

How to read minds

by Dr Damian Cruse

Where is my mind?

All of your thoughts and experiences are the result of your brain cells (neurons) sending signals to each other in a process we call neural **firing**.

In fact, your thoughts and experiences, and all of who you are, **is** the firing of your neurons.

Just like a video on your phone is actually just a set of tiny voltages across transistors on the phone's microchips, your thoughts and experiences are actually just tiny electrical signals across neurons in your brain.



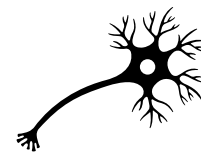
Some brain facts

Your brain contains 80-billion neurons that communicate with one another through small electrical signals.

When you're a baby, your neurons have about 50% more connections with one another than when you're an adult. During adolescence, you lose those extra connections – a process called **synaptic pruning** – as your brain becomes specialised for the world in which you live.

Brain injury is the leading cause of death and disability in the world. You should look after your brain.

Some ways to measure brain activity



Because your neurons communicate with each other through electrical signals, we can detect the electrical activity of your neurons by measuring the tiny voltages they create on the surface of your head – a method called **electroencephalography (EEG)**.



When neurons fire a lot, they use up more oxygen, just like you might breathe faster after exercising. This means that we can measure neurons firing by measuring which parts of the brain use oxygen most – a method called **functional magnetic resonance imaging (fMRI)** that requires a doughnut-shaped magnet about 500-times stronger than a fridge magnet.



Oxygenated blood is more red than deoxygenated blood. If we fire (harmless) lasers into your skull, we can measure the 'colour' of the brain underneath, and use that colour to work out which parts of the brain are using oxygen most, and are therefore most active. This is called **functional near-infrared spectroscopy (fNIRS)**.

A significant problem

Every day in the United Kingdom, twenty people are taken to hospital because they appear to be unconscious after a brain injury. Some of these people develop a **Prolonged Disorder of Consciousness** in which they open their eyes again but show little or no evidence that they are conscious of themselves or their environments.

To make the best medical decisions for these patients, we need to know whether they are conscious or not. Because they can't physically show us that they are conscious by, for example, giving us a thumbs-up when we ask them to, we need to be able to read their minds instead.

Reading minds



Helping people with brain injuries

Once we've chosen how we're going to measure brain activity, we can start to read minds. Using knowledge from Psychology and Neuroscience, we can **read out** how different thoughts are represented in the brain.

For example, we can detect whether someone is imagining moving their hand or their foot, just by looking at their brain activity. **Brain-computer interfaces** can then translate that thought into an action, such as controlling a character in a video game.

If a person in hospital can't physically give us a thumbs-up to show that they're conscious, but they can imagine giving us a thumbs-up instead, we could read that thought using our measures of brain activity and **know** that they're conscious.

As technology becomes more advanced, people who are paralysed by their injuries are beginning to have access to devices that can translate their thoughts for communication.



Things to think about

- If your mind is in your brain, could a machine ever have a mind and be conscious?
- How could we ever know if a machine is conscious?
- Are animals conscious in the same way as humans?
- What would this mean for the ethics of animal welfare?
- How are you making sure to keep your brain and mind safe and healthy?

