

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. ■

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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

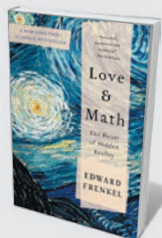


The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century
STEVEN PINKER
Allen Lane: 2014.

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. ■

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EVOLUTION

Tribes like us

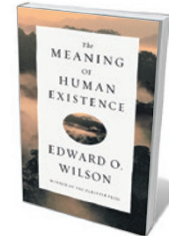
Tim Lenton is intrigued by E. O. Wilson’s sweeping perspective on humanity’s past — and possible futures.

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



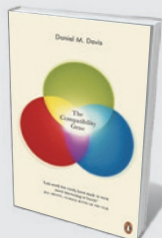
The Meaning of Human Existence
EDWARD O. WILSON
Liveright: 2014.

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.

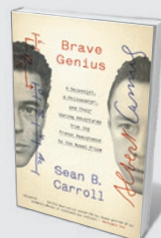
Wilson’s enthusiasm for a mixture of individual and group-level selection goes further, as he struggles to resist an “oversimplified” portrayal that “individual selection promoted sin, while group selection promoted virtue”. The inconsistency in this



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.)