Medical Xpress

Do we really only use 10% of our brain?

August 1 2014, by Amy Reichelt

As the new film Lucy, starring Scarlett Johansson and Morgan Freeman is set to be released in the cinemas this week, I feel I should attempt to dispel the unfounded premise of the film – that we only use 10% of our brains. Let me state that there is no scientific evidence that supports this statement, it is simply a myth.

The concept behind the film is that through the administration of a new cognitive enhancing drug, our female lead character, Lucy, becomes able to harness powerful mental capabilities and enhanced physical abilities. These include telekinesis, mental time travel and being able to absorb information instantaneously. Viewed as such, the human brain should be essentially capable of these feats, we just fail to push our capacity. So if we can unlock the "unused" 90% of the brain we too could be geniuses with super powers?

The beginnings of the myth

The 10% myth may have begun in the early 1900's when the neurosurgeon Karl Lashley removed portions of the brains of rats who were trained to navigate around a maze. He found that he could damage areas of the cerebral cortex and the rats were still able to perform the task correctly, as well as behave normally. The greater the area of damage, the more impaired the rats were at the task. However, these deficits could be recovered through additional maze training and time.

Lashley proposed the principle of "equipotentiality", meaning that different areas of the brain can carry out the same functions. He added to this the principle of "mass action" – in which the brain acts as a whole in many types of learning.

Function and dysfunction of the brain

But we know now that the brain is not a uniform structure. A small stroke can be devastating. Depending on the area damaged, different brain functions are disrupted. For instance injury to the motor cortex can lead to paralysis on one side of the body, damage to a small region of the frontal lobe known as Broca's area results in being unable to speak. Although there is some recovery of certain functions over time due to plasticity, where alternative areas of the brain can compensate for the damaged regions, recovery is rarely complete.

Neurodegenerative disorders such as Alzheimer's Disease and Parkinson's Disease target distinct brain regions. Memory deficits in Alzheimer's Disease are due to deterioration of the hippocampus, and motor dysfunction in Parkinson's Disease by loss of dopamine neurons in the substantia nigra. There is no recovery of function in these diseases, as the damage spreads no compensatory mechanisms step in.

We understand now that different brain areas function both separately and together to allow us to coordinate complex tasks. So at any moment we could be using 10% or 100% of our brain, depending on what we are doing.

To carry out actions as mundane as buying a coffee we have to use higher cognitive or executive functions to decide what we want, speech to communicate our choice, advanced cognitive processes to calculate the cost and fine motor skills to hand over the money. So many separate brain areas must work together to co-ordinate behaviour. Damage to a small region can cause massive disruption to the functional networks required.

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The hungry brain

Our brains are much more complex than Lashley's lab rats. The average human brain comprises of only 2% of our body mass, but uses 20% of our energy, much more than expected for our relative brain size. The cerebrum performs cognitive functions, the cerebellum controls motor coordination and the brainstem maintains essential unconscious functions such as breathing. Our brains are relatively large when compared to other animals, we wouldn't have evolved such an energy hungry and large brain unless we required it.

The majority of the energy consumed by the brain powers millions of neurons communicating with each other through electrical nerve impulses. This forms a control network that connects functionally distinct regions. If we did really only use 10% of our brain it wouldn't make sense to have such a large amount of energy powering an idle 90%.

We probably understand less than 10% of how the brain functions

Neuroscientists are still trying to understand how the brain functions. Currently, a major focus of research is into the role of different types of cells in the brain. In the brain only 10% of the cells are neurons; the other 90% are glial cells or astrocytes. These cells appear to be important in connecting neurons together, but recent research indicates they may be even more functionally important, particularly in forming memories.

Scientists are still trying to unlock the secrets of the brain. We do not yet understand what parts of the brain interact together to generate consciousness, or how our brain functions as a whole to control complex behaviours.

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