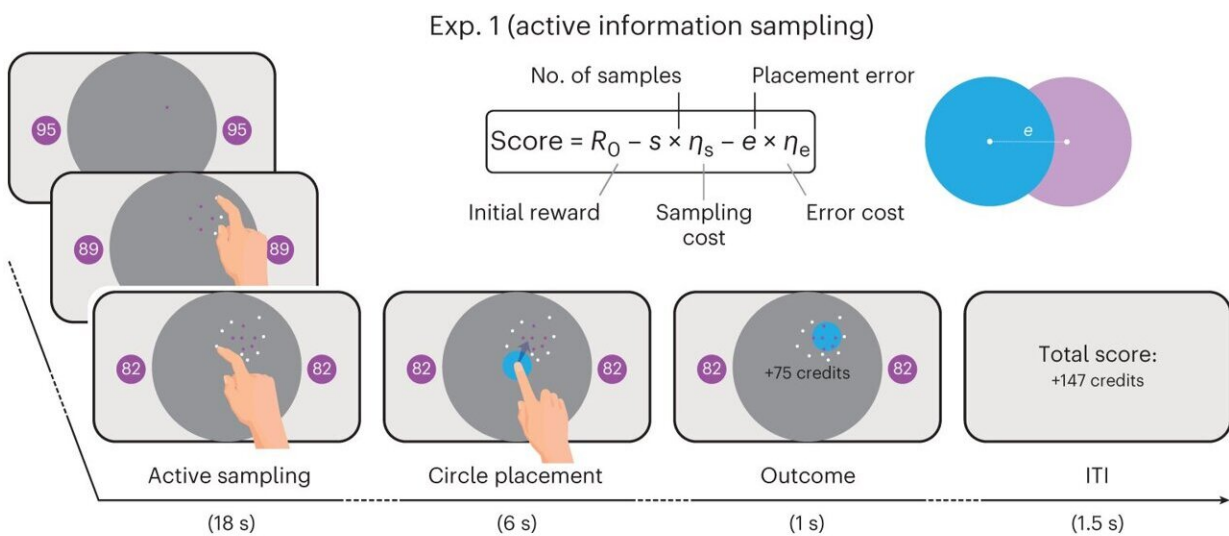
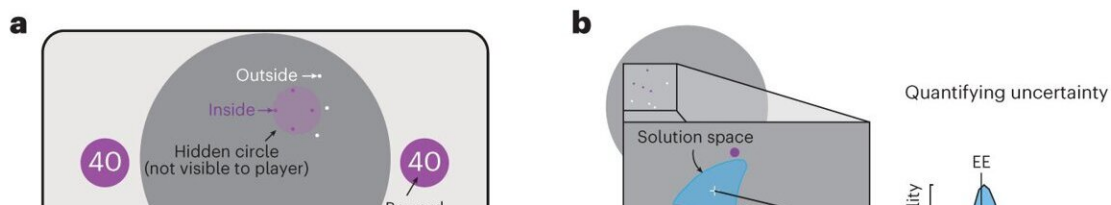


# How the human hippocampus contributes to value-based decision-making under uncertainty

June 14 2024, by Ingrid Fadelli



Exp. 2 (passive decision-making under uncertainty)



Task paradigms for Exps. 1 and 2. Credit: *Nature Human Behaviour* (2024). DOI: 10.1038/s41562-024-01855-2

Value-based decision-making is the process through which humans

choose between options associated with different costs or efforts, as well as rewards. These choices include, for instance, selecting different products at the grocery stores or making substantial lifestyle changes to accomplish a specific goal.

Past studies on animals have found that the [hippocampus](#), a key brain region associated with learning and memory, could play a role in the processing and evaluation of rewards, which is thought to also occur during value-based decision-making. In addition, research on humans has linked the hippocampus to memory, associative learning and imagination, which could also be connected to value-based decision-making.

Researchers at University of Oxford have recently been investigating the role of this brain region in the valuation and selection of different options. In one study involving individuals with cognitive impairments, they found that the hippocampus could support the active gathering of information that precedes value-based decisions in situations where outcomes are uncertain.

Their latest paper, [published](#) in *Nature Human Behaviour*, built on these findings to further explore how the hippocampus contributes to human decision-making under uncertainty. In this new work, they specifically examined how individuals with a [neurological condition](#) affecting the hippocampus decided between different options associated with varying rewards.

"The role of the hippocampus in decision-making is beginning to be more understood," Bahaaeddin Attaallah, Pierre Petitet and their colleagues wrote in their paper.

"Because of its prospective and inferential functions, we hypothesized that it might be required specifically when decisions involve the

evaluation of uncertain values. A group of individuals with autoimmune limbic encephalitis (ALE)—a condition known to focally affect the hippocampus—were tested on how they evaluate reward against uncertainty compared to reward against another key attribute: physical effort."

The researchers recruited 19 people with ALE, a neurological condition that is known to adversely impact the functioning of the hippocampus, as well as an equal number of people with no relevant medical diagnoses. The participants diagnosed with the disease had varying degrees of hippocampal damage, depending on how their illness had progressed and how quickly they had started treatment after its onset.

All the study participants took part in four different experiments designed to examine their value-based decision-making under varying uncertainty. Their responses and results were then analyzed using statistical methods, which also compared the performance of individuals diagnosed with ALE to that of healthy controls.

"Across four experiments requiring participants to make trade-offs between reward, uncertainty and effort, patients with acute limbic encephalitis demonstrated blunted sensitivity to reward and effort whenever uncertainty was considered, despite demonstrating intact uncertainty sensitivity," Attaallah, Petitet and their colleagues wrote.

"By contrast, the valuation of these two attributes (reward and effort) was intact on uncertainty-free tasks. Reduced sensitivity to changes in reward under uncertainty correlated with the severity of hippocampal damage."

Attaallah, Petitet and their colleagues found that patients diagnosed with ALE were sensitive to uncertainty, yet they were less sensitive to information related to changes in reward values and effort. Their study

gathered evidence suggesting that the hippocampus has a context-sensitive role in value-based decision-making, which is specifically relevant under conditions of [uncertainty](#) and influences how they evaluate the rewards and efforts linked with different options.

The researchers' new observations are a further step towards better understanding the hippocampus and its contribution to [decision-making](#) in instances where outcomes are uncertain. Future experiments employing additional methods and involving different study participants could help to validate these results.

**More information:** Bahaeddin Attaallah et al, The role of the human hippocampus in decision-making under uncertainty, *Nature Human Behaviour* (2024). [DOI: 10.1038/s41562-024-01855-2](https://doi.org/10.1038/s41562-024-01855-2).

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Citation: How the human hippocampus contributes to value-based decision-making under uncertainty (2024, June 14) retrieved 26 June 2024 from <https://medicalxpress.com/news/2024-06-human-hippocampus-contributes-based-decision.html>

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