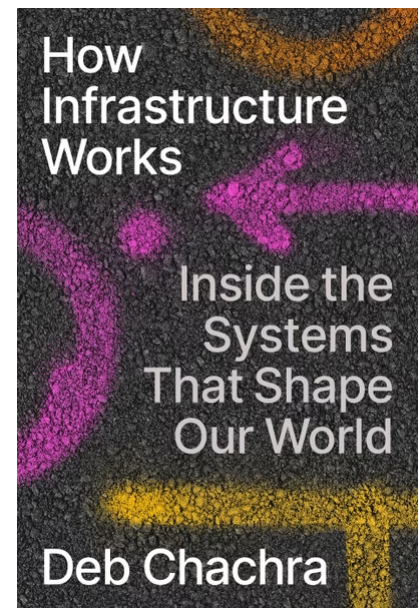
The Perfectionists - How Precision Engineers Created the Modern World

By Simon Winchester

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How Infrastructure Works, by Deb Chachra

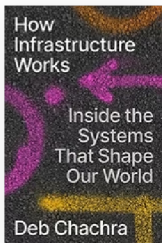
In its first chapter, *How Infrastructure Works* makes an earnest attempt to define what exactly infrastructure is. “All of the stuff that you don’t think about’ turns out to be a surprisingly good starting point,” Chachra writes. The networks that provide electricity, heat, water, sewage treatment, and internet to our homes, plus the roads, public transit, aviation, and GPS that allow us to traverse the world, are hidden from view and seem strikingly complicated when they are visible. But reliable access to these systems defines affluent contemporary life. When they fail, the result is, as Chachra puts it, “recognizably dystopian”—consider the February 2021 electrical outages in Texas, for just one bleak example. Rather than offering nitty-gritty explanations of how a power grid operates, though, this book articulates something of a philosophy of infrastructure: both a



Riverhead

convincing call for us to think harder about these systems and a road map for how we might do so productively, particularly as climate change threatens to destabilize our aging public works. Chachra's vision is positive, even galvanizing. I came away hopeful about a future powered by renewable energy, and determined to pay closer attention to what we might transform to make that future real.

Read: What *infrastructure* really means



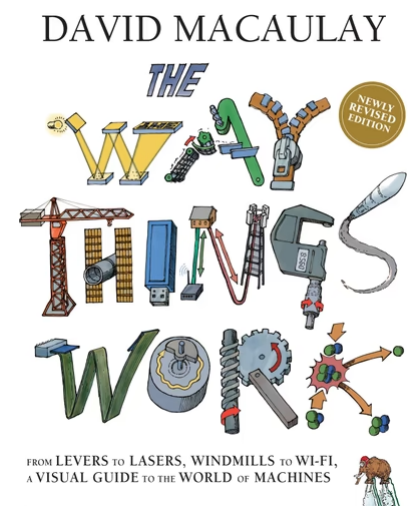
How Infrastructure Works - Inside the Systems That Shape our World

By Deb Chachra

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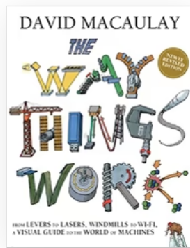
The Way Things Work, by David Macaulay

The Way Things Work is a classic children's reference book, full of lavish color illustrations laying out fundamental scientific concepts and interspersed with dryly funny "journal entries" from a fictional alternate universe in which woolly mammoths were domesticated. But I am firmly convinced that most adults would find this book more informative, revealing, and downright useful than a child would. (I had a copy of my own as a kid, and remember it as both alluring and totally impenetrable, because I had no idea what a combine harvester and a car's clutch were.) Diagrams on every page lay bare the inner workings of an array of devices. Small objects—CFL light bulbs, drill bits, batteries—are blown up to huge proportions and often illustrated with tiny people at their bases; big things like tower



Clarion

cranes and oil rigs and telecommunications networks are shrunk down to digestible size. You'll learn facts that will let you approach the material world with a curious and more discerning eye. And if you're anything like me, you will find it incredibly humbling to realize that even toasters operate based on principles you could previously barely follow—not to mention the technologies such as end-to-end encryption, touch screens, and the lidar units on self-driving cars that the book's newer editions cover.



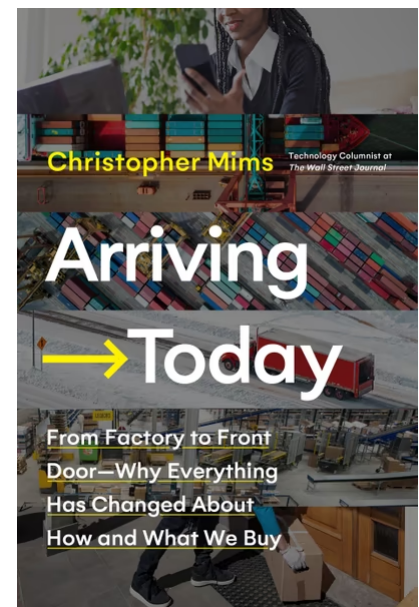
The Way Things Work

By David Macaulay

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Arriving Today, by Christopher Mims

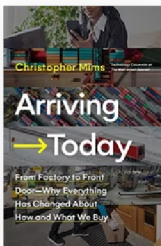
Modern supply chains are so convoluted, Mims informs us, that an average smartphone might include parts that have traveled through at least five countries before it even reaches its user's hand. Each component could tell "more stories than could be explored in a lifetime." His book unravels these long, winding journeys through the example of a hypothetical USB charger that someone has ordered on Amazon, starting from the Vietnamese factory that assembles the device and ending on an American doorstep. It's a vivid and occasionally outrage-inducing look at the systems and people involved in getting us our stuff. The author rides along with harbor pilots who maneuver container ships in and out of ports, and truck drivers who forgo sleep and personal relationships in order to haul enough loads



Harper Business

to make a (meager) living. Along the way are forays into the industry's history and its future: Mims explains how the shipping container became ubiquitous in part because of the Vietnam War, and investigates the continued role of robots and algorithms in shaping how goods are made and delivered. He focuses in particular on Amazon, where blue-collar workers are already forced to match the blistering pace set by machines. "So much of what happens in an Amazon fulfillment center is relevant to the entire \$5.5 trillion supply chain and logistics industry," he writes, "because in a way, it's the future of all of it."

[Read: What Amazon does to poor cities](#)



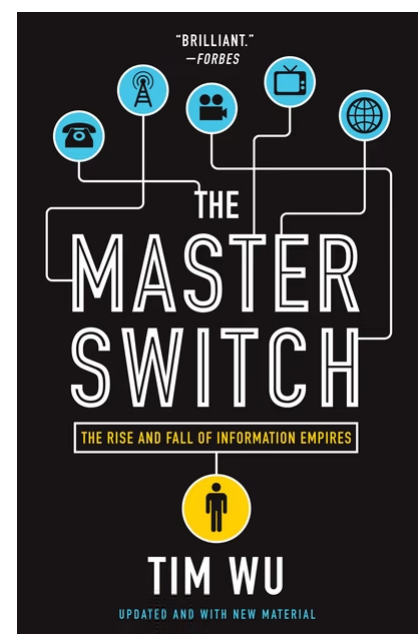
Arriving Today: From Factory To Front Door—Why Everything Has Changed About How And What We Buy

By Christopher Mims

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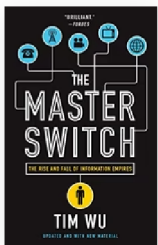
The Master Switch, by Tim Wu

Wu's book centers on five technologies that have transformed the way we share information: telephones, radio, film, TV, and the internet. But beyond focusing on the stirring technical wizardry of their invention, he also explores what happened after, as each technology hit the American market and entire industries sprouted up around them. The history is shaped by monopoly power, as the owners of established technologies in the 20th century actively sought to crush or control any spark of innovation that threatened their dominance.



Vintage

(He explains that AT&T, a successor to the 19th-century Bell Telephone Company, was especially guilty of this.) These forces of monopoly and resistance drive what Wu calls “the Cycle,” in which these industries shift between periods of openness that nurture scrappy upstarts, such as the utopian beginnings of radio and cable television, and an inexorable closing and consolidation: the three-network TV ecosystem of NBC, CBS, and ABC; the centralized Hollywood studio structure that fell prey to the restrictive Hays Code. Whether the internet will adhere to the Cycle is, by the book’s end, an open question. The specifics may have changed since 2010, when *The Master Switch* was first published, but the historical framework the book provides is still invaluable in helping us think clearly about today’s tech and media giants.



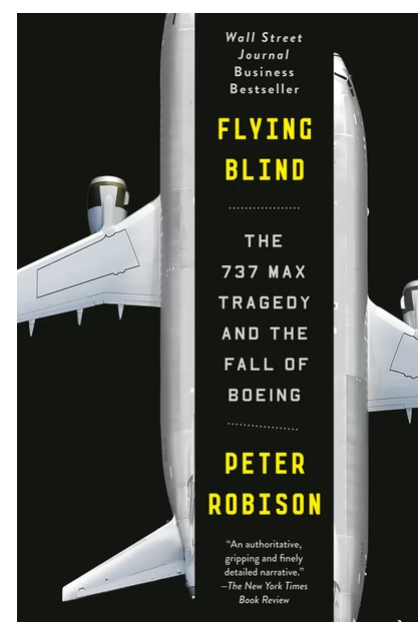
The Master Switch - The Rise and Fall of Information Empires

By Tim Wu

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Flying Blind, by Peter Robison

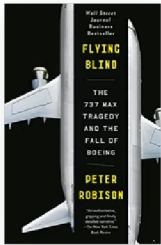
In 2018 and 2019, 346 people died in two crashes of malfunctioning Boeing 737 MAX 8 planes. Robison’s investigation into the tragedies asks: How did one of the most respected engineering companies in America produce such fatally flawed aircraft? This account covers the long arc of Boeing’s history and places the blame squarely on the corporate culture that arose after a merger in the late 1990s, which focused on enriching shareholders at the expense of careful engineering. Over the 737 MAX 8’s development, cost-cutting fixes piled



Anchor

up with agonizing implications: Not only had Boeing's employees created software that resulted in control being wrested from pilots because of a frequently faulty instrument's signals, they also deleted relevant parts of the plane's flight manual, and maintained that expensive flight-simulator training wasn't necessary for the new aircraft. What makes the account riveting, though—and blood-boiling—is Robison's attention to the stories of the victims and their grieving families. Reading them, one ends up emotionally invested in the workings of commercial aviation, and freshly aware of the great complexity and responsibility underlying an industry that so many of us depend on to work, travel, and see distant loved ones.

[Read: How Boeing lost its bearings](#)



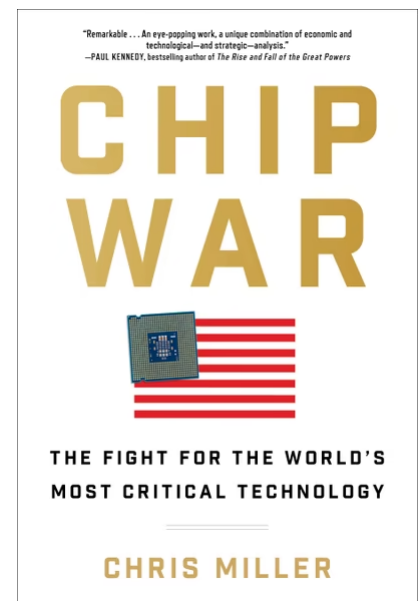
Flying Blind - The 737 MAX Tragedy and the Fall of Boeing

By Peter Robison

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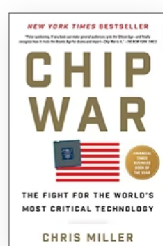
***Chip War*, by Chris Miller**

Chips, metal-and-silicon rectangles often no bigger than fingernails, live in practically all of our electronic devices. They let us stream videos on our phones seamlessly, run our laptops and new cars, and aim our country's missiles. *Chip War* tells the remarkable story of their development from the 1940s to the present. Nowadays, making chips involves squeezing millions or even billions of nanometer-scale transistors onto tiny slabs of silicon—a process that itself relies on decades of



Scribner

engineering and manufacturing improvements—and extraordinarily precise instruments that perform something called extreme UV photolithography. The consequences of such precision are global, because only a precious few companies can make cutting-edge chips or the tools involved in producing them, and just one—the Taiwan Semiconductor Manufacturing Company—dominates the manufacturing of the most advanced chips that, among other things, power Apple’s iPhones. “After a disaster in Taiwan,” Miller writes, “the total costs would be measured in the trillions.” His lucid book illuminates the stakes as the U.S. and China vie for control over chip manufacturing—and the geopolitical dominance that comes with it.



Chip War - The Fight for the World's Most Critical Technology

By Chris Miller

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