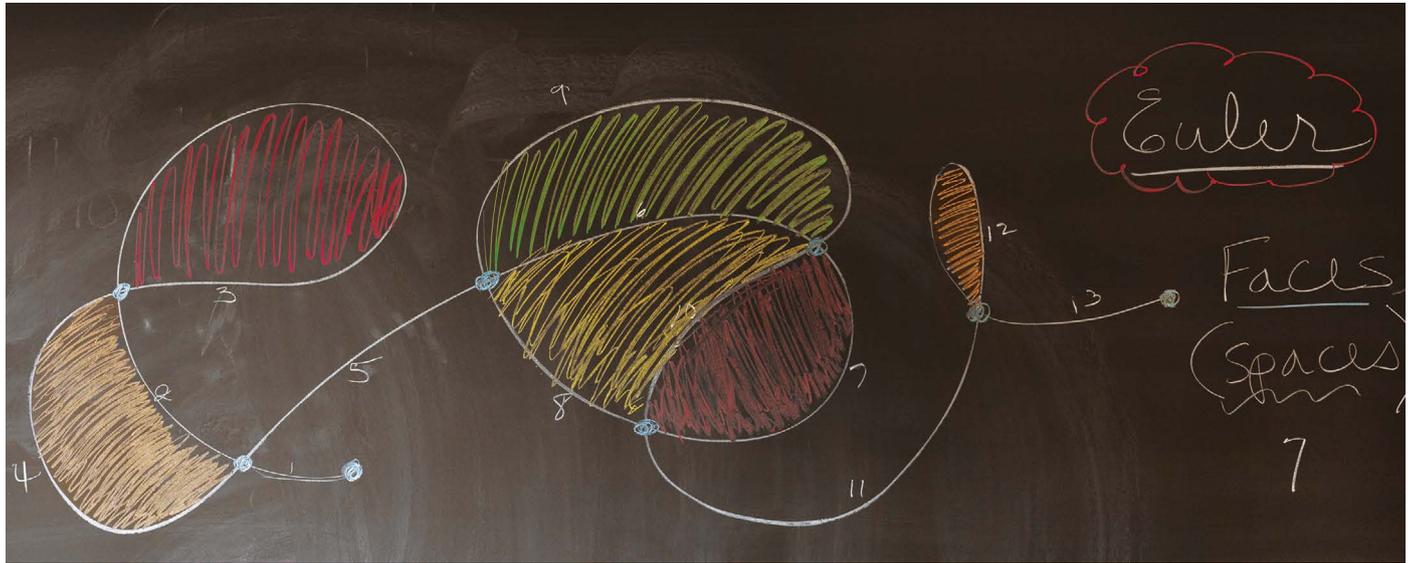


# Books & arts



Some mathematicians find chalk and board so essential for thinking that their tools are celebrated in a 2021 book, *Do Not Erase*.

## Think outside the brain box

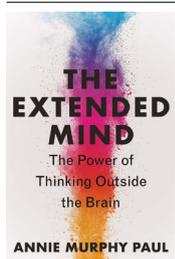
Can our bodies, tools and surroundings take more of the cognitive load? **By Alison Abbott**

**T**he disembodied brain in a vat is an amusing trope of science fiction. Without a vat, the brain needs a body to generate the nutrients to maintain itself and to furnish information about its environment. Sight, hearing, touch, taste, smell and proprioception help us to navigate, and find food or reproductive partners. Science fiction assumes that, with those basic needs taken care of by the vat, the brain can devote its full energies to developing genius intelligence.

Not so, argues science writer Annie Murphy Paul. Her book *The Extended Mind* lays out arguments that the body – and the world more generally – is part of being smart. The human brain is a structure with serious limits: in memory, in attention, in handling abstract concepts. But it can extend its thinking apparatus beyond its skull-bound membranes. Given that the modern world is ever more centred on non-intuitive ideas and abstractions, we need all the help that mind extension can offer. Society fails to recognize this, is Paul's claim.

We can, for example, offload information

from our heads to Post-it notes, phones, computers, friends, colleagues or our gesturing hands. Or we can transform ideas into concrete objects by building models – from blocks, bricks or bits. With the information thus externalized, we can contemplate and manipulate it from a distance – without paying the high cognitive price of having to hold it in the front of our minds while doing so. Relieved, the brain has more resources for understanding or problem-solving. Perhaps that's why Leonardo da Vinci drew and crafted, or nineteenth-century chemist John Dalton built atomic models out of balls and sticks.



**The Extended Mind:  
The Power of Thinking  
Outside the Brain**  
Annie Murphy Paul  
Houghton Mifflin  
Harcourt (2021)

There's many a mathematician who still uses chalk and board like a plug-in hard drive.

I don't completely buy the premise that today's society quashes or undervalues 'extensions'. Collaboration is ubiquitous from schools to CERN's high-energy physics experiments. Or perhaps the issue is that digital extensions are greatly privileged over physical ones: too much Slack, not enough pacing (like Charles Darwin along his "thinking path"). But the framing of the brain-body complex as a borderless thinking apparatus is interesting, bringing together a wide range of research, from education and business practice to psychology and cognitive neuroscience.

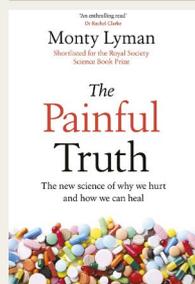
### Hacks and hands

Paul explores the many tricks that can foster people's ability to recall, focus and analyse. One is the venerable memory palace, in which items to be remembered are associated with a particular spot. Ancient Greek and Roman orators used this 'method of loci' to mentally attach points to be remembered in their speeches to, for example, the windows of a building, or the shop fronts in a street.

The method has been validated in scientific studies. It exploits the brain's built-in navigational system, and cognitive neuroscientists have shown that memory champions – and London taxi drivers – activate brain regions associated with spatial memory and navigation to a greater degree than average.

The simple act of gesturing while speaking can also drop what Paul describes as "mental hooks" into, say, a lecture to be learnt, to help reel in that piece of information when at the

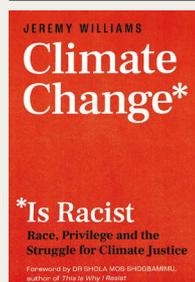
## Books in brief



### The Painful Truth

Monty Lyman *Penguin* (2021)

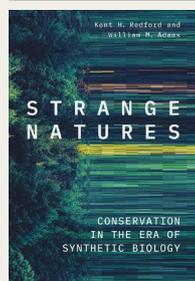
Why is pain, a universal experience, so poorly understood by both doctors and patients, asks clinician-researcher Monty Lyman. He relieved his irritable bowel syndrome through self-hypnosis, including visualizing his bowels changing from “rocky rapids to the languid Oxfordshire Thames”. But hypnotherapy went unmentioned at his medical school — probably owing to an outdated view that pain arises only from injury to the body. Lyman’s compelling mix of science and anecdote shows that persistent pain is “messy, complex and human”.



### Climate Change Is Racist

Jeremy Williams *Icon* (2021)

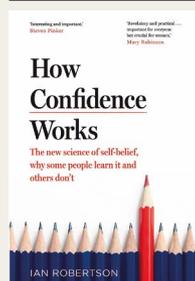
In a 2020 survey about the global impacts of climate change, conducted in the United Kingdom, 31% of respondents thought white people were hardest hit by droughts, floods, storms, food insecurity and air pollution. This gets “the injustice completely backwards”, says environmental and social justice campaigner Jeremy Williams. He argues that the countries most responsible for emissions are disproportionately white; those most vulnerable to its effects are mostly people of colour. Climate change, he writes, is “structurally racist”.



### Strange Natures

Kent H. Redford & William M. Adams *Yale Univ. Press* (2021)

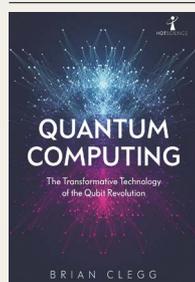
Lakenheath Fen is a nature reserve for birds, consisting of water bodies, reed beds and wet grazing marshes. It was dug from former farmland in 1995: “a mix of naturalness and artificiality”. The birds arrived on their own, but what if they, too, were to be artificially moulded? “Conservation faces a huge challenge in the rise of genome editing and of biotechnology,” observe Kent Redford and William Adams in their thoughtful study. They think these controversial techniques might help species survive in an increasingly unnatural world.



### How Confidence Works

Ian Robertson *Bantam* (2021)

Confidence is a “bridge to the future”, writes neuroscientist and clinical psychologist Ian Robertson: a capacity to visualize something non-existent and then to realize it. It can be strengthened, he notes. His appealing book ranges from neuroscience to politics, including over-confident male leadership in the United States, Brazil, Russia and the United Kingdom, contrasted with female leadership in Taiwan, Germany, Finland, Denmark, Iceland and New Zealand — in relation to COVID-19 death rates.



### Quantum Computing

Brian Clegg *Icon* (2021)

With Google, IBM and others pumping in money, quantum computing is “at a cusp”, says Brian Clegg. In 1981, physicist Richard Feynman speculated about ‘quantum bits’ operating on the superposed states of quantum particles, rather than binary bits of 0 or 1. Work began around 2000; after two decades of development of algorithms and experimental rigs, will the qubit finally become a “significant force”? Clegg thinks so, probably through quantum computers at specialist locations — like telescopes in modern astronomy. **Andrew Robinson**

podium. Movements, even the fidgety ones that a standing desk can engender, might help concentration. Pity the students required to sit still at their desks, she writes.

The book delves into the issue of how our surroundings affect how we think. Why, for example, does being in nature reduce the stress that erodes our cognitive powers, and why is natural light important in a workplace? Humans have, after all, evolved to function optimally in an outdoor environment. Paul lobbies for biophilic architecture that builds in generous windows and greenery. She lauds the design of the Salk Institute for Biological Studies in San Diego, California: a modern take on the medieval monastery, with spaces for meeting and talking, and others for solitary contemplation. These, she says, serve researchers’ dual need to think through difficult concepts without distraction, and to engage in fruitful discussions.

The latter exploits the mind extension of “thinking with our relationships”. The catalogue of studies on this phenomenon looks at the various ways in which social interaction — with peers, with experts and through teaching, arguing or group training — can help learning or analysis. Tapping into the hive mind, she argues, can spread the cognitive load.

So much research is covered at speed that it’s not always clear what’s robust and what’s flimsy. Given that psychology has known reproducibility problems, these distinctions are important. The book contains more than 70 pages of notes for those who want to follow up on some of the many studies mentioned. But somehow, the whole is less than the sum of the parts.

The ‘how to’ element, so beloved of publishers, seems rather one-size-fits-all. To live a more intelligent life, Paul recommends gesturing freely, enacting abstract academic concepts with our bodies (perhaps the annual Dance Your Ph.D. contest is on to something?), learning in groups, and many other activities that could help only in particular circumstances. She does not consider important issues of personality that would affect the value of many such measures. Would an introvert gain as much from group learning as an extrovert? Would an uncoordinated person take as much as a graceful one from physical action? Such questions are not addressed.

Still, many of the messages are indisputable. Evolution has built our brains to respond to signals that constantly monitor our environment and our bodies. Society should indeed give more thought to its environment. Individuals should heed what their bodies are telling them. But let’s not exaggerate: it’s the brain, and not the body, that does the actual thinking.

**Alison Abbott** is a science writer based in Munich, Germany.  
e-mail: [alison.abbott.consultant@springernature.com](mailto:alison.abbott.consultant@springernature.com)