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Committing the 'gamblers fallacy' may be in the cards, research shows

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It's called the gambler's fallacy: After a long streak of losses, you feel you are going to win. But in reality, your odds of winning are no different than they were before.

For years, the gambler's fallacy has been thought to be a prime example of human irrationality, but a new study published by researchers from the Texas A&M Health Science Center suggests that our brains naturally soak up the strange statistics of random sequences, causing us to commit the gambler's fallacy.

The study, which appears in the March 9 issue of the *Proceedings of the National Academy of Sciences*, was designed to help understand the

gambler's fallacy at the neural level. Researchers took a computer model of biological neurons and trained it with random sequences. They found that by simply observing a coin being tossed repeatedly, the neurons could learn to differentiate and react to different patterns of heads and tails. Most interestingly, the neurons that preferred alternating patterns such as head-tail significantly outnumbered the neurons that preferred repeating patterns such as head-head.

"In other words, these neurons behaved just like the gamblers in a casino: when the outcome of a fair coin toss is a head, they are more likely to predict that the following toss will be a tail than to predict it will be a head, despite the fact that either pattern is equally probable," said principal investigator Yanlong Sun, Ph.D., an assistant professor of microbial pathogenesis and immunology at the Texas A&M Health Science Center College of Medicine.

Hongbin Wang, Ph.D., a professor of microbial pathogenesis and immunology and a corresponding author on the paper, said the study demonstrates how neurons in our brains react to time-sensitive information.

"The model's rather surprising behavior has to do with the way these neurons encounter different patterns of heads and tails at different times," Wang said. "How likely an event is to occur and when it is to occur are two different questions, and traditional theories do not often distinguish them, which can lead to problems."

The finding that our brains may have naturally learned to commit the gambler's fallacy has implications for everything from medical decision making to building smarter machines.

"Physicians have these same sort of biases in terms of probabilities, and being aware of these biases and what causes them could help us train

physicians to be more accurate in their decision-making," said Jack Smith, M.D., Ph.D., professor of microbial pathogenesis and immunology and a co-author on the paper.

Smith said the research shows that we need to program machines more like neurons rather than just programming digital computers.

"If a computer is going to interact with humans it has to have similar behaviors, otherwise the interaction is strained," Smith said. "The more a computer's behavior is like the behavior we expect from people, the easier the interface between us and the device will be."

More information: Latent structure in random sequences drives neural learning toward a rational bias, Yanlong Sun, DOI: 10.1073/pnas.1422036112

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