

How Your Brain Works

*Inside the Most Complicated Object in
the Known Universe*

NEW SCIENTIST



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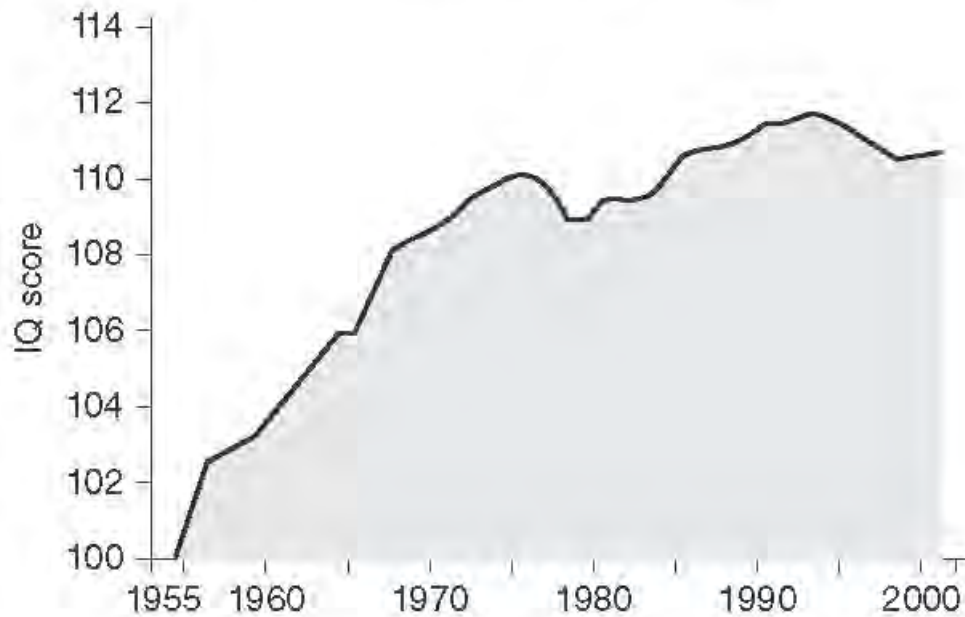
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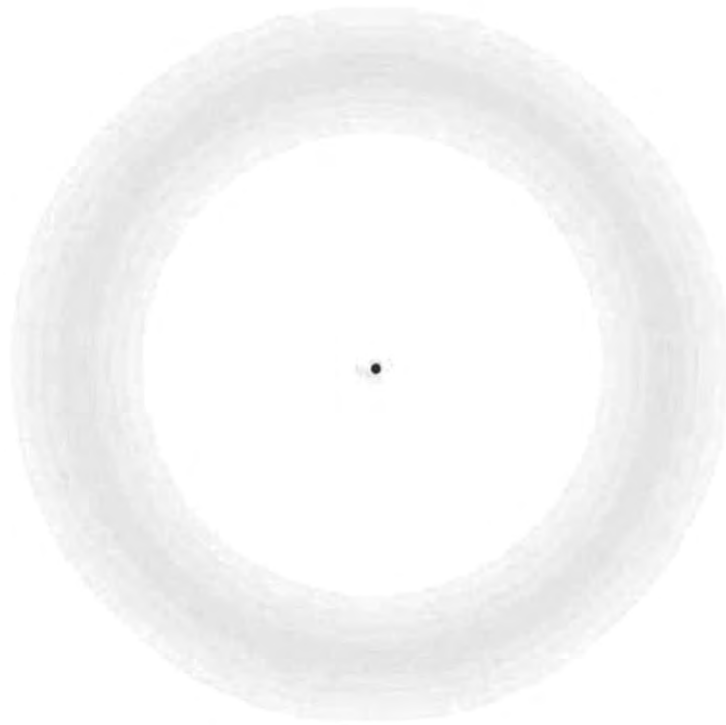
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The rise of average IQ scores of military conscripts in Norway has slowed and started to reverse. Similar patterns are seen in a few other countries

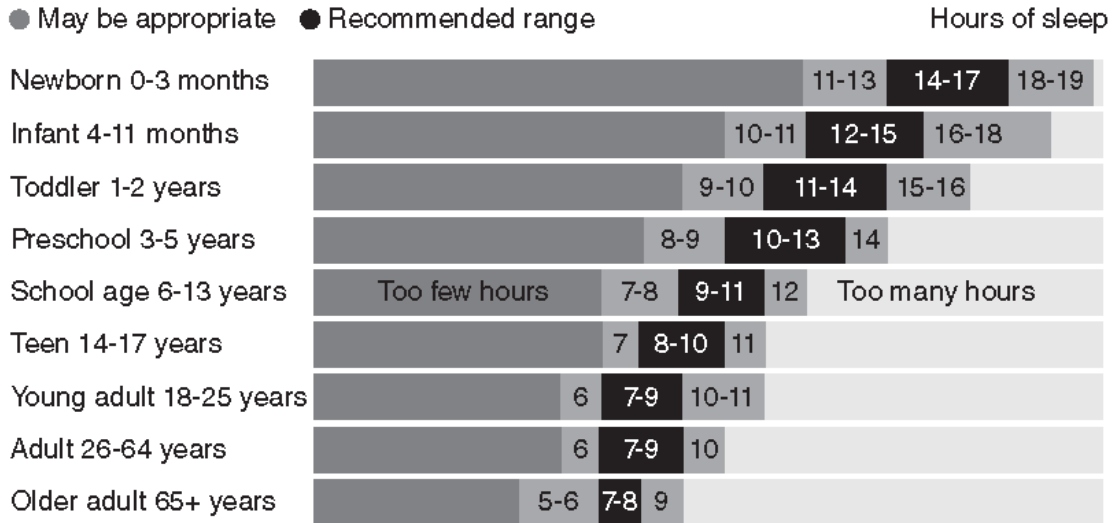


The pattern of IQ scores among military conscripts in Norway



Troxler's fading

How Your Brain Works – Chapter 8



How much shuteye do I need? Sleep need varies as we age, and for each individual.

Fifty ideas

This section helps you to explore the subject in greater depth, with more than just the usual reading list.

Five ideas for places to visit

- 1 Ramon y Cajal – Library of the Cajal Institute in Madrid, where there is a small exhibition of Cajal’s game-changing drawings of neurons dating from the early 1900s. By prior appointment only.
Contact details at: <http://www.cajal.csic.es/ingles/>
- 2 See the skull of Phineas Gage, and the tamping iron that went through it, destroying his left frontal lobe. Gage’s freak injury in 1848 revealed the frontal lobe’s role in personality and impulse control.
Warren Anatomical Museum, Harvard, 10 Shattuck St. Boston, MA 02115
<https://legacy.countway.harvard.edu/menuNavigation/chom/warren/exhibits.html>
- 3 Einstein’s brain can be found at the Mütter Museum, 19 S 22nd St, Philadelphia, PA 19103 <http://muttermuseum.org/exhibitions/albert-einsteins-brain/>
- 4 Freud’s House, London. See the famous couch where Freud attempted to delve into the dark recesses of his clients’ minds. 20 Maresfield Gardens, London NW3 5SX <https://www.freud.org.uk/>
- 5 Phrenology heads – Before we were able to look inside the brain, phrenologists tried to understand behaviour via the bumps on our heads and the shape of our skulls. The archive of the Edinburgh Phrenological Society, including variously shaped heads, is on display at the Anatomical Museum, Edinburgh University.
<http://www.ed.ac.uk/biomedical-sciences/anatomy/anatomymuseum/exhibits/masks>

Ten facts

- 1 Size doesn't necessarily matter. An average male brain weighs around 1,400g. Einstein's brain, at 1,230g, was slightly below average. Anatole France, who won the Nobel Prize in Literature in 1921 had even less up top at 1,017g. Whatever made them geniuses, it certainly wasn't a larger-than-average brain.
- 2 Pain is perceived in the brain but the brain itself contains no pain receptors. This is how some kinds of brain surgery can be done while the patient is awake. The blood vessels and membranes around the brain, however, do have pain receptors, which is why we get headaches.
- 3 While in the womb, up to a quarter of a million new cells form every minute, making 1.8 million new connections per second. About half of these will later be lost, leaving only those reinforced by use.
- 4 If you unravelled the human cerebral cortex it would measure 2,500cm², about the same as an A2 size sheet of paper.
- 5 The average person spends 25 years of their life, around a third of the average lifespan, asleep.
- 6 The idea that we use only 10 per cent of our brains is a myth. We use all of it, but not all at once.
- 7 Neurons are not the most common cells in the brain. This prize goes to the **glia**, which provide structure and technical support to the neurons.

- 8 Neurons that have been covered in **myelin**, a fatty white sheath that is added to the most commonly used pathways in the brain, can transmit electrical messages ten times faster than an unmyelinated neuron.
- 9 The magnet in an MRI scanner is as powerful as the ones used to pick up cars in a scrapyard.
- 10 An Iron Age brain, still preserved inside the skull of a man killed 2,600 years ago, was discovered in Yorkshire in 2008. Brains usually liquefy soon after death so this discovery, in oxygen deprived, waterlogged soil, was incredibly rare.

Ten quotes

- 1 “Men ought to know that from the brain, and from the brain only, arise our pleasures, joy, laughter and jests, as well as our sorrows, pains, griefs, and tears.”
Hippocrates (about 400 BCE).
- 2 “As long as our brain is a mystery, the universe, the reflection of the structure of the brain will also be a mystery.”
Santiago Ramon y Cajal.
- 3 “People who boast about their I.Q. are losers.”
Stephen Hawking.
- 4 “The highest activities of consciousness have their origins in physical occurrences of the brain, just as the loveliest melodies are not too sublime to be expressed by notes.” W. Somerset Maugham.
- 5 “All that we know, all that we are, comes from the way our neurons are connected.”
Sir Tim Berners-Lee.
- 6 “There is no scientific study more vital to man than the study of his own brain. Our entire view of the universe depends on it.”
Francis Crick.
- 7 “Any man who reads too much and uses his own brain too little falls into lazy habits of thinking.”
Albert Einstein.
- 8 “If I had to live my life again I would have made a rule to read some poetry and listen to some music at least

once a week; for perhaps the parts of my brain now atrophied could thus have been kept active through use.”
Charles Darwin.

9 “Until you make the unconscious conscious, it will direct your life and you will call it fate.”
Carl Jung.

10 “Toleration is the greatest gift of the mind; it requires the same effort of the brain that it takes to balance oneself on a bicycle.”
Helen Keller.

Five literary references

- 1 “I am a brain, Watson. The rest of me is a mere appendix.”
Arthur Conan Doyle’s Sherlock Holmes in *The Adventure of the Mazarin Stone*.
- 2 “My own brain is to me the most unaccountable of machinery – always buzzing, humming, soaring roaring diving, and then buried in mud. And why? What’s this passion for?”
Virginia Woolf.
- 3 “If both the past and the external world exist only in the mind, and if the mind itself is controllable – what then?”
George Orwell, *1984*.
- 4 “Of what a strange nature is knowledge! It clings to a mind when it has once seized on it like a lichen on a rock.”
Mary Shelley, *Frankenstein*.
- 5 “I like nonsense, it wakes up the brain cells.”
Dr Seuss.

Five jokes

- 1 What is everyone's favourite band when they're asleep?
REM
- 2 Where would your brain choose to go on holiday?
Hippocamping
- 3 What do you call a head *without* 86 billion neurons?
A no-brainer
- 4 I finally figured out what was wrong with my brain. On the left there's nothing right and on the right there's nothing left.
- 5 When should you carry a big umbrella?
During a brainstorm.

For more brain jokes, see:

<http://faculty.washington.edu/chudler/jokes.html>

Five things for kids

- 1 **Brain jelly:** Search online for a brain-shaped jelly mould. Turn it upside down and fill with a tangle of strawberry laces. Add light pink jelly or blancmange and leave to set. Makes a treat for all brain enthusiasts – and great for Halloween.
- 2 **Test your reaction time:** One person holds a 30cm ruler at the 30cm end and lets it hang down. The other person puts their hand beneath the ruler, ready to catch it when the first person drops it. Person 1 drops the ruler within 5 seconds. Note the number on the ruler where person 2 catches it. Repeat 3 times and take an average. This can be converted to reaction time as below.

Distance	Time
2 in (~5 cm)	0.10 sec (100 ms)
4 in (~10 cm)	0.14 sec (140 ms)
6 in (~15 cm)	0.17 sec (170 ms)
8 in (~20 cm)	0.20 sec (200 ms)
10 in (~25.5 cm)	0.23 sec (230 ms)
12 in (~30.5 cm)	0.25 sec (250 ms)

- 3 **The memory tray:** Add a handful of small objects to a tray. Show the tray to the child for 30 seconds then remove it and ask them to recall as many items as they can. Repeat with the whole family to see whose memory is best.

- 4 **A smartphone-based reading game** developed by researchers in Finland, which aims to help children with little access to education escape poverty by becoming literate.
<http://info.graphogame.com/>
- 5 **Visual illusions online:** A treasure trove of visual illusions and kid-friendly explanations
<http://psylux.psych.tu-dresden.de/i1/kaw/diverses%20Material/www.illusionworks.com/>

Ten ideas for finding out more

- 1 BrainFacts.org
A public outreach website from the Society for Neuroscience.
- 2 Neuroscience for Kids. Fun neuroscience facts and explainers from University of Washington neuroscientist Eric Chudler.
<http://faculty.washington.edu/chudler/neurok.html>
- 3 *The Brain: A very short introduction* by Michael O'Shea. Oxford University Press (2005).
- 4 *NeuroPod*: The neuroscience podcast of *Nature* magazine.
<http://www.nature.com/neurosci/neuropod>
- 5 The whole brain atlas: a collection of brain scans in health and disease.
<http://www.med.harvard.edu/AANLIB/home.html>
- 6 The brain from top to bottom.
A web-based introduction to the brain by researchers at McGill University in Montreal, Canada.
<http://thebrain.mcgill.ca/avance.php>
- 7 The Human Connectome Project aims to map the brain's circuit diagram. See latest project updates here.
<https://www.humanconnectome.org/>
- 8 *The Brain with David Eagleman*. A six-part television series available on DVD and with an accompanying book.

9 Testmybrain.org

Get a measure of your brain skills compared to others and contribute to neuroscience studies while you are at it.

10 An interactive introduction to neuroscience from the UK-based science centre @Bristol.

<http://www.youramazingbrain.org.uk/>

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Chapter 3: The pattern of IQ scores among military conscripts in Norway

Chapter 5: Troxler's fading

Chapter 8: How much shuteye do I need? Sleep need varies as we age, and for each individual. Source: National Sleep Foundation

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