his thinking about information theory. He believed that information is not a secondary concept, but fundamental to the Universe. He coined the shorthand "it from bit" for the concept that every entity — every particle, every field and even space-time — derives its meaning from ideas in information theory. His view is now becoming part of the physics orthodoxy. In later life, Feynman told his colleague Kip Thorne that if you "unwrap the layers of craziness" from Wheeler's ideas, "you will often find a powerful kernel of truth".

Halpern admires Wheeler and Feynman so much that the narrative is occasionally cloying. As usual, Feynman is portrayed as a popular and generous-spirited figure. Yet I have often heard that he was sometimes unpleasantly aggressive to physicists who might claim to be his peers, several of whom have told me privately that they didn't much like him. Freeman Dyson is an exception to this, although even he told me: "Conversations with Feynman were mostly all about him."

At first, I doubted the depth of Feynman and Wheeler's friendship, but Halpern eventually convinced me. In one delightful passage near the end of the book, he describes a conference organized by Wheeler and held in Austin, Texas, in 1981 at a venue much too "fancy-schmanzy" for Feynman, as Halpern puts it. Feynman checked out of the room and slept in nearby woods, even though he was in remission from cancer. After one night of al fresco slumber, Wheeler invited him to stay in his home. Shortly afterwards, Feynman told a local reporter: "One of the biggest regrets of my life is that I am not as nice as [Wheeler] is." Feynman died 7 years later; Wheeler outlived him by 20 years.

The Quantum Labyrinth confirms the received opinion that Feynman was one of the greatest intuitive problem-solvers in twentieth-century physics, a world-class doer. But I suspect that many readers will take most pleasure from the account of Wheeler's inspired dreaming. As Dyson told me: "Posterity has given Feynman his due, but Wheeler has been cruelly underrated." ■

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TECHNOLOGY

Into cyberia

Li Gong weighs up three tomes on Silicon Valley's vast influence, for good or ill.

The phrase "Making the world a better place" famously sums up the stated aim of Silicon Valley. Three books on California's digital kingdom and its 'four horsemen' (Amazon, Apple, Facebook and Google) see that as at best self-delusional. Their authors characterize the 'valley boys', their companies and, by extension, the technology industry and all of computer science as destroying the United States by eliminating jobs and polluting people's minds — even enabling Donald Trump's presidency. Is Silicon Valley guilty as charged?

The Four, by marketing scholar Scott Galloway, is full of sharp insights and unconventional views. (Colourful asides include an account of his stint on the board of *The New York Times* as an activist shareholder, and a no-holds-barred career guide.) Instead of the usual rehash of product innovations or the personal peculiarities of valley players, Galloway analyses the big four's business context and competitive landscape, and clinically pinpoints differentiators of success that may surprise many. Apple stores, not the iPhone, transformed the company into a luxury brand — even as it enjoys a spectacular sales margin by maintaining its low-cost production base. Galloway's own proposals for success include a "T-algorithm" of eight factors (such as geographical location) for evaluating a company's prospects of becoming a trillion-dollar enterprise.

Galloway's main criticism of the tech industry is its impact on non-tech jobs. He suspects that Amazon head Jeff Bezos supports a guaranteed income in the United States because he looks at the future and does not see many humans in jobs. Amazon's warehouses and data centres are exhibit A in a robotics heaven. Galloway brusquely calls on "Jeff" to show some real vision.

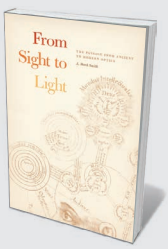
The Four: The Hidden DNA of Amazon, Apple, Facebook, and Google
SCOTT GALLOWAY
Portfolio: 2017.

World Without Mind: The Existential Threat of Big Tech
FRANKLIN FOER
Penguin: 2017.

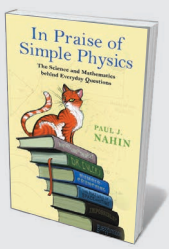
The Know-It-Alls: The Rise of Silicon Valley as a Political Powerhouse and Social Wrecking Ball
NOAM COHEN
The New Press: 2017.

THE INDUSTRY MANUFACTURES 'JUNK INFORMATION' THAT POISONS OUR THINKING.

In *World Without Mind*, journalist Franklin Foer argues that the tech industry has had a negative impact on knowledge and democracy, by controlling information flow. He sees tech as an existential threat. He focuses on its role in the decline of journalism and creative writing, drawing on his stint as editor-in-chief of *New Republic*. In 2012, Facebook co-founder Chris Hughes bought the magazine to rebrand it as a digital-media company, prompting a staff exodus. Foer was given a monthly ▶



From Sight to Light
A. Mark Smith (Univ. Chicago Press, 2017)
Historian Mark Smith unpicks optics from the classical period on. He pinpoints Johannes Kepler's seventeenth-century research on retinal imaging as the shift towards modern optics, along with René Descartes's study of refraction and the development of instrumentation.



In Praise of Simple Physics: The Science and Mathematics behind Everyday Questions
Paul J. Nahin (Princeton Univ. Press, 2017)
The energy of moving water, the physics of communication satellites and the maths behind catching a ball are all skilfully dissected by engineer and writer Paul Nahin in this enjoyable study of everyday physics.

dashboard showing each writer's cost, production output and associated ad revenue. He hid it, fearing a demoralizing effect.

Foer thinks that Silicon Valley's view of creativity is out of the middle ages, a time when it was held that "God alone creates" (in the words of thirteenth-century philosopher Thomas Aquinas) and writers were manual labourers. He argues that the tech industry's assault on copyright laws, championed by the likes of legal scholar Lawrence Lessig, have resulted in large-scale collateral damage. Moreover, the industry manufactures 'junk information' that poisons our thinking just as much as processed foods erode our health, he asserts. Ultimately, he blames computer science. He sometimes finds a smoking gun — such as a Google engineer who explains that the company's book-scanning project is aimed at machine-readers, not people. More often, his evidence is unconvincing. Mathematician Alan Turing's work did not determine the path of the digital revolution, although Turing and others, from philosopher Gottfried Leibniz to writer Stewart Brand, made major technological impacts. No single person fomented the change. Much of Silicon Valley might still be orchards if the Second World War had not extended to the Pacific, drawing defence industries, money and labour forces to California.

Foer argues that the US faith in technology is no longer consistent with its belief in liberty. His call for resistance includes a raft of measures, from government regulation of digital monopolies' behaviour to the rigorous application of anti-trust laws.

Like Foer, journalist Noam Cohen investigates computer and tech pioneers to shed light on the evolution of Silicon Valley's ideology of radical individualism and relentless disruption. His *The Know-It-Alls* examines highly influential figures such as the often-neglected computer pioneers John McCarthy and Frederick Terman, who helped to transform Stanford, California, and its valley into a digital powerhouse — McCarthy as the father of artificial intelligence, Terman as a catalyst for local entrepreneurialism. These finely researched portraits are a joy. Terman's father, for instance, a Stanford University psychologist, devised the first US IQ test to identify the best and brightest for selective assistance. Local boy William Shockley failed

to make the cut — only to go on to invent the transistor and win a Nobel Prize.

Cohen's arguments get contentious in the passages on what he sees as Silicon Valley's belief system. He is right that those who purport to serve others without their consent necessarily exploit. Yet his claim of a "natural affinity" between the values of Silicon Valley and Trump is shocking. The pillars of the Trump campaign, such as its anti-immigration stance, are the polar opposite of valley values. What Cohen sees is that digital disruptions caused by Silicon Valley businesses and their founders' libertarian principles have undermined forces that might have held Trump back, from mainstream media to labour unions. Hacker arrogance and entrepreneurial greed, he avers, have led to a loss of civility and empathy. He calls instead for a "just society" with "a commitment to the local, the plural, the small scale and the active".

Is the future, or even the present, as bleak as these books deem it? I don't think so. Technological revolutions always squeeze parts of the old economy: players come and go. Intel, Microsoft and IBM could be called the original big three. The fabulous four of 'Web 1.0' were Cisco, Oracle, Sun Microsystems (submerged into Oracle) and EMC (eaten up by Dell). As Galloway puts it, "business mimics biology and, thus far, the mortality rate is 100 percent".

Moreover, looking beyond the United States reveals a very different picture. Consider China. The early dominance of Baidu's search engine and Sina's Weibo social-media platform has not made them the sole arbiter of news. They have been mostly upended by Tencent's WeChat — itself now challenged by five-year-old upstart Toutiao. Something besides technology must be at work; government control over media does not usually benefit new entrants. As a long-time Silicon Valley resident, I often wonder which companies truly represent its spirit. To me that is, simply, and apolitically, innovation and entrepreneurship. Perhaps those who have made it symbolize only the past, and we need not pay much attention to their spiel. We'll have to wait to see what's around the bend. ■

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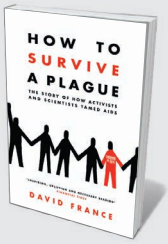
Twenty-Six Portland Place
Gordon C. Cook (CRC, 2017)
Founded in 1907, London's Royal Society of Tropical Medicine and Hygiene drew in pioneering researchers through two world wars. Former society president Gordon Cook has mined its archives to compile this gripping chronicle of its first, momentous, 50 years.



How to Survive a Plague
David France (Picador, 2017)
This poignant account of the US AIDS crisis of the 1980s and 1990s follows the activists who expedited treatment on the ground. Prolific campaigner Spencer Cox, for example, designed clinical trials of potential medication and raised awareness of the psychological effects of AIDS.