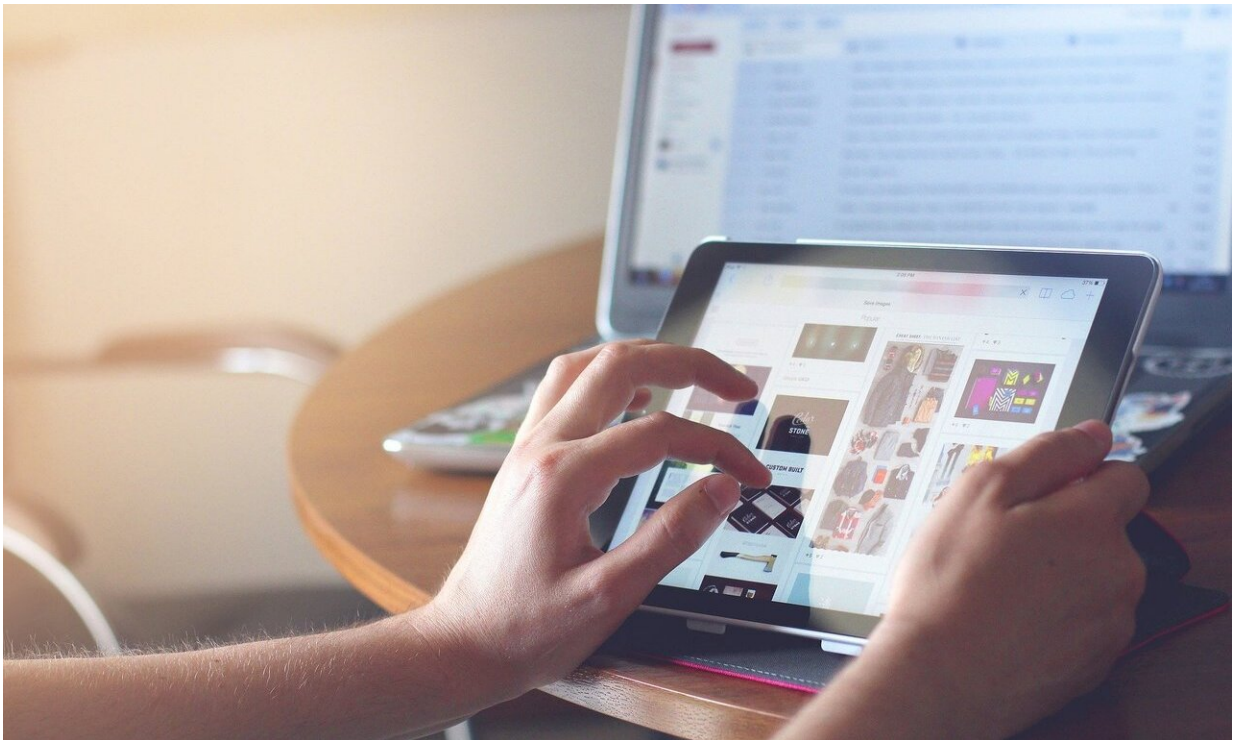


Feedback activity in the visual cortex is necessary for the perception of objects

June 30 2021



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An important function of vision is to segregate relevant figures from the irrelevant background. A visual stimulus drives a cascade of neural activity from low-level to higher level visual brain areas. The higher areas also provide feedback to the lower areas, where figures elicit more activity than the background, as if figures in the brain are highlighted

with extra activity. Researchers from the Netherlands Institute of Neuroscience (NIN) have now showed that feedback causes the extra neuronal activity in low-level areas and that the extra activity is essential for figure-ground perception. The findings were published in *Science Advances* on the 30th June.

Silencing the brain with light to change perception

The [primary visual cortex](#), also known as V1, is the first cortical brain area that receives [visual information](#) from the eyes and sends the information on to 'higher' brain areas for further processing. The research team, led by Pieter Roelfsema and Matthew Self, used optogenetics, a technique using light to silence [nerve cells](#), in V1 in mice who had been trained to detect [visual stimuli](#).

Disrupting the conversation between brain areas renders objects invisible

Critically, the researchers silenced only the late part of V1's response, allowing V1 to pass the visual information on to higher areas but preventing the [feedback](#) from higher areas back to V1. The result was dramatic and surprising: "When we allowed V1 to activate the higher areas, but curtailed feedback, mice only detected simple stimuli, but not stimuli on a complex background. This shows that feedback to V1 is necessary for figure-ground segregation" explained Lisa Kirchberger, the lead researcher on the project.

The researchers then silenced activity in the higher visual areas and found that it reduced the enhanced activity elicited by figures. "The results show that higher visual areas send information about objects back to V1 in the form of feedback. V1 and the higher areas are engaged in a conversation and if we disrupt the conversation by silencing V1 we can

render objects invisible."

The paper represents a major step forward in our understanding of the role that feedback and sustained neural activity play in allowing us to see the world. Mice have very comparable visual systems to humans and it is likely that these results will help us to understand what happens when the visual system makes mistakes, such as in the hallucinations and visual distortions present in diseases such as schizophrenia.

More information: L. Kirchberger et al., "The essential role of recurrent processing for figure-ground perception in mice," *Science Advances* (2021). advances.sciencemag.org/lookup...
[.1126/sciadv.abe1833](https://doi.org/10.1126/sciadv.abe1833)

Provided by Netherlands Institute for Neuroscience

Citation: Feedback activity in the visual cortex is necessary for the perception of objects (2021, June 30) retrieved 25 June 2024 from <https://medicalxpress.com/news/2021-06-feedback-visual-cortex-perception.html>

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