

## PHYSICS

# In thrall to uncertainty

A history of how quantum theory has permeated Western culture refreshes **Jim Baggett**.

Quantum theory is the most accurate and precise description of the molecular, atomic, sub-atomic and sub-nuclear realms ever devised. It is also utterly exasperating. To anyone tutored in the language and the logic of classical physics, it is mathematically challenging, maddeningly bizarre and breathtakingly beautiful. As charismatic US physicist Richard Feynman warned: “Nobody understands quantum mechanics.”

Given its recondite nature, quantum weirdness has entered popular culture in remarkable ways. What might otherwise have been the preserve of dry academic texts and stuffy scientific conferences has become common currency. Who hasn’t heard of Heisenberg’s uncertainty principle or Schrödinger’s cat? Quantum ideas of space, time and matter inspired British artist Anthony Gormley’s vast, enigmatic steel sculpture *Quantum Cloud* near London’s



**The Quantum Moment: How Planck, Bohr, Einstein, and Heisenberg Taught Us to Love Uncertainty**

ROBERT P. CREASE  
AND ALFRED SCHARFF  
GOLDHABER  
W. W. Norton: 2014.

O2 arena. And UK-based dramatist Tom Stoppard’s 1988 play *Hapgood* blends the duality of the double agent with a quantum duality in which matter and light are both waves and particles. Both of these works are cited in *The Quantum Moment*, in which philosopher Robert Crease and physicist Alfred Goldhaber explore quantum theory’s enduring cultural impact.

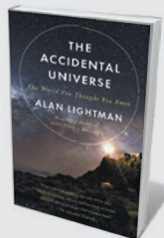
Based on a class that the authors have taught for six years at Stony Brook University, New York, the book asks why quantum theory carries such a metaphorical

punch — “wild and mysterious, packed with creative force” — and why it seems to be rediscovered in every generation. The authors’ tale is structured along approximately linear historical lines, from Max Planck’s discovery in 1900 that light can be described in terms of discrete ‘bundles’ of energy (quanta) to Bell’s theorem, which opened the door from the 1960s onwards to some extraordinary experimental tests of the nature of our physical reality. Each chapter explores how some of the core ideas and principles that sprang from these historical moments have been absorbed into (inevitably mostly US) popular culture. This makes for an entertaining read, even for those already familiar with the story.

As Crease and Goldhaber explain, much of the impact on modern culture derives from what quantum theory has to say about the nature of reality. Arguably, centuries of observation, experimentation and strenuous intellectual endeavour were founded

**NEW IN  
PAPERBACK**

*Highlights of this  
season’s releases*



**The Accidental Universe: The World You Thought You Knew**

Alan Lightman (Vintage, 2014)

Physicist and literary wizard Alan Lightman reflects on how our cosmos, potentially one among uncountable others, has fortuitously created the perfect conditions for life. He considers intricate symmetries in nature and the unfathomable vastness of space. This journey through seven overlapping ‘universes’ — frameworks for exploring recent research — culminates in a vision of humanity hooked on technology, gradually detaching itself from reality.

on scientists' expectation that the material world is composed of some kind of fundamental atoms of 'stuff'. Quantum theory, however, has rewarded these endeavours with phantom particles that, like waves, can be both here and there; a theoretical structure that tells us only what might happen (not what will); and quantum systems seemingly connected over great distances, giving rise to extended, non-local effects, or what Albert Einstein called "spooky action at a distance".

Einstein famously rejected the element of chance that lies at the heart of quantum theory, declaring that God does not play dice. He argued that quantum theory is not complete. Those scientists who, like Einstein, are less inclined to accept that we have reached an ultimate limit of what is knowable remain firmly in denial. So, in the past 40 years or so, the efforts of agents provocateurs such as John Bell and Tony Leggett have encouraged an orgy of sophisticated laser-based experiments to test the foundations of quantum physics — what I have

elsewhere called "experimental philosophy". It is this work that has prompted the current interest in quantum cryptography, quantum computing and the teleportation of photons.

I have only one quibble with *The Quantum Moment*. Crease and Goldhaber support their narrative with 'interludes' after each chapter, designed to provide technical details, including some equations. The exposition here is a little drier than in the main chapters, but does not need to be. The material also necessarily repeats much of what has already been covered, which can become a little tedious. The authors suggest that readers might prefer to skip these interludes; for linear readers like me, that does not really work.

Those versed in quantum theory's practical applications might be tempted to dismiss its many manifestations in popular culture as what the authors call "fruitloopery". And certainly, there is a lot of nonsense out there. But, as Crease and Goldhaber make abundantly clear at several points, many esteemed physicists

(who should probably know better) have been more than willing to indulge their inner metaphysician in research papers and popularizations on the mistaken principle that, as the Canadian philosopher Marshall McLuhan once put it, "mud sometimes gives the illusion of depth".

Thus we smile at the comical pronouncements on physics by US actress Shirley MacLaine, until the authors point out that she could be paraphrasing similar pronouncements made 55 years earlier by the British physicist James Jeans. I have elsewhere argued that contemporary theoretical physics has become rather self-indulgent and self-referential, a malaise that I have called fairy-tale physics. Deep questions about the nature of reality tend to provoke this kind of response, and it surely finds its origin in the quantum moment. ■

**Jim Baggott** is the author of *The Quantum Story and Farewell to Reality*. He is based in Reading, UK.  
e-mail: jim@logosconsulting.co.uk

## LINGUISTICS

# The write stuff

Steven Pinker's provocative treatise on language use and abuse would benefit from more data, finds **Paul Raeburn**.

No conversation about the science of language can get very far without a mention of Steven Pinker, the Harvard University cognitive scientist who has not yet made linguistics as popular as football — but is working on it. In *The Sense of Style*, he wants to give us the cognitive science, linguistics and psychology behind classic debates over proper English, from passive voice to split infinitives.

Plenty of others have given us stuffy decrees intended to end the interminable wrangling, but Pinker is different. He is unhappy with the classic style manuals — including revered texts such as *Strunk & White* (William Strunk and E. B. White's *The Elements of Style*) or

*Fowler's Modern English Usage*. We need a new guide "infused by the spirit of scientific skepticism", he writes, using grammar and research on "the mental dynamics of reading" to replace edicts with evidence. Pinker gave us the science in *The Language Instinct* (William Morrow, 1994); in *The Sense of Style* he sets out to offer its practical application.

He covers much of the same ground as the classic guides, including frequently misused words ("fulsome" and "noisome") and the serial comma. His problem with *Strunk & White*, however, is that the authors lack tools for analysing language, and so end up "vainly appealing to the writer's ear". That's on page two. By page three, he is challenging

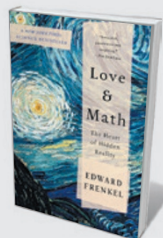


**The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century**  
STEVEN PINKER  
Allen Lane: 2014.

the manual's dismissal of the passive voice. Linguistic research, he later writes, has shown that the passive actually "allows the writer to direct the reader's gaze, like a cinematographer choosing the best camera angle". What research, exactly? Pinker does not tell us. His views are informed by psycholinguistics; that is his day job. But he

promises us science, so I expected to see data. However, in this instance, and in many others, the data are not there.

Similarly, Pinker's view on infinitives is to split them "if you need to", a conclusion backed by dictionaries and style manuals — not research. And when he quotes with admiration the opening line of Richard Dawkins' *Unweaving the Rainbow* (Houghton Mifflin, 1998) — "We are going to die, and that ▶



## Love and Math: The Heart of Hidden Reality

Edward Frenkel (*Basic Books*, 2014)  
With infinite passion, media-feted professor Edward Frenkel shares his rise to mathematical greatness against a tide of Russian anti-Semitism. Appeasing maths-haters, he uses a borscht recipe to explain quantum duality. (See Marcus du Sautoy's review: *Nature* **502**, 36; 2013.)



## Life at the Speed of Light

J. Craig Venter (*Abacus*, 2014)  
Biologist J. Craig Venter shares his life's work of catalysing progress in biological engineering, sequencing the human genome and ultimately creating the first "synthetic cell" (*Mycoplasma mycoides* JCVI-syn1.0). (See Nathaniel Comfort's review: *Nature* **502**, 436–437; 2013.)



► makes us the lucky ones” — he offers a detailed explanation of why it works that is, again, short on science.

Pinker is a good writer and a deeply humanistic one, and there are many bright moments here. His lists explaining right and wrong usage with a range of examples (enervate means to sap, not energize) are a useful desk reference. Among numerous good tips is one on, as Pinker has it, “the compulsion to name things with different words when they are mentioned multiple times”. “Hérons are herons,” he writes, not “long-legged waders, azure airborne aviators, or sapphire sentinels of the sky”.

At times, however, Pinker’s own writing verges on the incomprehensible. Consider his critique of this sentence: “Toni Morrison’s genius enables her to create novels that arise from and express the injustices African Americans have endured.” Some might say ‘her’ is an error, because an adjective (“Toni Morrison’s”) cannot be the antecedent of a pronoun. But Pinker explains it this way: “*Toni Morrison’s* is not an adjective, like *red* or *beautiful*; it’s a noun phrase in genitive case. (How do we know? Because you can’t use genitives in clear adjectival contexts like *That child seems Lisa’s* or *Hand me the red and John’s sweater*.”) After reading that several times, I think I know what he means. But it is tough to get through.

Pinker also reveals himself at the outset to be not a prescriptivist, like Strunk and White, but a descriptivist, who sees language as “a wiki that pools the contributions of millions of writers and speakers”.

I agree: we make the language. But if that is the case, science probably can’t do any better than *Strunk & White* at dictating style. The only legitimate data come from the people. So maybe it is too soon to jettison the classic style manuals: I suspect much of Pinker’s sense of style comes less from his science than from his own wonderful writer’s ear. ■

**Paul Raeburn** is the author of four books and the chief media critic for the Massachusetts Institute of Technology’s Knight Science Journalism Tracker. e-mail: paulraeburn@nasw.org

## EVOLUTION

# Tribes like us

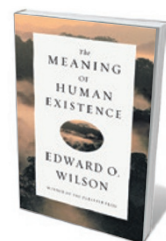
**Tim Lenton** is intrigued by E. O. Wilson’s sweeping perspective on humanity’s past — and possible futures.

What of that ultimate existential question, the meaning of life? Aristotle saw it as the achievement of happiness. UK comedy troupe Monty Python suggested that it involves reading “a good book every now and then”. In *The Meaning of Human Existence*, biologist E. O. Wilson offers a good book that adds to such prescriptions, but readers seeking a sense of purpose will be disappointed. What Wilson is after is really a deeper understanding of human existence.

Still, there can be few better guides through our species’ past journey and potential for the future. Wilson provides the literary equivalent of a greatest-hits album, giving us a pithy synthesis of his formidable body of work from *Sociobiology* (Harvard University Press, 1975) to *The Social Conquest of Earth* (Liveright, 2012), with a liberal dose of *Consilience* (Little, Brown, 1998). The result is a provocative and beautifully written collection of essays, although one that struggles to be more than the sum of its parts.

In the opening section, Wilson introduces his central premise that humans, like his beloved ants, are eusocial animals. Some individuals reduce their own lifetime reproductive potential so that they can raise the offspring of others (think of grandmothers after menopause). Key to the origin of eusociality is the creation of a nest, from which some of the population undertake risky foraging while the remainder stay safe at home. Wilson argues that our unique intelligence began to evolve when our ancestors tamed fire to cook, settled around the campsite and sent a fraction of the group off to risk life and limb hunting down energy-rich meat.

Thus began a tension between acting for ourselves and acting for our group, which Wilson argues is at the heart of our



**The Meaning of Human Existence**  
EDWARD O. WILSON  
Liveright: 2014.

conflicted human nature. Here he parts company with most evolutionary theorists, revisiting an already acrimonious debate (aired in *Nature*) over the origin of eusocial traits. Wilson originally supported evolutionary biologist W. D. Hamilton’s theory of inclusive fitness, in which the

costs of altruism can be rationalized if they are outweighed by the product of the benefits to recipients and the recipients’ relatedness to the altruist. But in 2010, he and some colleagues rejected it (M. A. Nowak *et al. Nature* **466**, 1057–1062; 2010). In its place, they argued for a mixture of individual and group-level selection.

Back from the firmly prodded ants’ nest of evolutionary theorists came a predictably forceful defence (see, for example, P. Abbot *et al. Nature* **471**, E1–E4; 2011), but Wilson remains unmoved by this stinging riposte. The frustration for the neutral reader is that both sides agree that the gene is the fundamental unit of selection, so the squabble is over different flavours of standard evolutionary theory. Neither side seems to see the Pythonesque irony of fighting over how to understand cooperation. Still, nothing could better demonstrate the tribal nature of humanity, which provides a focus for the rest of the book.

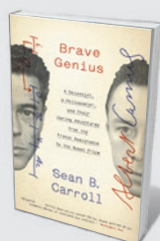
Wilson’s enthusiasm for a mixture of individual and group-level selection goes further, as he struggles to resist an “oversimplistic” portrayal that “individual selection promoted sin, while group selection promoted virtue”. The inconsistency in this



## The Compatibility Gene

Daniel M. Davis (Penguin, 2014)

At the heart of our immunological-response systems lie ‘compatibility genes’, which determine each body’s capacity to fight diseases or accept medication. Immunologist Daniel Davis explores these genes’ roles in successful skin grafts, ill-fated pregnancies and more.



## Brave Genius

Sean B. Carroll (Broadway, 2014)

Against the tumult of the Second World War, biologist Sean Carroll tells the interwoven stories of philosopher Albert Camus and geneticist Jacques Monod, friends who worked for the French resistance and won Nobel prizes. (See Jan Witkowski’s review: *Nature* **501**, 487–488; 2013.)



is soon exposed when he argues that religion has been crucial in reinforcing group-level tribalism, but is a collective sin that humanity needs to grow out of. One wonders what the publishers were thinking when they put on the dust jacket the promise of Wilson addressing “our greatest moral dilemma since God stayed the hand of Abraham”, given that inside, he decries belief in God with Dawkinsian fervour.

Yet Wilson’s route to species self-knowledge is rather omniscient, because it involves comparing ourselves to other known or imagined life forms, be they ants or aliens. As we decimate biodiversity, leaving ourselves lost in an Age of Loneliness — the ‘Eremocene’ — Wilson looks skyward for salvation. He is excited about exoplanets and brimming with existential confidence that

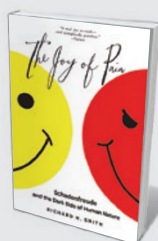
we are not alone in the Universe, offering a very anthropomorphic “portrait of E.T.”

Wilson’s imaginary aliens are, I think, really his prescription for humanity’s future. They have chosen not to supplement their intelligence or engineer their genetics, because their technological creations have long surpassed them physically and intellectually. They are not so foolish as to attempt interstellar travel — were it possible — because they have worked out that invading an independently evolved world would be a biological train wreck. Instead, they have made peace with their home planet and achieved a long-term sustainable state.

Back in the here and now on Earth, Wilson argues that we should relish our evolutionary legacy of internal conflict and the creativity it sparks. He sees a short future

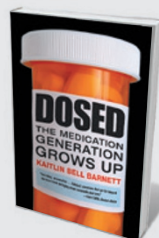
for scientific progress but a long one for the humanities, arts and social sciences. Surprisingly optimistic that brain-activity mapping is going to solve the riddle of human consciousness sooner rather than later, Wilson feels that we will be left clutching the sensation of free will, which he thinks is just an adaptation necessary for our sanity. If the resulting nihilism does not lead us to despair, the way forward will be to unify the sciences and humanities to reach a higher state of human “meaning”. Anyone fancy the ride? ■

**Tim Lenton** is professor of Earth system science at the University of Exeter, UK, and co-author with Andrew Watson of *Revolutions That Made the Earth*. e-mail: [t.m.lenton@exeter.ac.uk](mailto:t.m.lenton@exeter.ac.uk)



### The Joy of Pain

Richard H. Smith (Oxford Univ. Press, 2014)  
Psychologist Richard Smith explores the roots of *Schadenfreude* (joy in others’ pain) in society, from reality television thriving on public humiliation to cases of envy-incited crimes, including Nazi persecution of Jewish people. (See Dan Jones’ review: *Nature* **500**, 147; 2013.)



### Dosed: The Medication Generation Grows Up

Kaitlin Bell Barnett (Beacon, 2014)  
Journalist Kaitlin Bell Barnett, herself medicated in youth, tells the stories of five people who from childhood have been treated with psychotropic drugs for conditions such as depression and attention-deficit hyperactivity disorder, addressing their sense of lost freedom and identity.



# A societal sea change

Nico Stehr ponders Naomi Klein's call for strategic mass action on climate change.

This year, New Zealand became the first country to acknowledge climate change when granting residence on humanitarian grounds — in this case, to a family from the low-lying Pacific island nation of Tuvalu. That the environmental and human realities of climate change are tangled up in such legal, economic and political complexities is the focus of social activist Naomi Klein's *This Changes Everything*.

Klein's journey to this realization began in 2009 when, in the middle of the international economic meltdown, she first recognized the magnitude of climate change. As she states: "I denied climate change for longer than I care to admit." Five years on, she has synthesized her thinking about the dual financial and environmental disasters, arguing that the "market fundamentalism" favoured by the United States and the United Kingdom — involving privatization of public services, deregulation of corporate activities and reduced public spending — has "systematically sabotaged our collective response to climate change". Klein now advocates a mediating social force between climate science, politics and individual responsiveness and responsibility — in essence, "mass social movements" aiming to reduce fossil-fuel use and push for adaptation measures and behavioural change.

Klein's book — a combination of polemic, manifesto and analysis — covers much familiar territory. We get the history of global-warming discussions, the phenomenon of climate denialism and today's economic order, including the clash of interests between trade regimes and climate policy. As Klein notes, the "liberation of world markets, a process powered by the liberation of unprecedented amounts of fossil fuels", is now helping to accelerate the melting of Arctic ice. She also discusses responses to the climate emergency, including geoengineering schemes, as well as resistance to large-scale



**This Changes Everything: Capitalism vs the Climate**

NAOMI KLEIN  
Simon and Schuster/  
Allen Lane: 2014.

mining projects in various parts of the world. She includes her own eye-witness reportage from the front line, such as Canada's oil sands and the 2010 Deepwater Horizon oil spill in the Gulf of Mexico.

Klein acknowledges that extraction and use of fossil fuels is hardly analogous to social or political oppression such as slave ownership or gender discrimination, but argues that historical movements against such practices show how societal pressure can build, pushing governments to act. Mass action focused on climate change could have a transformative effect on societies, she posits, empowering the poor to demand rights and services.

In arguing that the "fundamentalist" changes to the structure of capitalism have stymied such a transformation, Klein overstates the case, however. Although privatization and deregulation triumphed in the 1980s in the United States and the United Kingdom, they did not in significant parts of the rest of the world, as she claims. And whether the US economic order exemplifies a secular trend towards global dominance remains an open issue. The conditions for change could be more favourable than Klein thinks, especially when it comes to the removal of ideological roadblocks to improving the ethics of markets on the basis of moral rather than mere monetary motives of production and consumption.

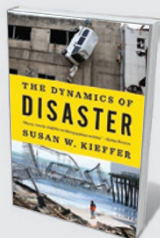
Of course, many other impediments to governing climate change remain. Klein is too optimistic in claiming that the immediately relevant solutions, such as adaptation or

reducing fossil-fuel use, have broadly been long understood. The governance of climate change, not merely mitigation and adaptation, is a tortuous problem and is hardly well developed theoretically, but it remains a key area of interdisciplinary research and real-world policy. We are just at the beginning of this difficult intellectual and practical journey. Klein recognizes the Sisyphean tasks ahead and proposes economic, legal and social measures that would enable better governance, such as the reform of trade law and the prevention of fossil-fuel extraction through the recognition of indigenous peoples' rights to oil- and coal-rich land.

The special appeal of Klein's position is her insight that any successful effort to curb emissions or adapt to climate change demands popular, pragmatic and sensible transformative goals that go well beyond mere fencing in. In contrast to climate scientists and observers such as James Hansen and James Lovelock, she is not an advocate of "inconvenient democracy" — that is, the claim that certain forms of democratic governance need to be overcome before climate change can be tackled effectively.

Whether *This Changes Everything* has identified the potential catalyst that will bring about an alternative future remains uncertain. Still-to-be-born large social movements around the world could act as a countervailing force to 'business as usual' and, as Klein puts it, "simultaneously clear some alternative pathways" to safer futures for humankind. Klein has explored early manifestations of such resistance among smaller, often ad hoc local social groups around the world. But her message is still delivered with a strong North American accent. ■

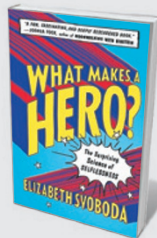
Nico Stehr is Karl Mannheim Professor of Cultural Studies at Zeppelin University in Friedrichshafen, Germany.  
e-mail: nico.stehr@t-online.de



## The Dynamics of Disaster

Susan W. Kieffer (W. W. Norton, 2014)

Geologist Susan Kieffer showcases Earth's most destructive processes, highlighting geographical discrepancies in disaster preparedness. In 2010, for example, similar-energy earthquakes caused over 50,000 deaths in Haiti, yet none in New Zealand. (See Roger Bilham's review: *Nature* **502**, 438–439; 2013.)



## What Makes a Hero?: The Surprising Science of Selflessness

Elizabeth Svoboda (Current, 2014)

Would you risk your life for a stranger's? Survival instinct would suggest not, but science writer Elizabeth Svoboda finds that heroism comes naturally to some, and others can learn altruism using methods such as compassion meditation.



## INTERNET

# Technology and its discontents

**Jaron Lanier** surveys four studies probing the vexed nexus of mind and digisphere.

**D**igital technology is remaking the cognitive environment in which human brains develop and function. This swift revolution is inevitably sparking much hard thinking. Books by neuroscientists Susan Greenfield and Daniel Levitin, and writers Nicholas Carr and Paul Roberts, propose either adaptation to the changes — self-help strategies to compensate for emerging cognitive misalignments — or critiques of the overall transformation.

Greenfield's *Mind Change* takes the latter approach. It proposes that global climate change can serve as a useful metaphor for

### **Mind Change: How Digital Technologies Are Leaving Their Mark on Our Brains**

SUSAN GREENFIELD  
*Rider: 2014.*

### **The Organized Mind: Thinking Straight in the Age of Information Overload**

DANIEL J. LEVITIN  
*Dutton: 2014.*

how human minds — our inner environments — are, in her view, being recklessly altered by digital technologies. Greenfield argues that because the human brain is remarkably plastic in youth, it is not unreasonable to ask how recently introduced, ubiquitous digital designs (such as those of

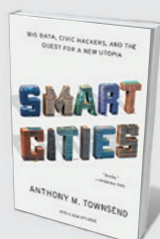
### **The Impulse Society: What's Wrong With Getting What We Want?**

PAUL ROBERTS  
*Bloomsbury: 2014.*

### **The Glass Cage: Automation and Us**

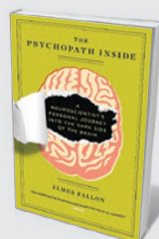
NICHOLAS CARR  
*W. W. Norton: 2014.*

social networks or reading tablets) might affect brain development. The acquisition of speech and reading can affect human brain architecture, but there has been little precedent for the kind of sudden, uniform, pervasive change in children's cognitive environments posed by these



### **Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia**

Anthony M. Townsend (*W. W. Norton, 2014*)  
As technology infiltrates urban life, Anthony Townsend observes how cities evolve in the digital sphere, from parking apps in Germany to crowd-sourced maps of African slums. (See Melanie Moses' review: *Nature* **502**, 299–300; 2013.)



### **The Psychopath Inside**

James Fallon (*Current, 2014*)  
After confusing his own brain scan with a psychopath's, neuroscientist James Fallon trawled his past and genealogy. Assembling evidence from obsessive-compulsive disorder to violence in his family history, Fallon considers how nurture may overcome nature.



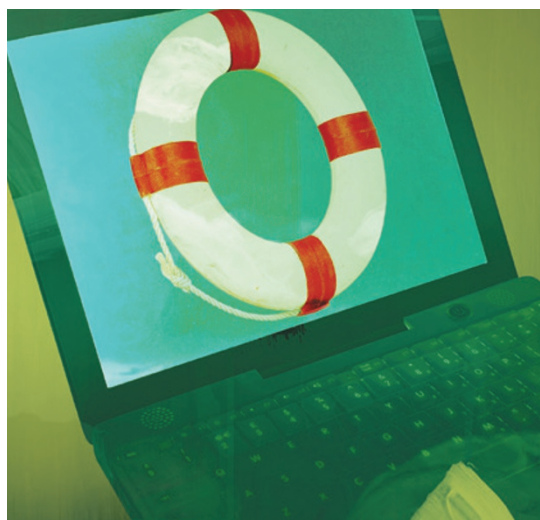
technologies. How might they affect the sense of identity or organic memory, for instance? Although she sometimes seems to push her argument beyond the reach of current research, Greenfield asks key questions — such as whether the next generation will think less critically than their forebears. And she broadly outlines the kind of research and policy agenda needed to address such haunting unknowns.

She occasionally veers into alarmism, for instance when discussing speculative links between the apparent rise in autism and the rise in the use of particular digital environments. However, some of Greenfield's caution may be justified. The neuroscience and cognitive-science communities that overlap with digital-technology developments often rely on the technology industry for support or cooperation, so it is especially important that they are not swayed by that industry's extreme enthusiasms. For all its faults, *Mind Change* is an important presentation of an uncomfortable minority position. It should be read by technologists in particular, as a check on self-congratulation.

By contrast, in *The Organized Mind*, Levitin takes the self-help approach. Accepting the design of information technology and today's information deluge as givens, he explores better brain function in that context. Our networked age often confounds the human mind, he notes, because of the kinds of cognitive quirks investigated by psychologists Daniel Kahneman and his late colleague Amos Tversky — notably Kahneman's idea of two brain systems, one 'quick and dirty' and the other slower and more reasoned. Levitin's strategy for overcoming such quirks is a set of tricks. To bypass poor intuitions about statistics, for instance, he suggests assessing data using a simple four-fold diagram.

Levitin's presentation is sensible and actionable, but I suspect that his audience is the sub-population residing between the extremes of technical ability. This group holds much of society's money and power: our highly technical society is for the most part guided by semi-technical people.

Carr's *The Glass Cage* — a meditation on



## AUTOMATION IN THE AGE OF CLOUD COMPUTING IS OFTEN A **FAKE FRONT.** REAL PEOPLE, **ANONYMIZED AND DEVALUED,** ARE THE SOURCES OF THE 'BIG DATA'.

automation, from apps-for-everything to self-driving cars — asks at the start how we should define a human being in such an era. Does automation change the sense of how people act, learn, or find value in their lives and each other? Carr tells contemporary and historical tales of technologists and entrepreneurs dripping with hubris, such as aviation wizard Wilbur Wright, and of people struggling with a sense that they are becoming denatured by a reliance on automation.

Carr can be understood as part of a literary movement that does not reject technologies. Rather, it rejects ceding what Carr calls "choices about the texture of our daily lives" to technologists and their businesses. That stance is a tightrope walk: one must move forward, succumbing neither to Luddite

tendencies nor to the seductions of hot technological trends.

Carr is one of our most accomplished tightrope walkers. However, *The Glass Cage* does fall prey to a flawed conceit. Automation in the age of cloud computing is often a fake front. It is real people, anonymized and unvalued, who are the sources of the 'big data' that allow cloud algorithms to function. Automatic language translation is made possible only through daily sampling of human translators' work. Celebrating how people are contributing to technology in new ways could address some of the problems Carr decries, whether economic or cognitive.

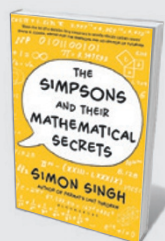
For *The Impulse Society*, Roberts draws on the work of research psychologists such as Walter Mischel, who has studied delayed gratification. More lament than prescription, the book considers the many ways in which technologies encourage an infantile desire for immediate gratification. What is most striking about Robert's critique is its panoramic sweep. During the financial crises of the past decade, for instance, an urge for an instant 'hit' cropped up among individual borrowers keen on home ownership, lenders set on unbelievable deals, and shareholders eager for soaring security valuations. At every level people were disabled by a common infatuation with false gold proffered by digital networks.

Roberts trips a bit towards the end of his book: he calls for a resurgence of traditional community as an alternative to the modern trend towards impatience. The book's ultimate programme seems sentimental and ill-matched to the theatre in which the troubles arise.

Taken together, these four books reveal a frontier of human experience. We are rapidly changing society, and in the course of it potentially laying our brains open to change. We must now become both competent and wise in our powers — not simply resisting or embracing new media technologies, but becoming instead more self-aware and discerning in relation to them. ■

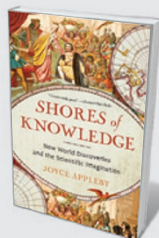
**Jaron Lanier** is a computer scientist with Microsoft Research. His latest book is *Who Owns the Future?*

e-mail: [jalani@microsoft.com](mailto:jalani@microsoft.com)



### **The Simpsons and their Mathematical Secrets** Simon Singh (Bloomsbury, 2014)

US television series *The Simpsons* is craftily dotted with maths jokes by numerate writers who chose comedy over academia. Physicist Simon Singh exposes and explains gags of varying complexity, although all can chuckle at Homer's naive belief in an "infinity plus one".



### **Shores of Knowledge: New World Discoveries and the Scientific Imagination**

Joyce Appleby (W. W. Norton, 2014)

Six centuries of overseas exploration is lucidly charted by historian Joyce Appleby. While voyagers exulted over exotic species, the spread of disease to indigenous peoples exposed the high price of scientific discovery. **Emily Banham**