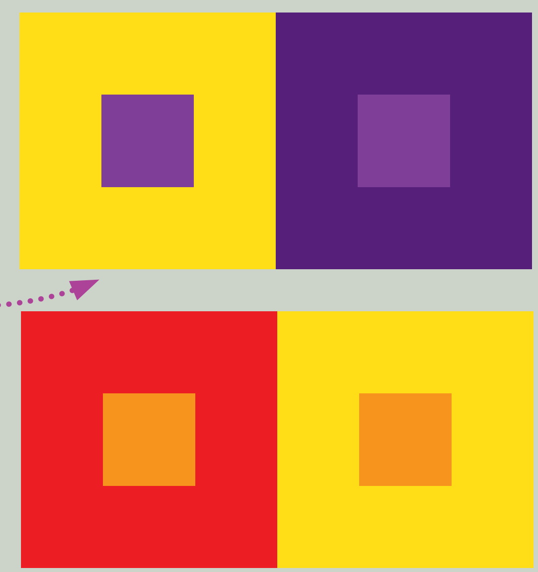
LIGHT & DARK

Our ability to see in colour and in different shades of light and dark is a very handy aid for survival. It enables humans to pick out objects from a jumbled background that would be difficult to spot in pure black and white. Colour vision helped early peoples to identify brightly coloured fruits and berries as food and to spot dangerous threats such as certain venomous snakes. But the colours and shades of light and dark we think we see can prove tricky for our brains to always spot correctly.

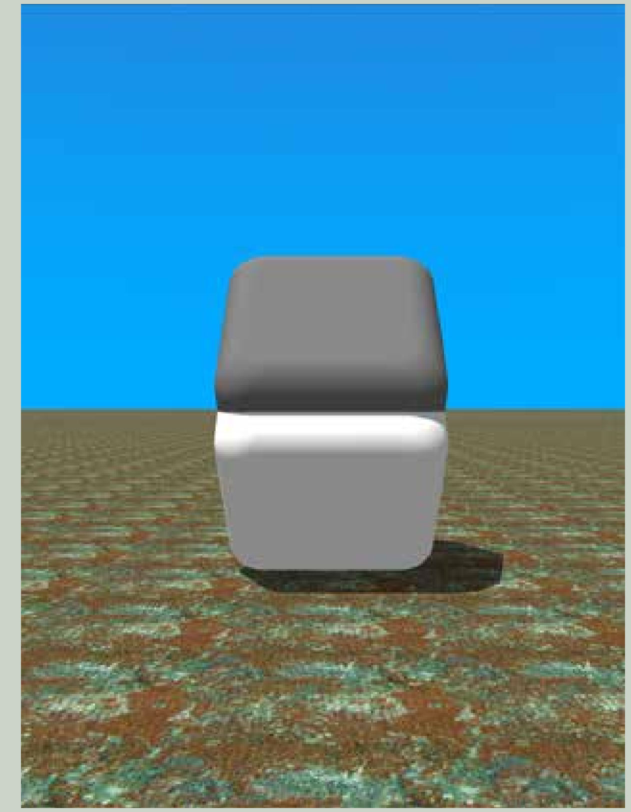
Although colours are registered by the cones in your retina, your brain sometimes processes them differently according to other elements in the scene. For example, a colour may appear lighter than it really is if it is surrounded by a background that is darker. Your brain can also be influenced by what it perceives as objects casting shadows over a scene; the two illusions on the opposite page show examples of this.

Are the small purple squares exactly the same shade as each other?



BRIGHTER AND LIGHTER

Check out the pair of squares with orange centres just above. Which of the orange squares seems a lighter shade? You'll probably answer the left one on the red background, but in fact they're both exactly the same shade. The same goes for the purple squares in the top image. When placed on a darker coloured background, a coloured area can appear clearer and brighter. This effect is called simultaneous brightness contrast.

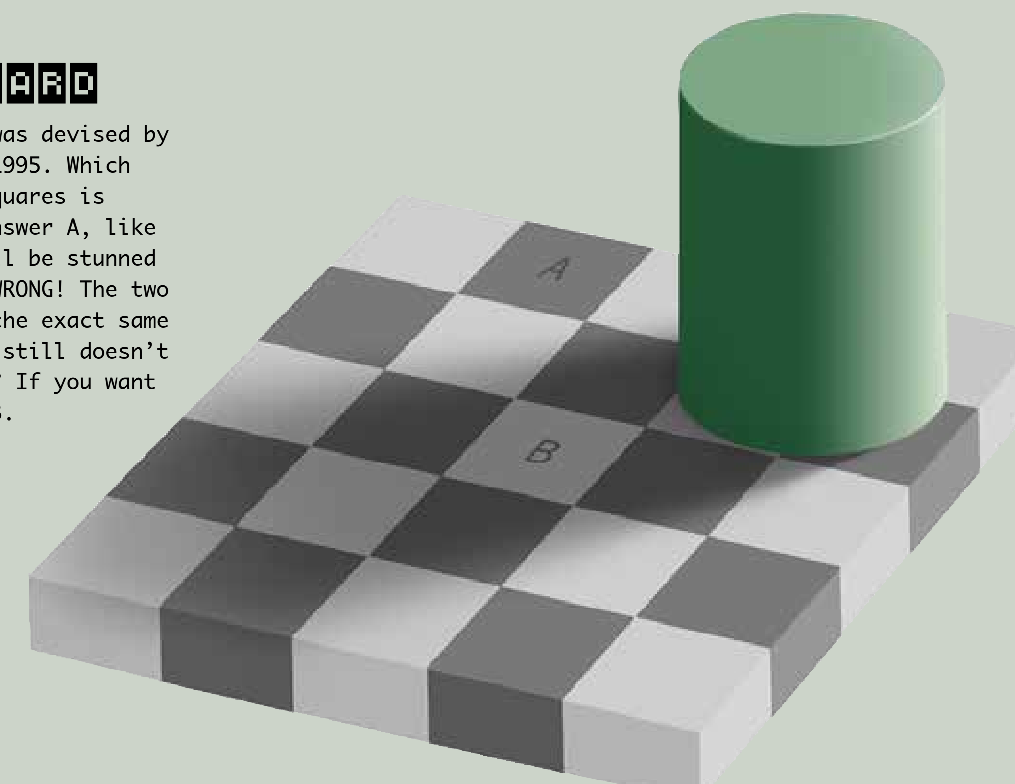


LOTTO CUBES

R. Beau Lotto is a neuroscientist who founded the Lotto Lab to investigate how our brains perceive things. This cracking illusion from the Lotto Lab features two cubes whose white and grey edges convince your brain that the faces of the cubes are quite different colours, with the "white" face merely in shadow. In fact, they are precisely the same shade of grey.

ADELSON CHEQUERBOARD

This famous illusion was devised by Edward H. Adelson in 1995. Which of the two labelled squares is the darkest? If you answer A, like everyone does, you will be stunned to learn that you're WRONG! The two squares are actually the exact same shade. Look again. It still doesn't seem correct, does it? If you want proof, turn to page 63.

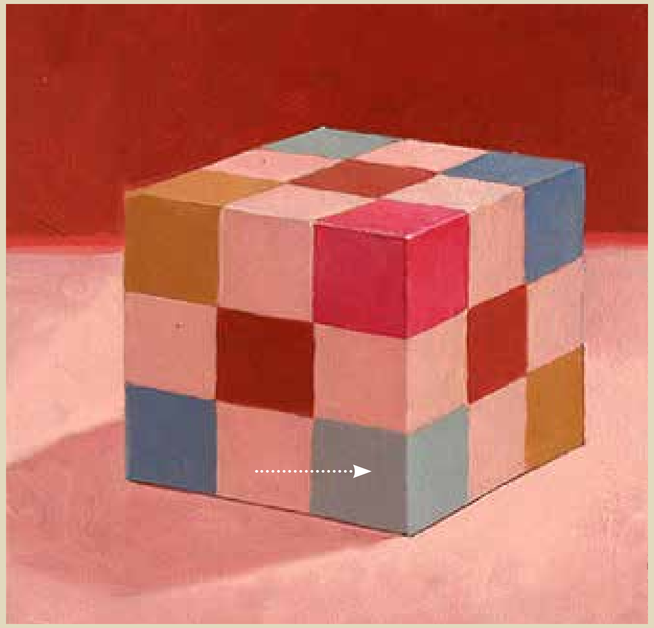


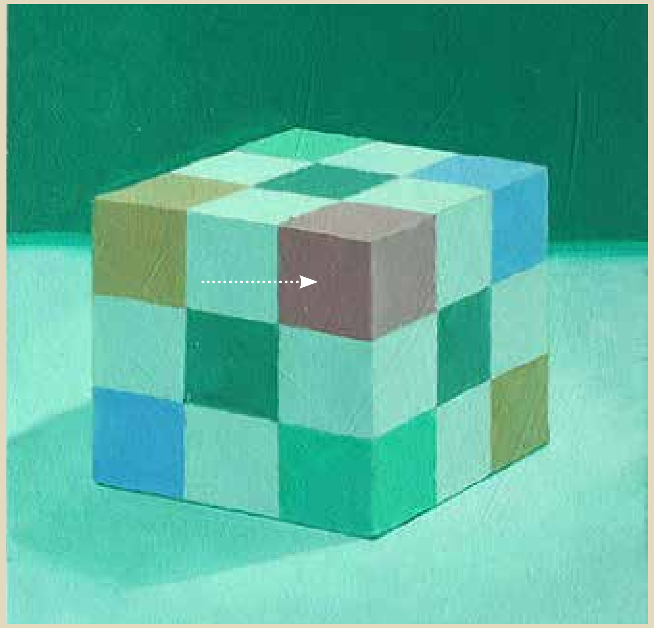
COLOUR PUZZLERS

As we've seen, our brain doesn't always get things right when it comes to colour and shades of light and dark. We don't view a single colour in isolation. We view it as part of a scene where other colours are present. Sometimes, neighbouring colours can influence the colour the brain thinks it is seeing.

Below is an illusion that will mangle your brain. Look at the two squares indicated by the arrows and name their colours. In the left image, the bottom corner square is greeny-blue and in the right image, the top corner square is a pinky hue... or is it?

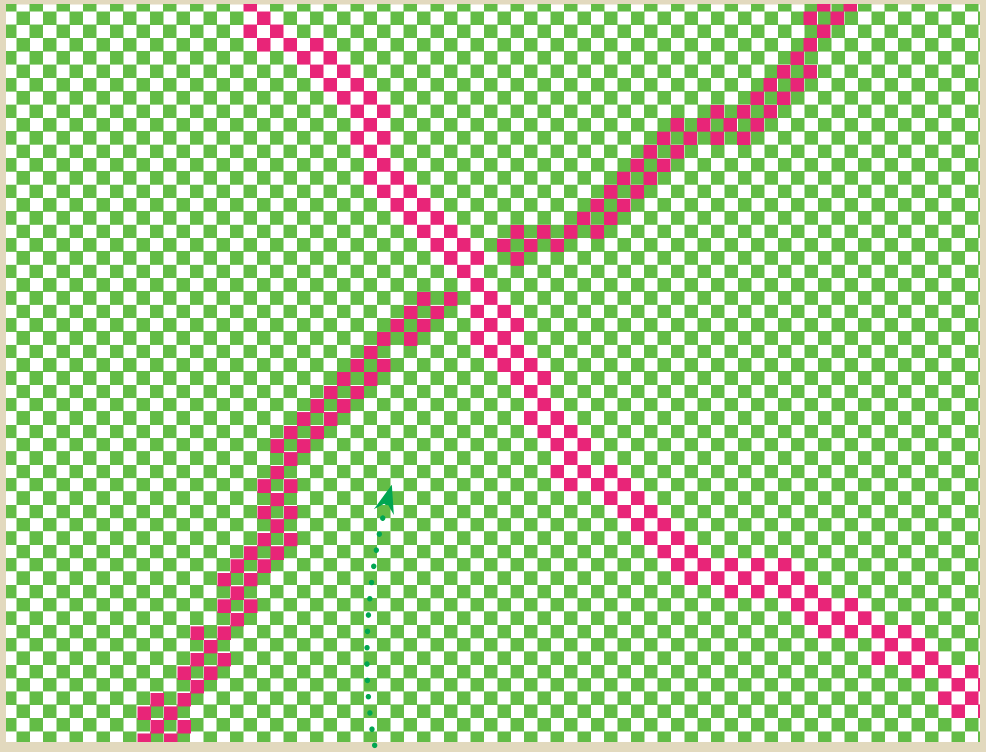
The amazing truth is that the two squares are both the same shade of the same colour – grey. What's happening is that your brain is making assumptions about the light reflected from the image and is influenced by the colours around it. Other illusions, like the red cross image (top right) and the Munker-White Illusion (bottom right), also use the presence of other colours nearby to trick your brain.





GURNEY ILLUSION

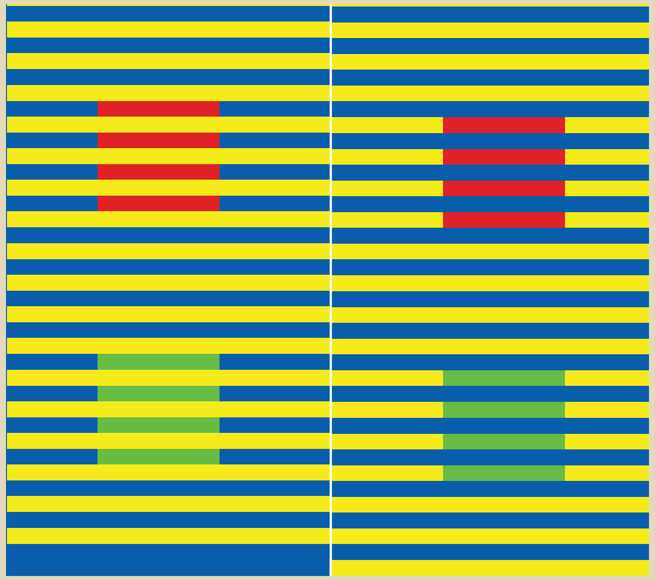
This astonishing illusion is by USA-based artist James Gurney. Look at the two squares indicated by the arrows in each picture. Then place sticky notes or pieces of paper or card over the image so that you can see only those two squares. What colour do they look now?



This cross is made up of red and pink squares... or is it?

COLOUR CROSS

This X shape appears to be made up of small red and pink squares. In fact, the whole X and all of its squares are the same colour. When the squares next to them are green, the squares look red, but when the neighbouring squares are white, the red squares appear pink.



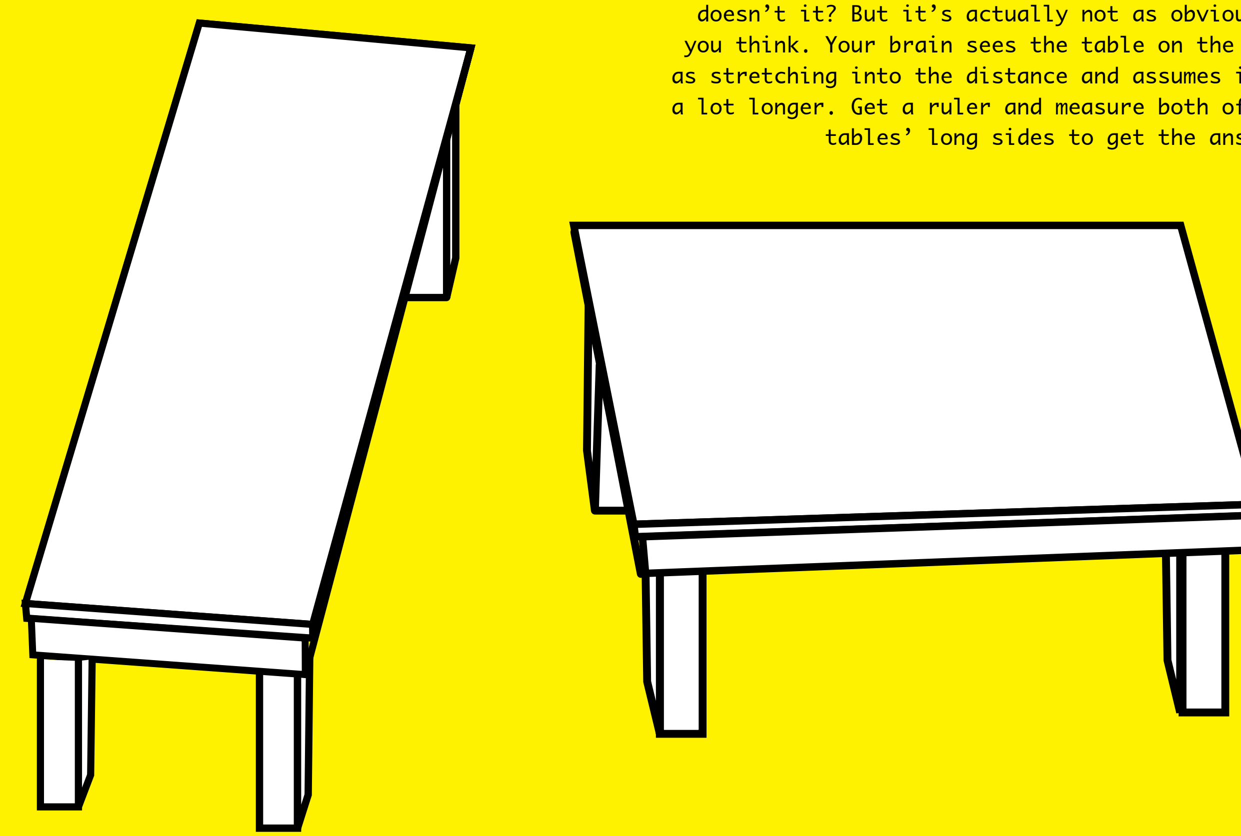
MUNKER-WHITE ILLUSION

Believe it or not, the two squares at the top are the exact same shade of red, and the two at the bottom are the same green colour. The proximity of bright yellow bars surrounding and crossing the two left-hand squares tricks the brain into registering the squares as lighter colours than they really are.

BRAIN KNOWS BEST

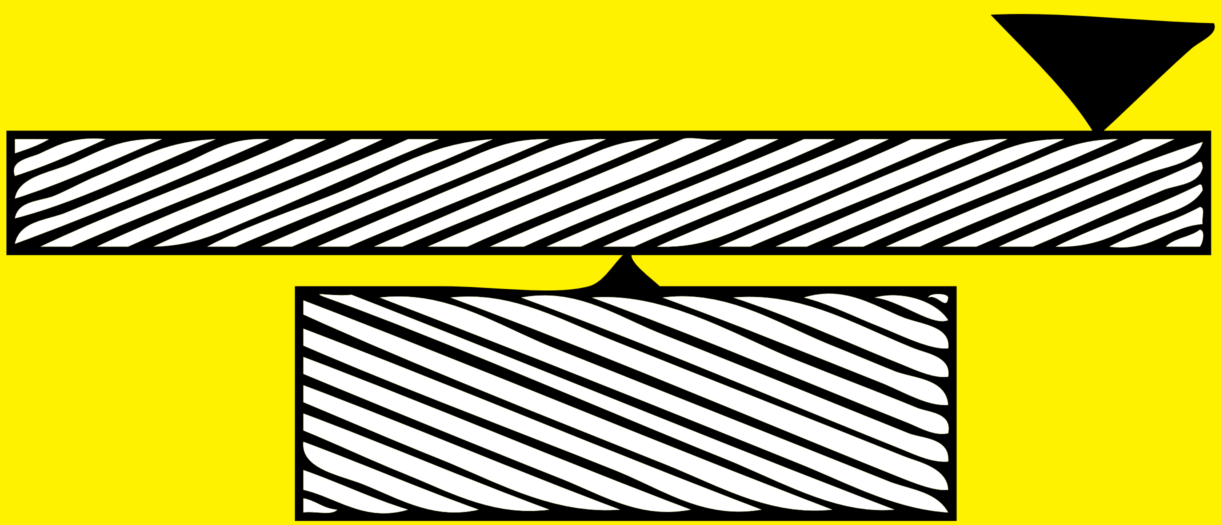
Most of the time, your brain is working overtime. It is dealing with many, many different inputs from your senses, which send back millions of individual nerve signals every minute. To cope, your brain makes some assumptions and comparisons based on your memory and experience. Scientists don't fully understand how it manages to do this, but they do know it can sometimes get it wrong and be tricked into thinking one thing is another.

Here are three sets of images that your brain makes mistakes in processing. The Two Tables Illusion was developed by Stanford University psychologist Professor Roger N. Shepard, in the 1990s, whilst the Jastrow Illusion is 100 years older. Both see your brain make a size comparison that it gets wrong in different ways.



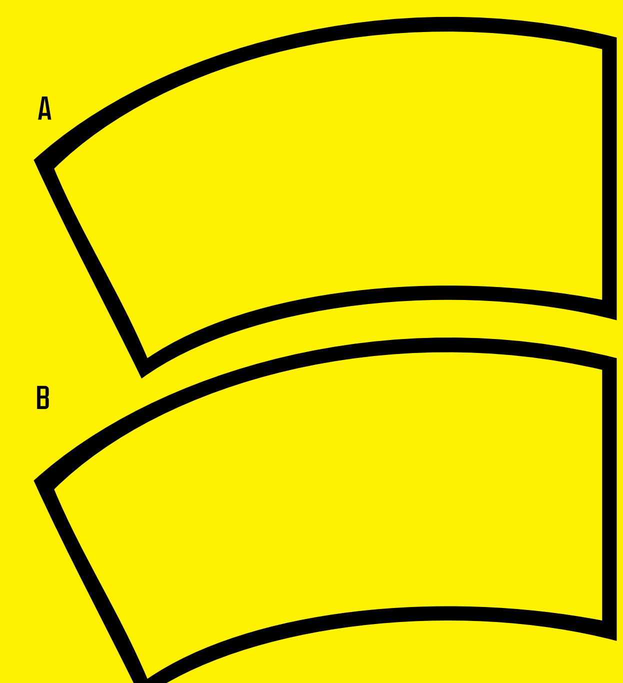
TWO TABLES ILLUSION

Which table is longer? It looks pretty obvious, doesn't it? But it's actually not as obvious as you think. Your brain sees the table on the left as stretching into the distance and assumes it is a lot longer. Get a ruler and measure both of the tables' long sides to get the answer.



A QUESTION OF BALANCE

The simple shaded seesaw or balance below is tilted down on the right-hand side by the triangular weight resting on top of it... Right? Wrong! The balance is totally, utterly level. The illusion is created partly through the diagonal line pattern and partly by the brain assuming that a weight on one side of a seesaw pushes that side down and the other side up.



JASTROW ILLUSION

Is Shape B longer than Shape A? You have five seconds to decide. Quick! We reckon you'll say yes... but the answer is no. They're both the same size.

Cover Shape A with a piece of paper and use a piece of string to measure the top and bottom edges of Shape B. You'll find the top is longer than the bottom. Your eye and brain assess the size of the two shapes by comparing the two edges nearest to each other – the shorter, bottom edge of Shape A with the longer, top edge of Shape B.