

# Unraveling the humanity in metacognitive ability: Distinguishing human metalearning from AI

July 10 2023

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Credit: AI-generated image ([disclaimer](#))

Monitoring and controlling one's own learning process objectively is essential for improving one's learning abilities. This ability, often referred to as "learning to learn" or "metacognition," has been studied in educational psychology.

Metarecognition is the ability to objectively monitor, control, and improve one's learning ability. Researchers from the University of Tsukuba demonstrate that the human brain exhibits metacognitive abilities that regulate implicit motor learning to maximize monetary rewards. Unlike artificial intelligence (AI), which is perpetually optimal, human metacognition exhibits an asymmetric bias in managing rewards (monetary gain) and punishments (monetary loss).

Owing to the tight coupling between the higher meta-level and the lower object-level [cognitive systems](#), a conventional reduction approach has difficulty understanding the neural basis of metacognition. To overcome this limitation, the researchers employed a novel research approach where they compared the metacognition of AI to that of humans. The research is published in the journal *Nature Communications*.

First, they demonstrated that the metacognitive system of AI, which aims to maximize rewards and minimize punishments, can effectively regulate learning speed and memory retention in response to the environment and task.

Second, they demonstrated the metacognitive behavior of human motor learning, which demonstrates that providing monetary feedback as a function of memory can either promote or suppress motor learning and memory retention. This constitutes the first-ever empirical demonstration of the bi-directional regulation of implicit [motor learning](#) abilities by [economic factors](#).

Notably, while AI exhibited equal metacognitive abilities for reward and punishment, humans exhibited an asymmetric response to [monetary gain](#) and loss; humans adjust their [memory retention](#) in response to gain and their learning speed in response to loss. This asymmetric property may provide valuable insights into the neural mechanisms underlying human metacognition.

Researchers anticipate that these findings could be effectively applied to enhance the learning abilities of individuals engaging in new sports or motor-related activities, such as post-stroke rehabilitation training.

**More information:** Taisei Sugiyama et al, Reinforcement learning establishes a minimal metacognitive process to monitor and control motor learning performance, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-39536-9](https://doi.org/10.1038/s41467-023-39536-9)

Provided by University of Tsukuba

Citation: Unraveling the humanity in metacognitive ability: Distinguishing human metalearning from AI (2023, July 10) retrieved 2 May 2024 from <https://medicalxpress.com/news/2023-07-unraveling-humanity-metacognitive-ability-distinguishing.html>

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