

Growth Mindset, Failure and Learning from Mistakes, 'Black Box Thinking' (extract) - Matthew Syed

In 2010 Jason Moser, a psychologist at Michigan State University, and colleagues, took a group of volunteers and gave them a test. As part of the setup, an electroencephalography (or ECG) cap was placed on their heads. This consists of a number of electrodes, which measure the voltage fluctuations in the brain.

In effect Moser wanted to see what was happening at a neural level when the volunteers made mistakes. He was interested in two brain signals in particular. One is called Error Related Negativity, or ERN. This was discovered simultaneously by two research teams in 1990, and is a negative signal, originating in the anterior singulate cortex, a brain area that helps to regulate attention. This reaction is likely involuntary and is the inevitable brain response to making a **mistake**.

The second signal under investigation was Error Positivity, or Pe. this is observed 200-300 milliseconds after the mistake and is associated with heightened awareness. It is a separate signal from ERN, emerges from a different part of the brain, and happens when we are focusing on our **mistakes**.

Moser was aware that previous studies had shown that **people tend to learn more rapidly when their brains exhibit two responses**. Firstly, a larger ERN signal (i.e. a bigger reaction to the mistake) And secondly a steady Pe signal (i.e. people are paying attention to the error, focusing on it, so they are more likely to learn from it).

Before beginning the experiment Moser divided the students into two groups according to how they answered a pre-set questionnaire. The questions were designed to elicit something called 'mindset'. People in a **Fixed Mindset** tend to believe their basic qualities, like their intelligence or talents, are largely fixed traits. They strongly agree with statements like 'you have a certain amount of intelligence, and you can't really do much to change it.'

People in a **Growth Mindset**, on the other hand, tend to believe that their most basic abilities can be developed through hard work. They do not think that innate intelligence is irrelevant, but believe that they can become smarter through persistence and dedication. As a group they tend to disagree with statements such as: 'Your intelligence is something about you that you can't change very much.'

Mindset is not quite as binary as it might sound. After all, most people tend to think that success is based on a combination of talent and practice. But the questionnaire forces volunteers to rate on a scale how we think about these issues. It drills down into *our implicit beliefs and assumptions, the thoughts that often drive our behaviour when we haven't got time to think*.

... As he looked at the electrical activity in the brain, Moser started noticing a dramatic difference in how the two groups responded to their mistakes. Both the Fixed and Growth Mindset groupings exhibited a strong ERN signal. Of course, they did. Speaking

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metaphorically, the brain sits up and pays attention when things go wrong. Nobody likes to mess up...

Yet, when it came to the Pe signal, the two groups with strikingly different. Those in a Growth Mindset recorded a signal that was vastly higher than those in a Fixed Mindset. Indeed, compared with those of the extreme end of the fixed spectrum, those in the Growth Mindset had a Pe signal three times larger...

It was as if the brain in Fixed Mindset people was ignoring the mistakes; was not paying attention to them. On the other hand, for those in the Growth Mindset, it was as if the mistake was of great interest; attention was directed towards it. What's more, the size of the Pe signals directly correlated with improvement in performance in the aftermath of mistakes.

Moser's research is fascinating because it provides a metaphor for many of the insights of this book. **When we engage with our errors we improve.** This is true at the level of systems... and at the level of individuals... It is also true, in a manner of speaking, at the level of the brain.

But it also explains why some people **learn from their mistakes**, while others do not. The difference is ultimately about how we conceptualise our failures. Those in the Growth Mindset, by definition, think about error in a different way from those in the Fixed Mindset. Because they believe that progress is driven, in large part, by practice, they naturally regard failure is an inevitable aspect of learning.

(p272-275, Black Box Thinking)