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## ‘At 98, I wouldn’t be so sharp without puzzles’: do crosswords and quizzes really boost your brain power?



Illustration: Jason Ford/The Guardian

We’re told that they give us a mental workout, but the evidence suggests it’s a bit more complicated

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Miriam Raphael, 98, is a veteran puzzler. As a child, she pored over clues with her father and, later, as a teacher and mother of three daughters, it became her small daily luxury. When she learned of the first annual [American Crossword Puzzle Tournament](#), her competitive streak kicked in and she entered, winning the second tournament in 1979. More than 40 years on, she is the tournament's most decorated competitor.

When she speaks to me on Zoom from her New York home (at a time compatible with her water aerobics and yoga classes) she has the astute air you might expect of a woman who has spent nearly a century successfully returning the names of French monarchs, obscure musical instruments and meteorological phenomena.

"It's part of my daily routine, like brushing my teeth," she says. "Do the puzzle. Have breakfast. It gets me ready for the day." For Raphael, crosswords are about a love of words and the thrill of cracking a clue. "There are a bunch of empty squares at the start. And there's a feeling of satisfaction at seeing them filled in," she says.

She also credits her crossword routine for keeping her brain active. "It involves memory, decision-making, all of those things," she says. "I definitely think that I wouldn't be as sharp as I am, at my age, if I didn't do puzzles."

The idea that crosswords and puzzles like sudoku and [Wordle](#) act as a "brain workout" has long simmered in the public consciousness. But increasingly, the benefits of these activities are framed in medical-sounding language.

[NHS webpages on healthy ageing](#) use phrases such as "use it or lose it" and liken the brain to a muscle that may waste away unless consciously exercised. In the last two decades, brain imaging has provided new evidence of our ability to remodel our brain at will, with snapshots taken just weeks apart [revealing physical changes](#) in its structure as volunteers learned new skills such as juggling. These insights, at a time when anxiety about dementia loom large, have inspired a brain-training software industry, valued at \$8bn in 2023. But, the scientific evidence that doing puzzles can boost your brain power, it turns out, is complicated.

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Puzzles do, at the very least, seem to be linked positively with cognitive abilities. [One recent study](#), involving more than 9,000 participants, found that lifestyle choices, including playing video games, drinking alcohol, exercise and learning musical instruments, appeared to explain about 7-9% of variation in cognitive scores. Playing board games and puzzles was the strongest predictor of scoring highly on reasoning tests, and was the second most significant predictor for short-term memory and verbal abilities (video games, incidentally, were just as predictive of cognitive abilities). However, these findings come with a big caveat.

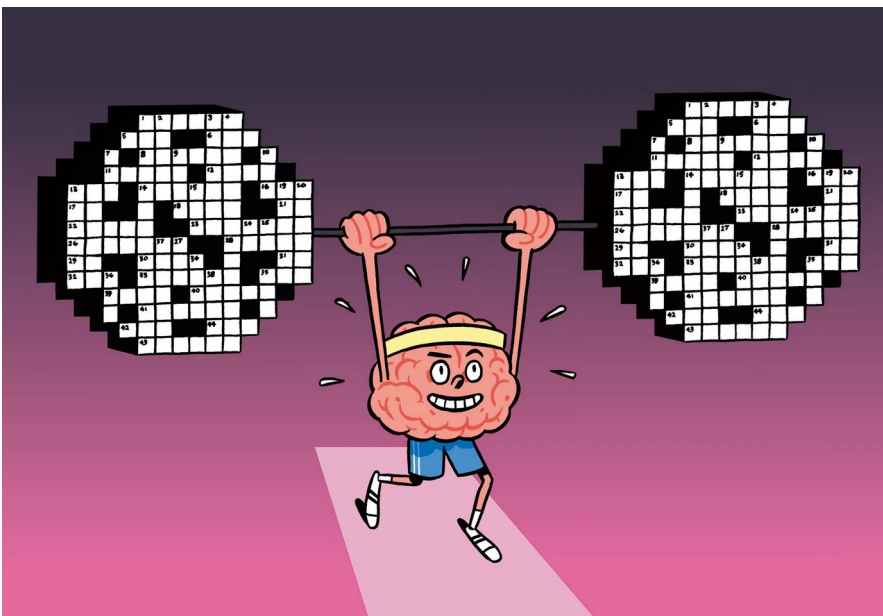
"It's likely that people who are better at puzzles to begin with are more likely to spend their time doing them," says Prof Adrian Owen, of Western University in Canada, who led the research. It follows that these might be people with good cognitive abilities already. "I'm not convinced that's the whole story," says Owen. "But trying to tease apart cause and effect is virtually impossible."

That hasn't stopped others drawing a causal link, particularly when the same tests are performed in older groups. [One 2021 study](#), similarly based on lifestyle questionnaires, concluded that activities

such as reading and doing crosswords could stave off dementia for five years. [Another suggested](#) that people who engage in word puzzles have “brain function equivalent to 10 years younger than their age”.

Given that there are no known mechanisms by which puzzling can target the root biological causes of dementia – such as the accumulation of amyloid proteins in Alzheimer’s, or the loss of blood flow through the brain in vascular dementia – the benefits are often presented as a way of boosting “cognitive reserve”. The idea sounds reasonable: the larger your mental reservoir, the longer it takes to notice it draining away. But while there is no doubt that doing a crossword puzzle every day will make you better at doing crosswords, the evidence for any broader cognitive benefits – the kind that would be meaningful in everyday life – has proved elusive.

“An analogy is often used of working out the brain and working out the body, but this can be subtly misleading,” says Dr Joe Hardy, who investigated the effectiveness of crosswords while working at the brain-training app company Lumos Labs. “If you’re working out the muscles, you can see physical changes. It’s visible and quantifiable and happens quite quickly. The brain is quite different. It’s not engaged in those massive shifts in volume or in its structures.”



*Illustration: Jason Ford/The Guardian*

In fact, neuroscientists have discovered that when we train on individual cognitive tasks it is often not possible to detect any transferable benefits at all. “When you learn a task, you strengthen the white matter networks involved in that task, but it’s very task-specific,” says Owen. “So if there are five nodes for crosswords and five for sudoku, of which three overlap, it doesn’t mean that doing crosswords will make you better at sudoku.”

Brain-training companies are, to some extent, incorporating these findings into their products. [In one study](#), led by Hardy while at Lumos, nearly 5,000 participants spent 15 minutes doing either crosswords or an array of 49 different brain-training exercises at least five days a week for 10 weeks. The training is presented in the form of mini-games, such as memorising items in a suitcase, matching tiles based on periodically changing rules, navigating to rescue lost pets using the most efficient route, unscrambling words, and entering the answers to sums that float down the screen in

raindrops. After the training period, the volunteers were given seven cognitive assessments aimed at measuring short-term memory, processing speed, grammatical and arithmetic reasoning.

Across all the tests, only marginal cognitive gains were observed for the crosswords group, with larger improvements for those doing brain training – with the exception of the grammatical assessment. But speaking several years on, Hardy acknowledges that the research had some weaknesses. For one, people were recruited through the cognitive training website, meaning they are likely to have had a prior expectation that the brain training would have a more powerful impact on cognition.

Similarly, one explanation for the boost to grammatical skills is that crosswords really improved these abilities, but another is that the volunteers expected to do better and so went into the test feeling more confident. “The placebo question is a real problem with a lot of behavioural research,” says Hardy. “If I did crossword puzzles all this time, I feel like I should be better at grammatical reasoning. Does that matter?”

“I think it’s good to be humble about the fact that at a fundamental level it’s a difficult thing to test. You’re having to define what is a cognitive ability. That’s something that we don’t really have agreement about as a culture, as a scientific community.”

There is also the issue of how easy it is to stick to a brain-training regime in the real world. Hardy initially describes Lumos’s brain-training games as “quite fun”, before admitting that he has lost the habit of using the software since leaving the company. “I still do Wordle, though,” he adds.

While many scientists express scepticism about the purported cognitive benefits of brain-training tools that have been explicitly designed with the aim of boosting cognition, there is emerging evidence that action video games are positively correlated with cognitive performance. These findings, including those in Owen’s most recent lifestyle study, challenge the stereotype of games such as Call of Duty fuelling impulsivity and an inability to concentrate on anything aside from highly stimulating gameplay.

However, scientists uncovering this new line of evidence say that perhaps we should not be so surprised. Unlike many custom-built brain-training exercises, video games such as Minecraft or The Legend of Zelda are immersive, strategic and involve problem-solving, concentration and high-speed reactions. “You’re kind of learning to think, not just learning to be better at one task,” says Owen. “I think that’s also true of crosswords. You’re drawing on a whole bunch of neural circuits and a style of thinking that is useful in normal life.”

And, as with crosswords and Wordle, video games tick another important box for those who play regularly. “Even though action video games were never designed as teaching tools, they nonetheless embody many pivotal learning principles,” notes a [Scientific American article](#) co-authored by Prof Daphné Bavelier, a neuroscientist at the University of Geneva who has pioneered research into video games and cognition. “For one, they are fun – a cardinal pedagogical prerequisite that is often given short shrift.”

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According to Owen and others, it is plausible that crosswords, which rely on diverse mental abilities, do have a small positive impact on the brain. But that is not the only way our mental performance and wellbeing can be altered or improved.

“One of the fallacies is we focus on the intellectual part,” says Prof Vladimir Hachinski, a neurologist at Western University in Canada. “You can improve people’s wellbeing by improving their social connectivity and emotional participation. We’re wrong to just focus on cognition. How we perform also depends on how we feel.”

Hachinski says the tendency to focus on cognition can lead to unrealistic expectations and anxiety about dementia, even without any obvious age-related memory loss. “Until the 1800s, we lived in villages,” he says. “If you met a new person, you’d remember them. Now we’re bombarded with information all the time. It’s a tremendous overload.”

Hachinski points to the US surgeon general’s description of [loneliness as an epidemic](#) on a par with tobacco use and obesity, and a factor that can substantially increase the chances of both [early mortality](#) and [dementia](#).

When I speak to Raphael, she mentions she has just returned from an annual weekend event for word lovers, including linguists, writers, a rap performance and the community of crossword aficionados to which she has belonged for decades.

“There’s a lot of evidence that remaining social is good for your health in older age,” says Owen, adding that this is a common component of many of the lifestyle factors that appear to protect brain health as we grow older. “A lot of these things are wrapped up in being social. You sit down with their partner and do the puzzle. It gets complicated really quickly.”

There is also compelling evidence that almost every factor that influences poor heart health – smoking, drinking, obesity, high blood pressure and lack of exercise – is also bad for the brain, Hachinski points out. “It’s well established that physical activity has a benefit, unlike puzzles,” he says. “And if you exercise with someone else you double the chances you’ll continue doing it.”

Activities can also be beneficial for different people in different ways. Some may view puzzles as a mental challenge, but they can also be a form of relaxation, which could bring about benefits by lowering the body’s stress response. “Cognition is very affected by cortisol levels,” says Brad Love, a computational neuroscientist at University College London. “If you’re feeling good, it affects cognition in a positive way. For all we know, puzzles could be like meditation – you don’t think of all the problems in your life while you do the puzzle. Even assuming it has a benefit – because it’s kind of in doubt if it does – who actually knows what’s behind that?”

Part of the problem with trying to study the benefits of lifestyle interventions in the lab is that they are removed from the real-life context, which can be crucial. We are, after all, making choices, often replacing one activity with another. “We only have so many hours in the day,” says Love. If you’re deciding whether it is better to spend that time brain training rather than going for a walk with a friend, “that’s a high bar to pass”.

When it comes to good brain health in old age, the best guidance reads as common sense. The substantial benefits of exercise, sufficient sleep, eating well and socialising are backed by very clear evidence. Doing a daily crossword won’t guarantee that your brain keeps working like a well-oiled machine. But if you enjoy puzzles – and especially if they motivate a walk to the corner shop to buy the morning paper, or if they form the basis of a friendly family rivalry, or even if they just allow your mind to turn away from troubles for 20 minutes – they’re probably a good thing. And, in any case, life’s small pleasures don’t need to be medicinal to be appreciated.

“There are many problems in life that have no solutions or where you can’t find a solution,” says Raphael. “A puzzle has a solution and there’s a satisfaction in that.”