Do brain trainers work?

Experts challenge the science behind claims made for Nintendo and other PC games

People who buy brain trainers to keep their minds in shape may be just as well off leading active social lives or surfing the internet, according to experts.

Devices such as the Nintendo DS are fun and hugely popular, helped by TV ads featuring celebrities such as Nicole Kidman, Julie Walters and Patrick Stewart.

Some manufacturers claim they can improve memory or that brain training may help stave off the risk of illness.

We asked leading neuroscientists to examine the evidence for the claims. They found much of it weak. In some cases, they found other activity may have an equal effect, or that the evidence showed only that using the trainer made you better at that task.

Adrian Owen said of one group: 'If they'd been asked to play Space Invaders for a month and improved at it – as surely they would – would we have concluded this was a beneficial form of brain training? Probably not.'

Our research

Experts give their views on claims made for brain trainers

In November 2008, we asked manufacturers of brain training devices and software what the benefits of using their products were and requested evidence to back up their claims.

We sent this to experts and asked if they thought the evidence justified the claims.

They looked at whether the evidence related directly to the product concerned and whether it had been 'peer reviewed' (checked by experts working in the same field) and published in a reputable scientific journal.

They also looked to see whether the studies involved a control group.

WHO ARE OUR EXPERTS?

Dr Chris Bird
A clinical neuroscientist at the Institute of Cognitive Neuroscience at University College, London.

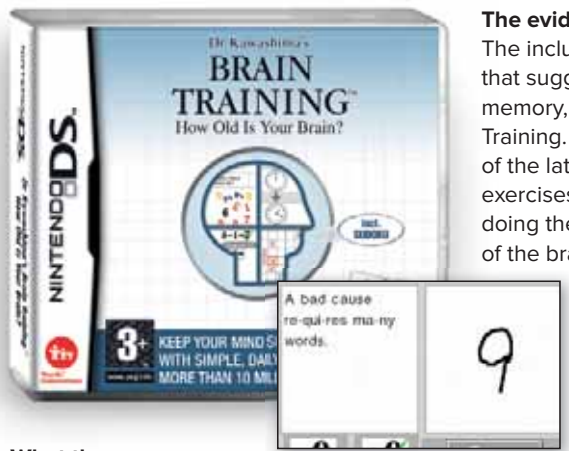
He has research interests in memory processes and memory disorders associated with dementia.

Dr Paul Howard-Jones
A senior lecturer at the Graduate School of Education, Bristol University. His interests include how neuroscience can be used to enhance learning, including game-based learning.

Dr Adrian Owen
A senior scientist and assistant director at the Medical Research Council's Cognition and Brain Sciences Unit, Cambridge. He has more than 20 years' experience developing computerised tasks to assess mental processes.

We also asked five Which? members who had written to us with experiences of brain training to try the products for a month.

DR KAWASHIMA'S BRAIN TRAINING (Nintendo) £110 includes DS console



What the company says
This exercises the brain, like a treadmill for the mind, and the challenges in the game can help stimulate memory. Nintendo says it doesn't claim the game can improve the brain's health or reverse the effects of ageing. But the instruction booklet says training can help consolidate memory and creativity and may hopefully help develop a resistance against decline in later life: 'It's vitally important to continue training'.

The evidence
The included booklet mentions studies that suggest everyday processes, such as memory, will benefit if you use Brain Training. It also states that – on the basis of the latest scientific evidence – the exercises have been chosen because doing them increases blood flow to a part of the brain called the frontal cortex.

Our experts say
None of the studies has been published in recognised scientific journals. And increased brain activity in terms of blood flow isn't evidence the brain is being trained or altered at all. Adrian Owen said that surfing the internet and chatting with friends will also increase blood flow to the frontal cortex. 'If we use Nintendo's logic, these activities are just as likely to train your brain.'

Chris Bird also said that areas of the brain affected by diseases such as Alzheimer's are well supplied with blood, which makes Nintendo's logic even more problematic. If you practise the tasks you will almost certainly get better at them and reduce what the game calls your Brain Age. But while the Brain Age idea is fun and motivating, Chris Bird said: 'There is no evidence this will have any functional impact on your life whatsoever.'

> **'All the user will have done is trained their brain to be better at the tasks practised.'**
> Chris Bird

In 2008, Dr Kawashima wrote: 'Although general interest in brain training has been increasing in the public, evidence for its beneficial effects still remains insufficient.'

Which? member says
Kerry Redden, 42
'I was pleasantly surprised by how much I enjoyed using Brain Training and how easy it was to use. It has improved my mental arithmetic. I'm not looking forward to handing it back – I'd like to get my brain age down below 26!'

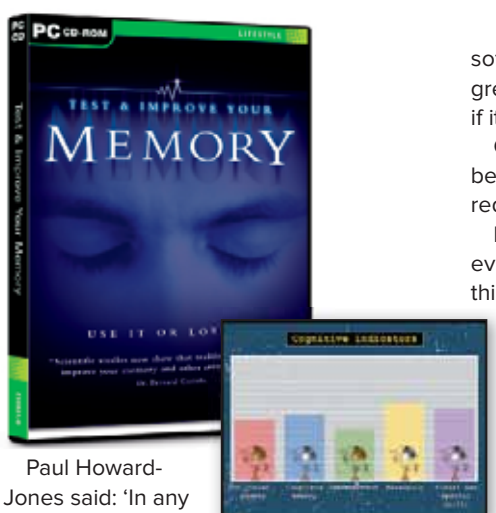
TEST AND IMPROVE YOUR MEMORY (PC CD-ROM) Focus Multimedia £9.99

What the company says
'Scientific evidence has shown that regular brain training, as offered by the CD, can help defer the onset of age-related brain decline, dementia and Alzheimer's. It claims that in just 20 minutes a day, the CD will help increase thinking ability, prevent brain aging, and hone memory, language, concentration, visual/spatial skills and executive function.'

The evidence
Focus Multimedia has carried out research using the program. People in the studies mentioned were asked to do the exercises on the CD for a period of time, then did the same exercises again and were assessed for whether they had improved.

Our experts say
Adrian Owen said: 'It is hardly surprising that they improved. The results are nothing more than proof that practising a specific task improves performance on that task.

'It doesn't mean that any aspect of their general mental ability improved.'



Paul Howard-Jones said: 'In any case, as many everyday tasks are also highly stimulating, the benefits of using this product may depend on what you'd be doing otherwise.

> **'The benefits of using this product may depend on what you would be doing otherwise.'**
> Paul Howard-Jones

'For example, if they were using this software instead of washing the car then greater benefits would be expected than if it was used instead of playing chess.'

Chris Bird played down the claimed link between brain-training exercises and reduced risk of dementia and Alzheimer's.

He said: 'The company offers no evidence that the product can do any such thing. The argument linking brain-training sessions to Alzheimer's is, in any case, extremely tenuous.'

It's difficult to see how the claims made can be supported as none of the research that was mentioned has been published in reputable scientific journals.

Which? member says
Tony Pickard, 69
'It was fun, had a good variety of exercises, and seemed to keep the mind active.

'It was very good value at £9.99, but unlike Brain Training on the Nintendo DS, which I had already, you can't take it everywhere with you.'

MINDFIT (PC CD-ROM) £88

The company says
MindFit exercises important abilities that are used in everyday life and are known to decline in later life, such as short-term memory, spatial memory, visual perception, scanning, divided attention, shifting, awareness, hand-eye coordination, time estimation, planning and inhibition. The systematic exercising of these functions with MindFit has been shown to improve performance.

The evidence
MindFit is endorsed by the renowned neuroscientist, Baroness Susan Greenfield. We were sent three studies.

Our experts say
None of the studies is published in a reputable scientific journal.

Adrian Owen said that two have 'basic design flaws', for example there isn't a control group in either case, which means it's impossible to say that the improvement noted in people that used MindFit would not also have happened with any other form of regular computer use.

> **'The study appeared to show that people who used MindFit improved mental performance.'**
> Adrian Owen

The third study, though unpublished, is well designed and sticks to good scientific principles. It suggests that MindFit's claims may be more credible than those made by other products, though the results didn't show it was significantly better than playing computer games like Tetris (which the control group were asked to do). The average age of those in the study was over 50, so it isn't possible to say these improvements would be seen in younger people.

Paul Howard-Jones said the results were encouraging, but MindFit could be dull to use as its tasks were similar to those used in laboratory experiments, which aren't usually designed with fun in mind.

Another claim made was that 'cognitively challenging' activity protects against Alzheimer's. Chris Bird said even if that was true, it was unlikely brain-training would be more effective than doing crosswords or joining a book club.

Which? member says
Heather McAlone, 47
'I quite enjoyed a couple of the activities, but mainly it was slow and tedious. I don't think it's good value for money. I paid £5.99 for a book of cryptic crosswords, which really gives my brain a workout.'

LUMOSITY (Online training System) Luminos Labs £4.99 per month

What the company says
'Fundamental cognitive abilities can be improved with appropriate training, and the exercises in the Lumosity brain training program are designed to stimulate the neuroplasticity that leads to improved cognitive ability and a healthier brain. People who train with Lumosity improve memory, attention, processing speed and cognitive control.'

The evidence
The study we were sent compared the memory and attention skills of 14 people who trained for five weeks on the Lumosity exercises with a 'control group' of nine people who did not. Both improved their memory scores, but the group using Lumosity improved significantly. They also improved attention scores, but the control group's attention apparently got worse.

Our experts say
Adrian Owen said that the study contained basic errors. 'The control group was less than two-thirds the size of the trained

group, so it's statistically and therefore scientifically incorrect to conclude that one improved more than the other.'

And while one group used Lumosity, the other did nothing. So it's impossible to be sure that any form of computer use, such as surfing the internet, wouldn't have lead to similar effects. Our experts also disputed the claim that the tasks people did before and after training to check for improvement, were different from exercises they did while training. Our experts said the tasks were similar enough to mean the improvement could be interpreted as simply the effects of practising.

Chris Bird said: 'This does not mean that improvements on the tasks will lead to improvements in day-to-day living, and it does certainly not mean your brain will have been made healthier by the process.'

> **'How do we know that doing any kind of computer-based activity, wouldn't lead to similar effects?'**
> Adrian Owen

None of the research has been published in peer-reviewed scientific journals.

Which? member says
Mark Gosling, 48
'I liked the variety and nature of the games available, but unlike Brain Training on the Nintendo DS you can't be spontaneous with it as you have to boot up the PC. I didn't enjoy it enough to go back to it after the trial – let alone day after day.'

PHOTOGRAPHY GETTYIMAGES, STOCK FOOD, SUPERSTOCK

MINDSPA (A/V Stim) £175

What the company says

'MindSpa is an effective way to learn, improve performance and increase the focus of children and adults. It will help people relax, leading to better sleep, and cognitive benefits. It helps generate alpha brainwave activity using frequencies of light and sound tuned to brainwave frequencies.'

The evidence

We were sent details of studies involving MindSpa, and A/V Stim's website invites you to click a link to 'published, peer-reviewed university research'. The link leads to an unpublished study claiming audiovisual stimulation while listening to Disney stories helped improve the maths of children with learning difficulties.

Our experts say

With MindSpa, you relax with your eyes closed while wearing headphones and glasses studded with brightly flashing LED lights (known as 'audiovisual stimulation').

Our experts said the study was irrelevant because the system used in it wasn't MindSpa. Also, there was no control group so we don't know if any form of regular attention, such as listening to the stories without the system, would have had the same effect. They doubted whether studies involving children with learning difficulties could apply to adults without the conditions.

There is good evidence sleep improves concentration, so techniques to improve sleep would have benefit.

'There's no evidence audiovisual stimulation is more effective than other forms of relaxation, such as an early night.' Chris Bird

Which? member says

Josephine Stephens, 59

'I get more benefit from listening to relaxing music on my £10 MP3 player.'

ONLINE

How to buy a games console

www.which.co.uk/howtobuyaconsole

Keep your brain in shape

Here are some things to try to keep your brain in trim

Physical exercise

A study of people aged over 65 found that those who exercised at least three times a week were 38% less likely to develop dementia than those who exercised less frequently. Not smoking, keeping a healthy weight, controlling blood pressure and getting enough rest are also likely to help.

The food you eat

Eating fish, olive oil, grain and vegetables (especially spinach, lettuce, cauliflower and broccoli) has been linked to slower rates of mental decline.

Challenge your mind

The most mentally challenging tasks, such as learning a musical instrument or doing crossword puzzles, are likely to be of most benefit. Games such as chess are also likely to be of benefit. Doing a variety of tasks and activities will keep up the challenge and avoid you getting into a routine.

Which? says

Many of us enjoy solving puzzles such as crosswords and Sudoku, and brain-training devices belong to this tradition

The companies behind brain trainers propose that using them will make our brains more able to deal with mental challenges in our daily lives.

Some say it's 'vitally important' and that if we don't 'use it' we will 'lose it'. Others say that using their product to train our brains may help to delay the onset of devastating conditions such as dementia.

Some of the claims that are made are dressed up in the kind of scientific-sounding language that many of us would struggle to understand.

But according to our experts, the bottom line is that none of the claims are supported by peer-reviewed research published in a recognised scientific journal and involving the specific product. This is the accepted standard by which research is judged. Our experts say that many of the studies also have errors that would make them unpublishable.

There is good evidence that some activities help maintain mental processes. But many of these are cheap or even free, such as filling in a crossword or having an active social life.