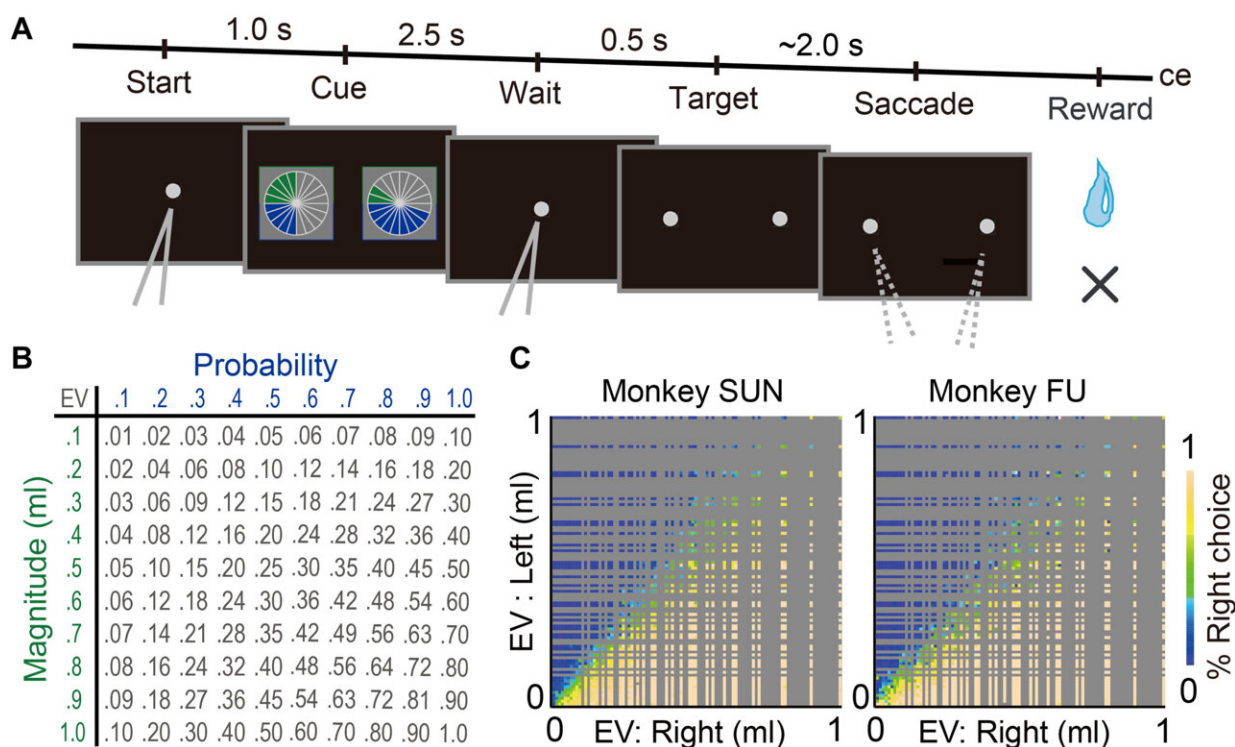


Unexpected wins in both humans and monkeys increase risk taking

May 26 2023



Lottery choice task and monkey choice behavior. (A) A sequence of events in choice trials. Two pie charts representing the available options were presented to the monkeys on the left and right sides of the screen. Monkeys chose either target by fixating on the side where it appeared. (B) Payoff matrix. Each magnitude was fully crossed with each probability, resulting in a pool of 100 lotteries from which two were randomly allocated to the left- and right-side target options on each trial. Expected values (EVs) are calculated in milliliters. (C) The frequency with which the target on the right side was selected for the expected values of the left and right target options. Credit: *Science Advances* (2023). DOI: 10.1126/sciadv.ade7972

How do humans make decisions when the outcomes are uncertain? One possible way would be to calculate the expected value of each option by multiplying each possible outcome amount by its probability and then choosing the option with the highest expected value. While this strategy would maximize the payoff in expectation, this is not what people tend to do. In particular, people seem to be irrationally influenced by past outcomes of their decisions when making subsequent choices.

Researchers from the University of Tsukuba have developed and validated a model ("dynamic prospect theory") that integrates the most popular model in [behavioral economics](#) to describe [decision-making](#) under uncertainty—prospect theory, and a well-established model of learning from neuroscience—reinforcement learning theory. This model more accurately described the decisions that people and monkeys made while facing risk than prospect theory or reinforcement learning theory alone.

Specifically, the researchers asked 70 people to repeatedly choose between two lotteries in which they could gain some reward with some probability. The lotteries varied in the size of the reward, the probability of receiving it, and the amount of risk involved. The results showed that immediately after experiencing an outcome that was bigger than the expected value of the selected option, participants behaved as if the probability of winning in the next lottery increased.

Senior author of the study Assistant Professor Hiroshi Yamada says "This behavior is surprising because winning probabilities were clearly described to the participants (participants did not have to learn them from experience) and these probabilities were also completely independent of previous outcomes." Using their dynamic prospect theory model, the researchers were able to determine that the change in

behavior is driven by a change in the perception of probabilities rather than by a change in valuation of rewards.

Yamada also says, "Such learning from unexpected events underlies reinforcement learning theory and is a well-known algorithm that occurs when people need to learn the rewards from experience. It is interesting that it occurs even if learning is not necessary."

In similar experiments with [macaque monkeys](#), whose brains closely resemble those of humans, essentially the same results were observed. Researchers commented that the similarity in [human](#) and monkey behavior was remarkable in this study.

Based on the results of this research, it is expected that the investigation of the monkey brain will lead to an understanding of the brain mechanisms involved in the perception of rewards and probability that all of us use when making risky decisions, as well as the joy we feel when we succeed.

The paper is published in the journal *Science Advances*.

More information: Agnieszka Tymula et al, Dynamic prospect theory: Two core decision theories coexist in the gambling behavior of monkeys and humans, *Science Advances* (2023). [DOI: 10.1126/sciadv.ade7972](https://doi.org/10.1126/sciadv.ade7972)

Provided by University of Tsukuba

Citation: Unexpected wins in both humans and monkeys increase risk taking (2023, May 26) retrieved 24 April 2024 from <https://phys.org/news/2023-05-unexpected-humans-monkeys.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private

study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.