

# Brain more robust than previously thought

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The brain is well capable of coping with the erratic way individual brain cells transmit information. This robustness is quite useful because variation in signal transmission doesn't merely concern noise, but also contains valuable information. This is the finding of research conducted by neuroscientists from the University of Amsterdam. Their results are published in the current issue of *Cell Reports*.

Neuroscientists Jorrit Montijn, Guido Meijer, Carien Lansink and Cyriel Pennartz used a special microscope to measure the activity of hundreds of cells in the mouse [brain](#) across a period of several weeks. They specifically focused on the part of the brain that is responsible for processing visual input and registered the activity while the mice were being exposed to different images.

## Mood and hunger

The scientists discovered that the variability in [brain signals](#) doesn't concern noise, as has been assumed until now. The activity of a single neuron in response to an image is variable and unreliable. However, within the synchronised activity of a large number of neurons, patterns can be distinguished that seem to suggest the value of such variation. 'The relationships in activity between different neurons might provide an opportunity to states like mood and hunger to influence how, for example, the representation of an apple is processed in the brain', says Guido Meijer.

The neuroscientists suspect this phenomenon isn't only restricted to

mice, but could also be extrapolated to humans. Previous studies have shown a strong overlap between humans and mice in the way the examined part of the visual cortex operates.

## Order from chaos

Traditionally, the variation in brain response to a particular stimulus was regarded as something negative, as 'noise'. Meijer: 'This makes sense, because if a brain cell reacts to the same signal in different ways at different times, for example when exposed to the image of a tiger, you run the risk of the activity being so different at a certain point that the tiger isn't noticed, because the brain coincidentally registers it as a zebra, with all the accompanying consequences. The brain turns out to be organised in such a way that it minimises the risk of misclassification but is still able to ensure variability.'

The team's findings offer further insight into the complexity of the brain. It appears that an understanding of the behaviour of individual cells isn't sufficient to predict or understand the behaviour of the entire brain. 'The brain isn't a computer constructed from chips, which always process a signal in the same orderly fashion', Meijer adds. 'Nature is more chaotic, and is apparently also constructed to effectively manage this chaos. We have now found one of the underlying principles that ensures order arises out of chaos on the scale of large numbers of connected neurons.'

**More information:** Population-level neural codes are robust to single neuron variability from a multidimensional coding perspective'; J.S. Montijn, G.T. Meijer, C.S. Lansink & C.M.A. Pennartz; *Cell Reports*; DOI: [10.1016/j.celrep.2016.07.065](https://doi.org/10.1016/j.celrep.2016.07.065)

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