How imperfect memory causes poor choices

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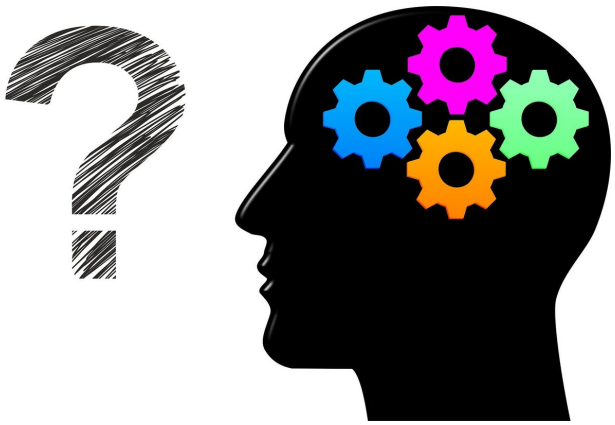

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Quick: Pick your three favorite fast-food restaurants.

If you're like many people, McDonald's, Wendy's, and Burger King may come to mind—even if you much prefer In-N-Out or Chick-fil-A.

A new study from UC Berkeley's Haas School of Business and UC San Francisco's Department of Neurology found that when it comes to making choices, we surprisingly often forget about the things we like best and are swayed by what we remember. The paper, publishing this week in the journal *Proceedings of the National Academy of Sciences,* combines insights from economics and psychology with decision-making experiments and fMRI brain scans to examine how our imperfect memories affect our decision making.

"Life is not a multiple-choice test," says Berkeley Haas Assoc. Prof. Ming Hsu, director of UC Berkeley's Neuroeconomics Laboratory, who co-wrote the paper with Dr. Andrew Kayser, associate professor of neurology at UCSF, and lead author Zhihao Zhang, a Haas postdoctoral scholar. "Yet researchers traditionally give people a menu of options and ask them to choose."

The findings break away from traditional economic models that assume people make rational decisions from all available options. In most situations, rather than choosing from a ready-made list, we conjure choices from our memory.

"While everyone knows that human memory is limited—and there's a thriving market for reminder apps and Post-it Notes—scientists know surprisingly little about how this limit impacts our decisions," says Zhang. Answering this question could hold implications for everything from conducting consumer research and crafting public policy to managing neurodegenerative diseases.

To measure the influence of memory on decisions, the researchers examined people's choices for different types of consumer goods, such as fast food, fruit, sneakers, and salad dressing. For each, they asked one group of participants to name as many favorite brands or items in the category as they could. They asked a second group to choose their preferences from a menu of options. Based on those results, they created a mathematical method to predict which items people would choose in an open-ended situation.

The most surprising takeaway was just how often people seemed to forget to mention items they liked best, choosing less-preferred, but more easily remembered items. "A lot of people name McDonald's as their favorite, but many of those people don't actually like McDonald's as much as other brands," says Kayser. In an open-ended situation, 30% of people said McDonald's is their preferred fast food; yet for those given a list of restaurants, only half that many (15%) chose the Golden Arches, with the other half instead choosing restaurants such as In-N-Out or Chick-fil-A.

The researchers found similarly large differences between people's preferences in open ended versus list-based choices in all the other types of consumer goods tested, both branded and non-branded items, such as fruit. "The magnitude of these changes was very surprising," says Hsu.

"The fact that so many people don't mention their favorites really argues against the notion that we usually act in our own best interest, as standard economic models might have us believe."

To gain a deeper scientific understanding of how memory impacts decisions, the researchers next constructed a new mathematical model that combines economic models of decision-making with psychological models of memory recall. "Very little attention has been paid to connecting these two areas," says Zhang. "By taking the best features of each, we found that we could make amazingly accurate predictions of how often people fail to choose their more preferred options due to their imperfect memories."

In fact, the predictions were so accurate that the researchers thought they had made a mistake. "We only came to trust the findings after checking and repeating the experiments multiple times," he said.

Understanding the role memory plays in decision making has implications for millions of people managing neurodegenerative diseases such as Alzheimer's disease, says Kayser, who researches behavioral neurology.

"We know that memory declines as Alzheimer's disease progresses. We also see that decision-making capacity diminishes in areas such as financial management. But we don't yet have good models of how they might be linked, or even good ways to measure changes in decision-making capacity," he says. "For neurologists, these are urgent questions."

To nail down the role of memory retrieval in decision making, the researchers scanned the brains of a group of participants using fMRI (functional magnetic resonance imaging). Past neuroscientific research has shown that decision-making—which involves valuation—and memory are served by different brain systems.

"When people made open-ended choices in our experiments, we saw increased activity in memory retrieval regions of the brain and enhanced communication with valuation regions," says Zhang. That didn't happen when participants simply picked choices from a list: The valuation part lit up, but memory systems showed much less activity.

This provides neural evidence for the direct involvement of memory systems in open-ended decisions, and sheds light on the nature of suboptimal decisions in these situations.

"Based on these findings, it's possible that Alzheimer's patients are particularly vulnerable when decisions are open-ended," says Kayser, "If so, this could motivate development of decision support systems that can alleviate these vulnerabilities."

The research could also provide a more targeted way of designing "nudges" that help people expand their options without mandating specific choices. For example, "If we want consumers to switch to more sustainable species of fish, it might help to find a way to get people to consider other types of seafood they may have overlooked otherwise," says Hsu.

More information: Zhihao Zhang et al. "Retrieval-Constrained Valuation: Toward Prediction of Open-Ended Decisions." *Proceedings of the National Academy of Sciences (PNAS) (2021)*. DOI: 10.1073/pnas.2022685118

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