



Author Joshua Foer winning the USA National Memory Championship in 2006.

PSYCHOLOGY

The art of remembering

Larry R. Squire enjoys an engaging account of how memory works and how to win in memory competitions.

In ancient times, before printing and the ready availability of paper for taking notes, a trained memory was of utmost importance. In his writings on oratory, the Roman statesman and philosopher Cicero recounted how the art of memory was invented 400 years earlier in Greece and became a corpus of techniques that were widely known and widely practiced. The method of loci, as it is commonly known, involves constructing visual images for items to be remembered, and then placing them at spatially discrete locations in a familiar building or along a known path. The items are then recovered from memory by mentally retracing one's steps. The only existing classical treatise on the subject (*Ad Herennium*, written about 86–82 BC) and the most authoritative modern treatment (Frances Yates' *The Art of Memory*, Routledge and Kegan Paul; 1966) describe the technique and trace its history to the seventeenth century.

The best-known modern example of this method at work comes from Alexander Luria's *The Mind of a Mnemonist* (Basic Books, 1968). Luria, a Russian neuropsychologist, recorded the remarkable ability of a man identified as S, who from his early life had an

essentially unlimited memory capacity. He could listen to long lists of words or numbers and later give back the whole list, as long as he had a few seconds to visualize each item at the time of learning. These images, which were aroused involuntarily in response to sensory impressions, were then placed along a familiar street. When, infrequently, he omitted an item, the difficulty was in perception, not in memory. For example, he describes why he once omitted the word egg: "I had put it up against a white wall and it blended in... How could I possibly spot a white egg up against a white wall?" S's abilities came with serious drawbacks. His memory was so cluttered with detail and so overwhelmed with separate images that he could not notice the regularities among related experiences. Metaphor and

poetry were often beyond him. For S, his ability was abnormal and a tragic burden.

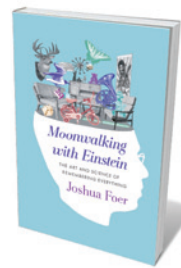
In his charming book *Moonwalking with Einstein*, journalist Joshua Foer describes how the same extraordinary feats of memory are possible through training, even for people with average memories. These are the mental athletes who compete in memory championships and whose achievements are scarcely credible: memorizing lists of binary digits (record: 4,140 digits in 30 minutes); the order of a deck of playing cards (record: 32 seconds); as many decks of playing cards as possible in one hour (record: 27 decks).

The book is interwoven with informed exposition about the psychological science of memory (including discussion of one of this reviewer's study patients). What happens when memory fails, as in amnesia after brain injury? What is the nature of acquired expertise, such as typing, ice skating or the reading of mammograms? Studies show that recently trained radiologists are more accurate at screening mammograms than those who were trained some time ago. Because the accuracy of a diagnosis becomes known only later, practitioners may forget the case details and so cannot learn effectively from their mistakes. As a result, their skills can backslide.

Experts engage in directed, highly focused practice. In the words of the great American-football coach, Vince Lombardi: "Practice does not make perfect. Perfect practice makes perfect." The best ice skaters spend more time practising routines they have difficulty with, whereas lesser skaters work more on routines they have mastered. Typists can improve their speed by deliberately practising at a rate above whatever plateau they have reached and then analysing their errors.

The most entertaining parts of the book are the detailed accounts of how the mental athletes prepare for competition and develop expertise, including the author himself, who in a one-year adventure entered and won the US Memory Championship. The technique begins by selecting a familiar space such as a large building (historically called a memory palace), which the competitor populates with the images of what is to be remembered. Experts use dozens of these, each with a unique route that can be followed for depositing and retrieving images. The images themselves are crucial — they should be highly detailed, bizarre, even lurid. Competitors need to deliberate on each image to know its colour and shape, its smell and texture, and their feelings about it. When the image is a person, the introduction of humour, action and sex is encouraged.

The main competitive method for remembering the order of a deck of playing cards involves pre-memorizing a



Moonwalking with Einstein: The Art and Science of Remembering Everything

JOSHUA FOER
Penguin/Allen Lane:
2011. 320 pp.
\$26.95/£14.99

NATURE.COM
For a review of Oliver Sacks's *The Mind's Eye*, see:
go.nature.com/cshza4

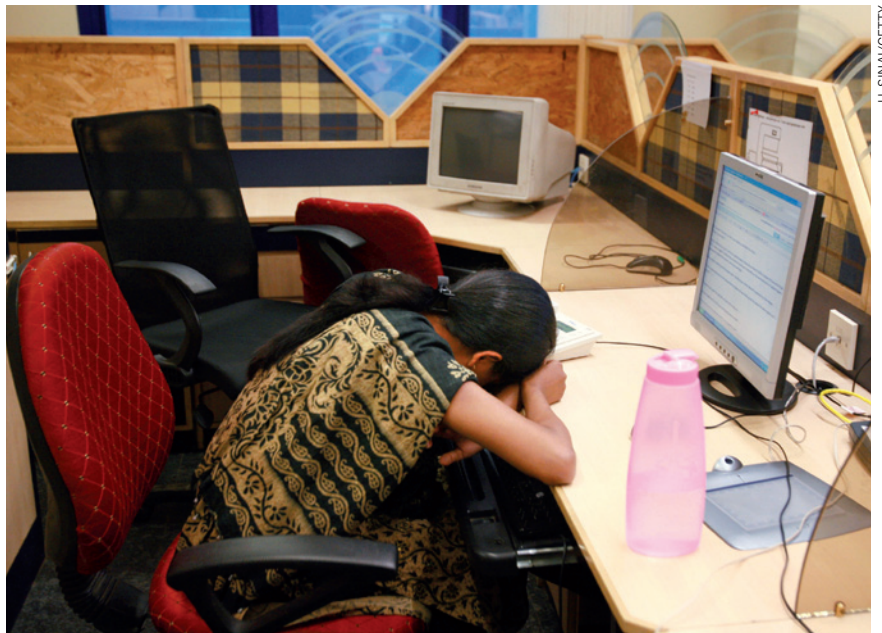
subject-verb-predicate image for each card. For example, the king of diamonds: Dad riding a tricycle or, using the book's title, Dad moonwalking with Einstein. In tournaments, cards are turned over three at a time. A new image is then constructed to represent all three cards (images ABC, DEF and GHI are converted into the single image AEI). This new image retains a trace of each card's identity, which can be placed in a room of the memory palace for later retrieval. To support memory of a 52-card deck, the expert needs 17 images plus one additional image.

Because a collection of images typically includes a number of titillating acts, difficulties can arise when combining them results in images of family members engaged in socially unacceptable practices. As he prepared for competition, Foer worried that he was being distracted by the indecent acts his mother had to commit "in the service of my remembering the eight of hearts". His coach knew the problem: "I had to excise my mother from the deck. I recommend you do the same."

After gaining his trophy, Foer retired from competition and now rarely uses the techniques. They are effortful and hardly vital in an age of external memory in which remembering information may be less important than knowing how to find it. Also, ordinary memory works at cross-purposes with memory-training techniques. We are best at generalizing, abstracting and assembling general knowledge, not at retaining a literal record of events: we forget the particulars and thereby can retain the main points. Studies show that people will remember the meaning of sentences but forget whether the sentences were presented in the active or passive voice. Freud wrote: "Normal forgetting takes place by way of condensation. In this way it becomes the basis for the formation of concepts."

Influenced by these realities of memory, current pedagogy has minimized rote memorization and drills, emphasizing instead problem solving and independent thinking. Yet, if it is true (as stated in the book) that two-thirds of US teenagers cannot locate the Civil War within 50 years, or that 20% cannot identify the adversaries in the Second World War, perhaps there is a place in education for the skill of memorizing. Foer tells of an inner-city history teacher, an enthusiast of memory training, who introduced the techniques rigorously, comprehensively and with considerable success. As Foer writes, "even if facts don't themselves lead to understanding, you can't have understanding without facts." ■

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U. SINAI/GETTY

The time difference with the West takes its toll on a web tutor at an Indian-based company.

GLOBALIZATION

Behind India's technological boom

The rise of outsourcing by Western companies stifles local innovation, learns **Andrew Robinson**.

It is now an everyday experience to phone a large US- or UK-based company with a technical, financial or administrative enquiry and end up talking to someone in Bangalore or Mumbai. India's ready supply of well educated, English-speaking and relatively cheap workers has made the country a top destination for many Western companies, from banks and airlines to big pharma and information technology (IT) firms. Yet the outsourcing of labour has had unforeseen local impacts on science and innovation — and on the technologically gifted young people of India.

Dead Ringers, by US sociologist Shehzad Nadeem, is the first academic field study to explore what turns out to be an occupational dead end for hundreds of thousands of Indians working for Western corporations. As well as the multitude who man telephones, this vast group includes an army of software programmers, accounting specialists and interpreters of medical scans. Nadeem interviewed more than 125 workers, managers, employers and trade unionists in India and the United States, mainly in 2005–06. He offers concrete and important insight into the world



Dead Ringers:
How Outsourcing
is Changing the
Way Indians
Understand
Themselves
SHEHZAD NADEEM
Princeton University
Press: 2011. 288 pp.
£24.95

of outsourcing, but in highlighting the downsides, he downplays the undeniable successes and the homegrown roots of India's research and development sector.

India's IT boom, which started in the mid-1990s after the liberalization of the Indian economy in 1991, has generated headlines and hyperbole in both business and politics. As Nadeem readily accepts, outsourcing has provided many young Indians with comparatively well-paid opportunities and it has boosted India's reputation internationally. In 2004, the boom even contributed to the electoral slogan of the ruling Bharatiya Janata Party (BJP), "India shining".

But the BJP's controversial phrase turned out to be ill chosen. The party lost