VR goggles for mice create immersive scenarios for brain research

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Whether exploring distant galaxies or dashing about a fantasy world, virtual reality has immersed humans in extraordinary places. Now, it seems, mice will be able to join us. Researchers have developed a pair of virtual reality “goggles” that can plunge the rodents into various scenarios, from navigating mazes to experiencing the threat of a predator. While VR has been used in mouse experiments for years, the researchers say this has typically involved placing the animals on a treadmill in front of a large screen displaying a digital scene, with their heads fixed in place to allow study of their brains. Prof Daniel Dombeck, a co-author of the study at Northwestern University, in Illinois, said this had drawbacks as the mice could still see the static laboratory surroundings and equipment as they moved through the virtual world by walking on the treadmill. “We think [this] reduces their immersion in the virtual world,” he said. “Also, there is no depth information provided by big screens; the mice just see the same flat scene as we do when we watch TV.” By contrast, the new setup, revealed in the journal Neuron, involves a pair of lenses and screens mounted on stands either side of a mouse’s head, providing each eye with a 180-degree field of view. Again, the mouse’s head is fixed in place and it can navigate the virtual environment using the treadmill. “Our prototype goggle system described in this paper is a bit too large to be carried around by mice, but we plan to make smaller versions in the future that mice could carry around like a headset,” Dombeck said. The team says the new approach not only allows mice to see the virtual environment in 3D and eliminates visual clues of the lab, but offers a way to present virtual images from above – for example, of a hovering hawk. “This stimulation in real environments causes mice to freeze or flee, reactions they have to survive a predatory bird attack in the wild,” said Dombeck. The team’s experiments show mice react the same way in the VR goggle system. When the mice froze, activity from neurons in their brains involved in navigation suggested they were in a different location from where they actually were. “It was as if they were thinking about where they would rather be – a safe, covered location up ahead,” Dombeck said, adding such results might help explain how imagination arises in the brain. The team are also working to identify neurons involved in forming memories when mice navigate a maze, as well as which connections between them are modified to form memories, and how. “Answering these questions will help us understand how our brains know where we are in the world around us, how we form memories of those experiences, and ultimately,” said Dombeck, “how those memories are degraded in neurodegenerative diseases.”