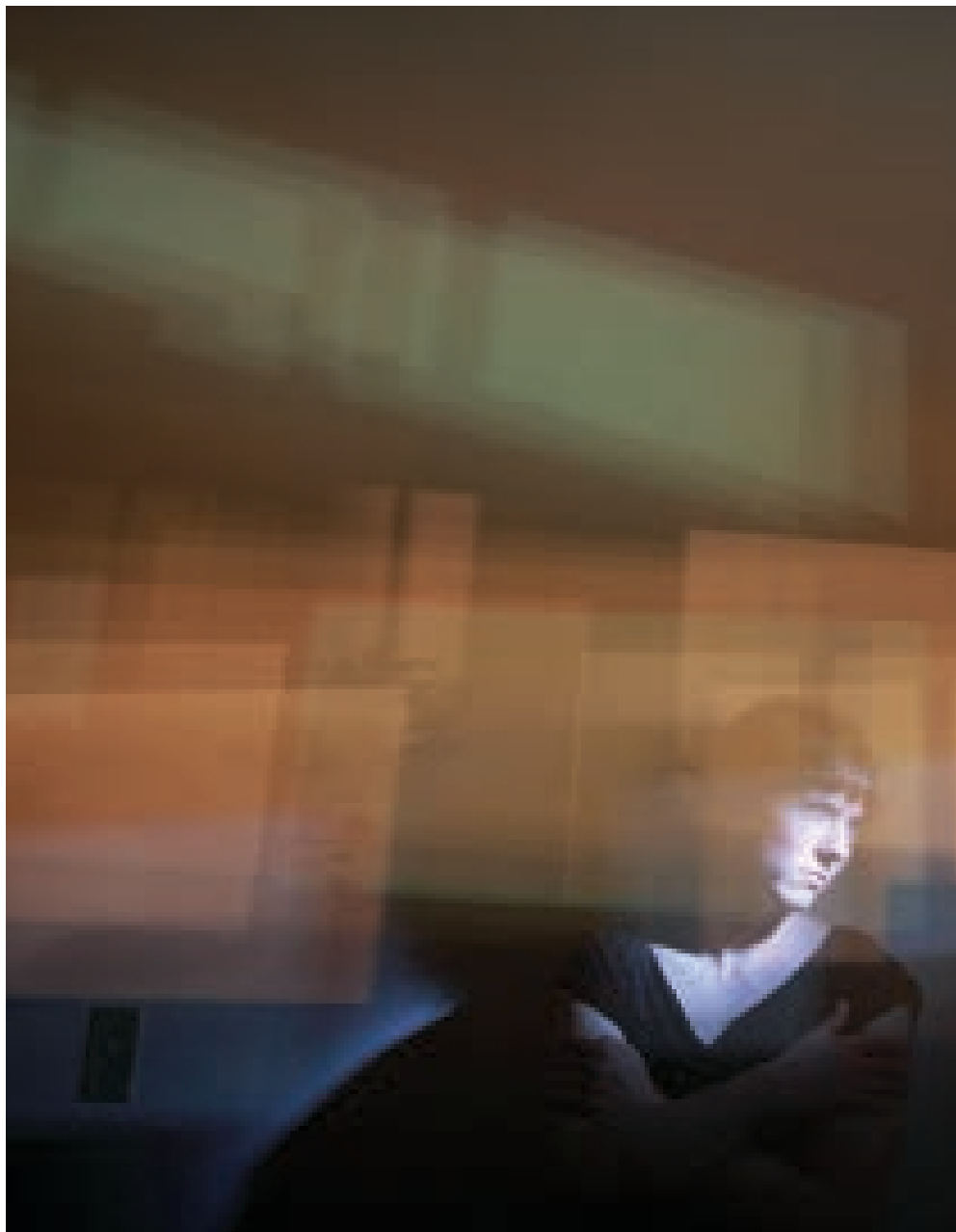


BLIND IN THE MIND

I can't visualise things,
says **Dustin Grinnell**.
So what's going on in
my head?

LONG-DISTANCE relationships aren't easy at the best of times. But when my girlfriend and I had to move to opposite sides of the US for work, we faced an obstacle that few others do. I couldn't picture her face.

It is the same for landscapes and sunsets, parks and rivers: when it comes to mental imagery, I am blind. At the time, I didn't think anything of the fact that I couldn't conjure up a mental image of my girlfriend at will. I have never had that ability, so I didn't know what I was missing. And it wasn't as if I have trouble with tasks that you imagine might require such a "mind's eye", like navigating around town or recognising friends.



So I got a shock when I saw a TV interview with Craig Venter, the biologist who created the first synthetic organism. He spoke then of how he attributed his academic success to an unusual way of thinking, using purely concepts with no mental imagery whatsoever. And he says the same thing now: "It's like having a computer store the information, but you don't have a screen attached to the computer." That's exactly how I feel too – and so my questions began. Why am I different? How do I navigate life without a mind's eye? Could I ever train my mind to see – and would I want to?

I began to investigate and soon discovered that science is starting to find answers. And

ironically, studying people like me is helping to reveal a lot about how our brains process the things we see around us.

We have known of the existence of people with no mind's eye for more than a century. In 1880, Francis Galton conducted an experiment in which people had to imagine themselves sitting at their breakfast table, and to rate the illumination, definition and colouring of the table and the objects on it. Some found it easy to imagine the table, including Galton's cousin, Charles Darwin, for whom the scene was "as distinct as if I had photos before me". But a few individuals drew a total blank.

Today there is a standard way to probe the acuity of the mind's eye: the Vividness of



Visual Imagery Questionnaire. It asks people to imagine various scenes and rate the clarity of the mental picture (see “Picture this”, page 37). Surveys show that most people have fairly vivid mental imagery; only 2 to 3 per cent report a completely image-free mind.

For a long time, no one gave much thought to what caused this. “It was an academic blind spot,” says neurologist Adam Zeman of the University of Exeter, UK. That changed in 2003, when Zeman got a call from a colleague who said: “I’m sending you a patient because he can no longer imagine.” The man was a 65-year-old building surveyor known as MX who reported losing his mind’s eye after heart surgery. Zeman decided to find out what was going on inside MX’s head.

Tony Blair’s eyes

We have a good idea how creating a mental image usually works. When you see a real object, the information captured by your eyes and fed to the brain activates a pattern of neurons unique to that object: a chair has one distinct pattern, a table another. MRI brain scans show that when you imagine a picture of that object, the same neural pattern lights up, just slightly less strongly than when you are actually seeing it.

“Picturing an image in your mind’s eye is like running the system from the top down, rather than from the bottom up,” says Zeman.

To find out how MX’s brain worked, Zeman put him into an MRI scanner and showed him pictures of people he was likely to recognise, including former UK prime minister Tony Blair. The visual areas towards the back of his brain lit up in distinctive patterns as expected. However, when MX was asked to picture Blair’s face in his mind’s eye, those areas were silent. In other words, the visual circuits worked when they had a signal from the outside world, but MX couldn’t switch them on at will (*Neuropsychologia*, vol 48, p 145).

But then came an unexpected finding. Even though MX couldn’t form a picture of Tony Blair, he could handle tasks that would seem to require one – stating Blair’s eye colour without seeing a picture of him, for example. He also aced other tests, such as imagining standing in his own home and counting its windows.

Soon after Zeman published his results, he heard from another 21 people who said they had this condition, which he called aphantasia. However, unlike MX, they claimed to have had it from birth. A battery of cognitive tests soon confirmed they had the condition and that, like MX, they had no problem getting on with life, including tasks that might seem impossible without a mind’s eye.

It might sound paradoxical, but for me these “tests of visual imagery” aren’t difficult to complete without a mind’s eye. Take the ➤

How clear is your mind’s eye?

This puzzle is used as a test for mental imagery. If you can solve it quickly, you probably have a strong mind’s eye.

To begin, stare at this shape until you can remember it. Then turn the page and find three similar objects. Which ones are rotated versions of this shape, and which are not?



DAVID REHOR/MILLENNIUM IMAGES

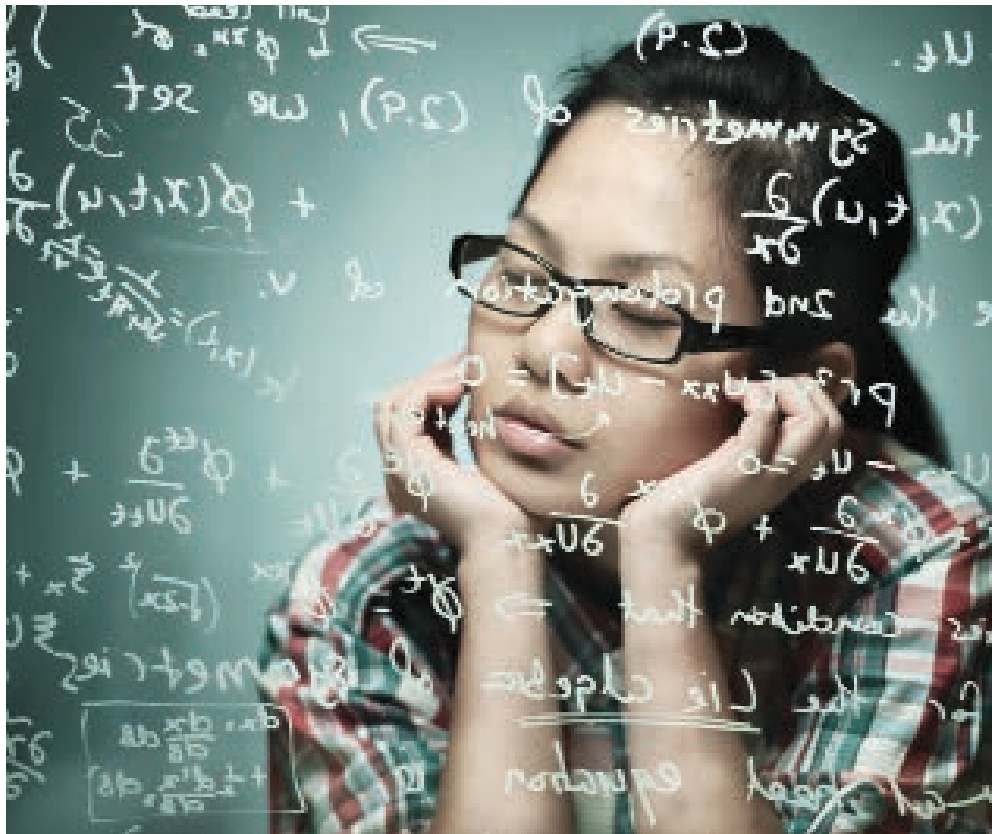
window-counting test. I don't experience a mental image of my house, but rather an awareness of being there. Venter says it is the same for him. He doesn't have to "see" events to relive them, he says. "There are different ways of storing visual information than just the picture."

To find out about these, I spoke to Stephen Kosslyn, a cognitive neuroscientist at the Minerva Schools university in San Francisco. He says visual imagery is not constructed in just one way in the brain. There are separate circuits for things like shape, colour and spatial relationships, among much else. It seems as if not all my circuits are disabled. I have no trouble answering some of the test questions Kosslyn ran me through, like, "Which is darker green: spinach, or the outside of an avocado?" But others were tougher. Kosslyn asked me: "In the upper-case letter 'A', what shape is formed by the enclosed region?" After concentrating for a few moments I replied that it was a triangle, and Kosslyn asked me how I had arrived at it. It almost felt as if I was drawing the letter, I said.

Kosslyn thinks the drawing sensation gives us a clue as to how aphantasics deal with apparently pictorial information. He suggests that to complete these tasks I am piggybacking on neurons involved in controlling physical movements rather than using the visual brain circuitry.

Kosslyn once had a patient who had a stroke that damaged the visual areas of her brain and left her blind. She too could still complete what might be considered visual tasks. When Kosslyn asked her to imagine the letters of the alphabet one at a time and tell him whether they had any curved lines, she could do it perfectly. "But if you watched her," says Kosslyn, "she was drawing the letters with her fingers."

Zeman agrees this might be how some aphantasics do it. "There are many ways of representing the world beyond the visual," he says. "You might be able to imagine a letter



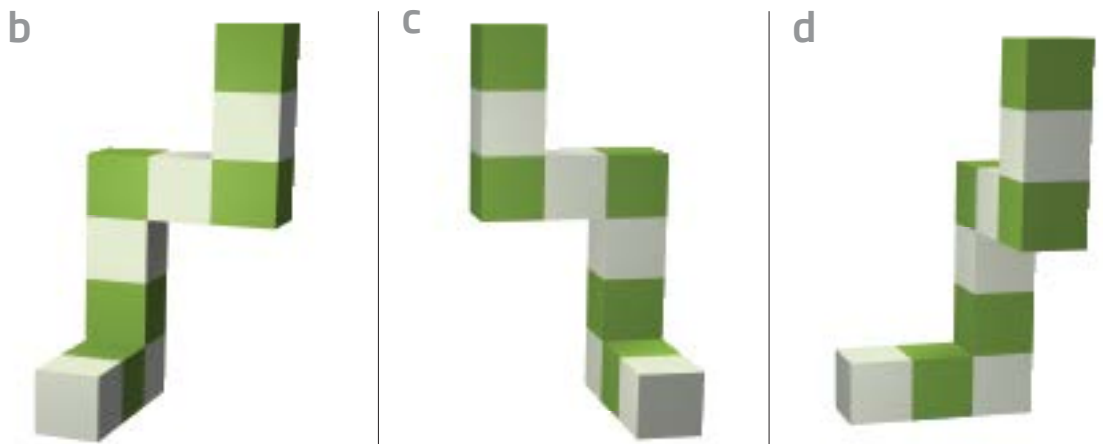
because you can see it or because you can imagine making it."

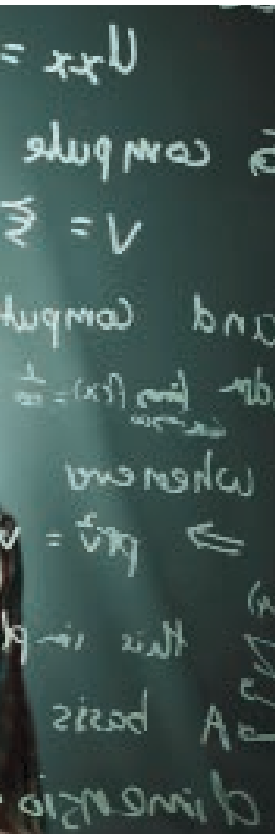
It's not just that mental pictures aren't the only way to process "visual" information; they might not even be the best way. Zeman has evidence that points to this. "A surprise is that we've been contacted by a certain number of aphantasic artists," he says. You might assume that artists in particular need a mind's eye, but perhaps this isn't the case. Then there is Venter, who sees a connection between his aphantasia and his scientific achievements. "I've known many people with photographic memories for facts who can't even remotely combine them conceptually like I can," he says. Perhaps not having a

mind's eye forces you to see the world differently, resulting in an unusual eye for art or alternative modes of thinking.

MX provided more concrete evidence of the unique skills of people who have aphantasia. When Zeman first tested him, he gave him a classic test of proficiency with mental pictures. The challenge was to work out which images are the same as a guide image, only rotated, and which are not (see diagram, page 35). The greater the rotation, the longer it takes most people to perform the mental gymnastics and work out if there is a match. The theory goes that people rotate a mental image in their heads, and the more they have to manipulate it, the longer it takes

Which of these shapes is a rotated version of A on page 35? It's a good test of your mind's eye, because it probably involves playing with images of the shapes in your mind. (See the end of the article for the solution.)





It's a rare mind that works exclusively in concepts not images

off to sleep. So although they can't consciously control their mental pictures, the capacity itself doesn't seem to have vanished.

There are parallels with blindsight, says Zeman. People with this condition have no conscious awareness of being able to see, yet can navigate a cluttered room without problems. Zeman suspects that some aphantasics process visual information in similar ways: when mentally counting the windows in their home, they don't think they are seeing a picture, but they are – subconsciously.

For people with no experience of aphantasia, this probably sounds bizarre. Yet the idea has prompted some researchers to think seriously about whether aphantasics are really missing a mind's eye, or just not noticing that they have one. Stefania de Vito at the University of East London, UK, and Paolo Bartolomeo at Pierre and Marie Curie University, Paris, suggest that aphantasics do retain the capacity to form mental images – they simply believe they can't. They propose that extreme stress could induce this change, pointing to an 1883 case study of a “Monsieur X”, who developed aphantasia after a period of intense anxiety (*Cortex*, vol 74, p 334).

This probably isn't the whole story, Zeman thinks, because there are examples of aphantasics who developed the condition when they weren't overly stressed, including MX. But it does raise a tantalising question for people like me: is aphantasia sometimes reversible? Can a blind mind be trained to imagine pictures?

Mental reset

Joel Pearson at the University of New South Wales in Sydney, Australia, has tested exactly that. To get started, he needed an objective way to measure the clarity of people's mental imagery, a tall order because such tests tend to rely on subjective ratings.

In 2008, he found a way. He divided people's fields of vision so that they saw a set of horizontal red stripes through one eye and vertical green stripes through the other. Under these circumstances, people perceive not a combination of the two patterns but one or the other. At first there's a 50-50 chance of perceiving either. But when Pearson flashed the stripes in front of people several times he found that, for most people, the probability of perceiving the pattern they had spotted the first time round went up. That is presumably because they had created a picture of the pattern in their mind that primed them to perceive it again. When he tried this on aphantasics, he saw the priming effect in some but not in others. Conclusion? Some of the aphantasics have an unconscious mind's eye, but some really don't.

to solve the task. MX apparently wasn't doing that – yet he completed the challenge faster than average.

We still don't know exactly how people with aphantasia do what they do, but the idea that various brain circuits can be used to process visual information is gaining traction. Zeman reckons we all use different circuits to some extent. It's just that most people with a functioning mind's eye rely predominantly on visual circuitry. But could some of us be better than others at using non-visual circuits to process visual information? And would this give people an edge at certain tasks and jobs?

We don't have enough evidence to answer that question yet. But Zeman has been running a large experiment probing these areas and results are expected next month.

Zeman has now encountered many people with little or no mind's eye. Like me, many of them didn't grasp that they were missing anything until they heard about aphantasia, and most say they felt only a mild sense of loss. But for some, the condition is distressing. I spoke to one patient of Zeman's who mourns the ability to conjure up pictures in his head. “I'd love to be able to recall memories of my childhood holidays or my first kiss. It would be like waking up from being blind,” he says.

Happily, there are reasons to think such an awakening is possible. For one thing, many aphantasics dream in pictures and some see flashes of imagery under certain circumstances, such as just before they drift

PICTURE THIS

Try imagining these scenes, designed to exercise different aspects of mental imagery, including colour and movement. How clear are the mental images?

The silhouette of the sun rising above the horizon

Clouds gather. A storm blows up, with flashes of lightning

The sky brightens and a rainbow appears

Find out how you score and take a more detailed test of your mind's eye at bit.ly/blindmind

It was those who appeared to have a mind's eye without realising it that Pearson wanted to coach. So next he asked them to try visualising either the green or red striped pattern for a few seconds every day for five days.

Back in the lab, he had them repeat the process, and this time he asked them to subjectively rate the strength of the image. Immediately afterwards, he simultaneously flashed the red pattern in one eye and the green in the other as before, and measured whether people had a perception bias. He was now armed with both a subjective and an objective rating of the minds' eyes.

In some cases he found the objective rating remained constant but the subjective rating improved, suggesting that the training had helped people begin to access a previously subconscious mind's eye (*Frontiers in Psychology*, vol 3, p 224).

In the spirit of investigation, I had to give it a go myself. When I did, a shapeless light flashed into my mind. It was the first time in my life that I've seen anything approaching a picture in my head. But I don't think I'll be continuing with the training. I've learned that I see the world in a unique way and I don't want to give that up. ▢

Dustin Grinnell is a writer in Los Angeles

Eye test solution: Only C is a rotated version of A.