Don't believe your eyes: Team discovers way to induce visual hallucinations

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Credit: public domain

Visual hallucinations ... everyone has heard of them, and many people have experienced the sensation of "seeing" something that isn't there. But studying the phenomenon of hallucinations is difficult: they are irregular, transitory, and highly personal—only the person experiencing the hallucination knows what he or she is seeing, and representations of what's being seen are limited to verbal descriptions or drawings.

A research team of Bard Ermentrout from the University of Pittsburgh's Kenneth P. Dietrich School of Arts and Sciences and Joel Pearson from The University of New South Wales in Australia have come up with a way to create hallucinations that could make them easier to be studied objectively, potentially leading to new treatment methods. Ermentrout and Pearson outline their discovery in a paper, "Sensory dynamics of visual hallucinations in the normal population," which was published in the Oct.11 edition of *eLife*.

Most visual hallucinations are associated with illnesses such as schizophrenia, Parkinson's disease, migraines, and some forms of dementia, but healthy people can also experience hallucinations, from drugs, sleep deprivation, or loss of vision.

Ermentrout, Distinguished University Professor of Computational Biology and professor of mathematics, with partner Joel Pearson, associate professor of psychology, displayed a white ring that flickered against a black background between two and 30 times per second. The subjects, college students with no history of migraines or psychiatric disorders, uniformly "saw" what they all described as pale grey blobs rotating around the ring, first in one direction, then the opposite direction.

"Because the pale grey blobs are much simpler and uniform than more complex hallucinations that people generally see, they are much easier to study objectively," said Ermentrout.

To measure the hallucinations, Ermentrout and Pearson created a second ring with actual grey blobs inside the white ring, and participants were able to convey the relative strength of the hallucinations by indicating whether the hallucinated blobs were lighter or darker than the real blobs. The researchers were also able to have participants gauge the relative speed of the hallucinated motion by placing fixed lines at the top and the bottom of the white ring and noting how quickly the blobs passed the lines.

The researchers found that both the real blobs and hallucinations seemed to be perceived in the visual cortex, and they created a computer model of the visual cortex. They hope this model will help to explain both normal vision and hallucinations, and lead to the next step, determining whether the

experimental method can be used to model hallucinations produced by psychiatric disorders.

Ermentrout and Pearson were assisted by Stewart Heitmann at Pitt and Rocco Chiou, Sebastian Rogers, and Marcus Wicken at New South Wales.

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