Medical Xpress

Can animals count? Neuroscientists identify a sense of numeracy among rodents

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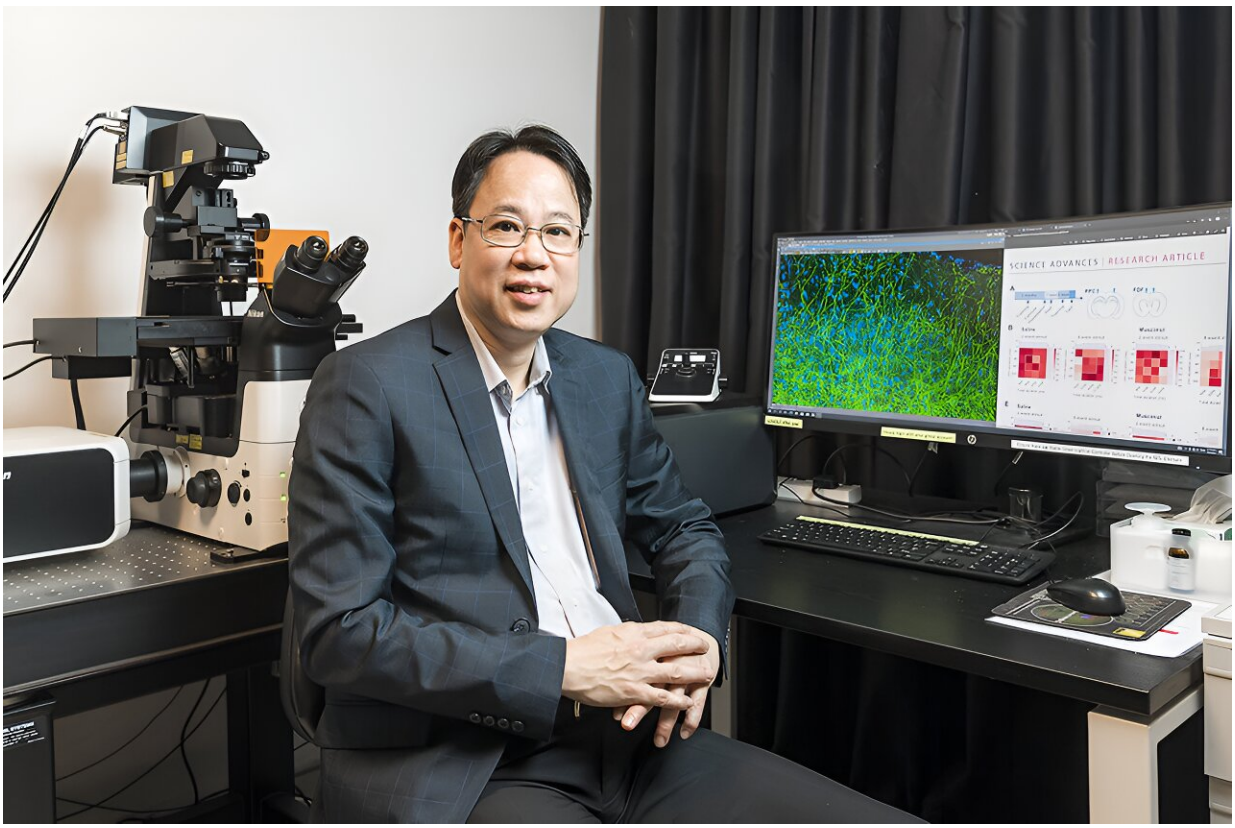

The study, published in *Science Advances*, sheds light on the mechanisms underlying numerical ability, a cognitive ability fundamental to mathematical aptitude, according to Professor Yung of City University of Hong Kong. Credit: City University of Hong Kong

A discovery that appears to confirm the existence of discrete number

sense in rats has been announced by a joint research team from City University of Hong Kong (CityUHK) and The Chinese University of Hong Kong (CUHK).

The findings offer a crucial animal model for investigating the neural basis of numerical ability and disability in humans, the Hong Kong-based researchers say.

This innovative study deployed a numerical learning task, brain manipulation techniques and AI modeling to tackle an ongoing debate about whether rats can count, says Professor Yung Wing-ho, Chair Professor of Cognitive Neuroscience at CityUHK, who collaborated with CUHK scientists at the Faculty of Medicine.

Their study, published in *Science Advances*, sheds light on the mechanisms underlying numerical ability, a cognitive ability fundamental to mathematical aptitude, which is a hallmark of human intelligence. The article is titled "Disparate processing of numerosity and associated continuous magnitudes in rats".

Professor Yung, also Associate Dean of the Jockey Club College of Veterinary Medicine and Life Sciences at CityUHK, said the research team set out to minimize the influence of continuous magnitudes in numerical tests and conducted a meticulous quantitative analysis in the study to determine the respective contributions of numbers and magnitudes.

The team developed an algorithm to generate stimuli that enable animals to focus only on numbers and minimize other distracting factors.

"This will help us better understand how animals perceive and quantify numbers," Professor Yung explains.

The team found that rats without any previous knowledge of numbers could develop a sense of numbers when trained with sounds representing two or three numbers. Despite the influence of continuous magnitudes, the rats consistently focused on the number of sounds when making choices for food rewards.

In addition, the study helps dissect the relationship between magnitude and numerosity processing. The researchers discovered that when they blocked a specific part of the rats' brains, called the posterior parietal cortex, the rats' ability to understand numbers was affected but not their sense of magnitude. "This suggests that the brain has a specific area for dealing with numbers," Professor Yung continues.

The study not only solves a long-standing mystery about how brains handle numbers but also offers new insights into studying the specific neural circuits involved in number processing in animals and how genes are associated with mathematical ability. The findings from neural network modeling could have practical applications in the field of AI.

More information: Tuo Liang et al, Disparate processing of numerosity and associated continuous magnitudes in rats, *Science Advances* (2024). DOI: 10.1126/sciadv.adj2566

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