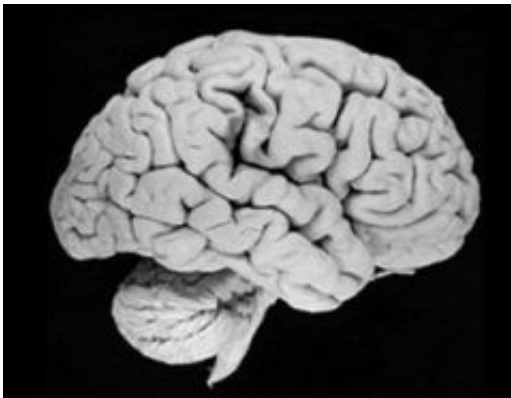


Remembering the future: Our brain saves energy by predicting what it will see

March 24 2010



Modern human brain. Credit: Univ. of Wisconsin-Madison Brain Collection.

(PhysOrg.com) -- Researchers have discovered that the brain saves energy by predicting what it is likely to see. According to scientists in the Department of Psychology at the University of Glasgow in collaboration with the Max-Planck Institute for Brain Research, Frankfurt, Germany, the visual cortex does not simply react to visual stimuli but proactively predicts what it is likely to see in any given context - for example, within familiar environments such as your house or office.

By doing so it uses less energy to process images, but if something unexpected were to appear in that familiar environment, the [visual cortex](#) becomes more active in order to process this information.

“Imagine your desk in your office,” said lead researcher Dr Lars Muckli. “You’ve seen it a million times so your [brain](#) knows what it looks like so it doesn’t need to spend lots of time processing the scene. It already has a mental image of it and so the brain predicts that this is what it will see before you walk into the room.

“However, if you were to walk in to your office one day and see someone totally unexpected sitting in your chair - the Prime Minister, for example, your brain would have to work harder to process the same scene.”

The findings build on a fairly new hypothesis developed by University College London neuroscientist Karl Friston called predictive coding - or free energy principle - which suggests the brain is actively predicting what input it will receive, rather than just passively processing information as it arrives.

Dr Muckli said: “By predictive coding we refer to the idea that the brain generates predictions that estimate the visual input it will most likely receive given the contextual information from the recent past. For the brain it’s really about surprise reduction.”

To test the predictive coding hypothesis, the Glasgow researchers conducted an experiment where 12 volunteer subjects were asked to view a visual stimulus while undergoing an fMRI brain scan.

The subjects had to look at a fixed point on a computer screen above and below which two dots would flash alternatively creating an illusion of motion.

For predictable/unpredictable trials, the researchers briefly presented a third dot on the screen. To test predictable stimulus the dot would appear at a point between the two other dots, timed to correlate to the illusion of

smooth movement. For the unpredictable stimulus it would appear out of synch with the motion illusion.

The primary visual cortex (V1) of each subject was monitored while the tests were undertaken and the results showed that the predictable patterns resulted in less activity in V1, compared to the unpredictable stimulus.

Dr Muckli said: “The brain expects to see things and really just wants confirm it now and again - it’s almost like remembering the future.

“It might explain why sometimes you don’t notice something different in a familiar environment because your brain is seeing what it expects to see, rather than what is actually there.

“What we need to do now is extend this research to consider predictive coding in more natural environments and other aspects of sensory perception.”

The paper, ‘Stimulus Predictability Reduces Responses in Primary Visual Cortex’, was published in the *Journal of Neuroscience*.

More information: Stimulus Predictability Reduces Responses in Primary Visual Cortex, *The Journal of Neuroscience*, February 24, 2010, 30(8):2960-2966; [doi:10.1523/JNEUROSCI.3730-10.2010](https://doi.org/10.1523/JNEUROSCI.3730-10.2010)

Provided by University of Glasgow

Citation: Remembering the future: Our brain saves energy by predicting what it will see (2010, March 24) retrieved 26 April 2024 from <https://medicalxpress.com/news/2010-03-future-brain-energy.html>

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