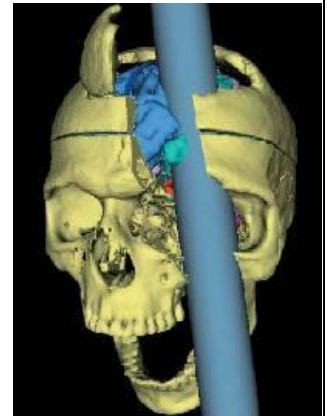


Stories of Science: Who was Phineas Gage?

The story about one of neuroscience's most famous patients.

"The wound was oblique, traversing the cranium in a straight line from the lower jaw on one side to the centre of the frontal bone above, where the missile emerged; the iron was forcibly thrown into the air and picked up some distance from the patient, smeared with brains and blood." Henry Bigelow, Professor of Surgery at Harvard Medical School

This is a description of a horrific injury inflicted on Phineas Gage in 1848 whilst working on a new railway line in Vermont, USA. The "missile" was an iron rod approximately 3cm in diameter and 1.1m long. Astonishingly, Phineas recovered and was able to return to a working life. But this story isn't simply one of a man surviving destruction of a portion of his brain. Following the accident Phineas was reported to have become a "boastful, brawling, foul-mouthed, dishonest useless drifter, unable to hold down a job, who died penniless in an institution." This account turns out to not be entirely true, but his case is famous for being the first evidence that the part of the brain that Phineas lost could be the home of our personality and where our self-control resides. The idea that distinct parts of the brain had different functions was a great focus of study in the 19th century and here was a captivating piece of evidence illustrating the role of the frontal lobe (the front portion of the brain).



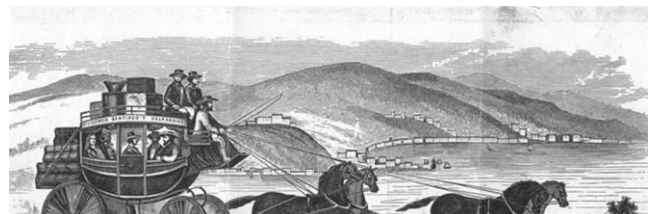
Gage pictured holding the missile which passed through his brain

No Longer Gage

Phineas was initially treated by a young local physician, Dr Harlow. In his detailed case records, Harlow described how previous to the accident Phineas was looked upon by those who knew him as a shrewd, smart businessman, very energetic and persistent in executing all his plans of operation." Following his remarkable physical recovery, however "his mind was radically changed, so decidedly that his friends and acquaintances said he was "no longer Gage"; Phineas's personality had been altered by injury to this specific part of his brain.

Two short months after the accident Phineas was keen to return to work but it seems that this apparent change in personality meant his employers saw fit to refuse his request. Nevertheless, he did find work, and for the remaining twelve years of his life he worked at a livery stable and became a coach driver (the kind pulled by six powerful horses). This clearly refutes the claims that he was "a useless drifter, unable to hold down a job." Phineas was recruited to work on a route in Chile, South America. An advert for a stagecoach driver might say "Driver required. Must be reliable, resourceful and possess great endurance. Will

need to maintain horses and coach and get on well with passengers." In addition, Phineas would have to do this in a country speaking a different language. Phineas had less brain tissue than he did before the accident and yet somehow his brain had recovered some or most of that function. Scientists refer to this 'remoulding' of the brain as neuroplasticity; the workings of the brain can change.



A Concord coach or 'diligence' on the Santiago-Valparaiso route. It is the kind Phineas is believed to have driven.

A Place In History

So here we have a man who due to the considerable progress in medicine in the 19th century survived an iron bar shot right through his head. This traumatic brain injury seemed to have resulted in dramatic changes to his personality, although evidence here is vague, and it appears the changes were not long-lasting or incapacitating. This man then recovered physically and mentally enough to hold down a job of quite some responsibility. It's a fascinating case which deserves its place in history and psychology textbooks.



Comprehension and Reflection Questions

1. Find out about the following parts of the brain and write a brief sentence or two about what function they have:

- a. The motor cortex
- b. The prefrontal cortex
- c. The hypothalamus

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2. The changes to Phineas's personality were attributed to brain injury, but some scientists suggest that some or all of these changes could have been down to the emotional effects of surviving such an injury and the treatment he probably received from strangers staring at his wounds etc. Imagine you were Phineas, describe some of your feelings in the weeks and months following the accident.

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3. Dr Harlow was careful to record details of Phineas's recovery process in the hours and days following the accident.

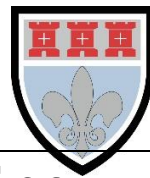
Why is it so important for doctors and scientists to record their observations and results in a clear and concise way?

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Extension Activities

Ideas for things to do next:

Find out about some other parts of the brain and their functions.

Find out about modern techniques for studying the brain and its function such as CT scans and functional MRI.

Research other cases of brain injury, including strokes and tumours, and what scientists have learnt from them.

Find out about the concept of neuroplasticity including cases where the brain can learn to adapt to the loss of a sense such as sight
(<https://www.newyorker.com/magazine/2017/05/15/s-seeing-with-your-tongue>)

Further Reading

Ideas for things to read next:

Much of the information described here comes from the author of one of the most comprehensive descriptions of Phineas Gage, Malcolm Macmillan of the School of Psychology, Deakin University. A summary of his findings can be found here: Phineas Gage Information Page at <http://www.uakron.edu/gage>

You can read Dr Harlow's accounts of Phineas's recovery online:

https://en.wikisource.org/wiki/Passage_of_an_Iron_Rod_Through_the_Head

https://en.wikisource.org/wiki/Recovery_from_the_passage_of_an_iron_bar_through_the_head

Ideas for things to read next:

Mapping Connectivity Damage in the Case of Phineas Gage

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0037454>.

This work from 2012 using modern imaging techniques predicts the exact region and pathways that would have been damaged in Phineas's brain.

And something to watch:

3 clues to understanding your brain

https://www.ted.com/talks/vilayanur_ramachandran_on_your_mind