

## Why living in the moment is impossible: Study finds decision-making memories stored in mysterious brain area

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(Medical Xpress) -- The sought-after equanimity of "living in the moment" may be impossible, according to neuroscientists who've pinpointed a brain area responsible for using past decisions and outcomes to guide future behavior. The study, based on research conducted at the University of Pittsburgh and published today in the professional journal *Neuron*, is the first of its kind to analyze signals associated with metacognition—a person's ability to monitor and control cognition (a term cleverly described by researchers as "thinking about thinking.")

"The brain has to keep track of decisions and the outcomes they produce," said Marc Sommer, who did his research for the study as a University of Pittsburgh neuroscience faculty member and is now on the

faculty at Duke University. "You need that continuity of thought," Sommer continued. "We are constantly keeping decisions in mind as we move through life, thinking about other things. We guessed it was analogous to working memory, which would point toward the prefrontal cortex."

Sommer predicted that neuronal correlates of metacognition resided in the same brain areas responsible for cognition, including the frontal cortex—a part of the brain linked with personality expression, decision making, and social behavior. Sommer worked with Paul G. Middlebrooks, who did his research for the study at Pitt before he received his Pitt PhD in neuroscience in 2011; Middlebrooks is now a postdoctoral fellow at Vanderbilt University. The research team studied single [neurons](#) in vivo in three frontal cortical regions of the brain: the frontal eye field (associated with visual attention and eye movements), the dorsolateral prefrontal cortex (responsible for motor planning, organization, and regulation), and the supplementary eye field (SEF) involved in the planning and control of saccadic eye movements, which are the extremely fast movements of the eye that allow it to continually refocus on an object.

To learn where metacognition occurs in the brain, subjects performed a visual decision-making task that involved random flashing lights and a dominant light on a cardboard square. Participants were asked to remember and pinpoint where the dominant light appeared, guessing whether they were correct. The researchers found that while neural activity correlated with decisions and guesses in all three brain areas, the putative metacognitive activity that linked decisions to bets resided exclusively in the SEF.

"The SEF is a complex area [of the [brain](#)] linked with motivational aspects of behavior," said Sommer. "If we think we're going to receive something good, neuronal activity tends to be high in SEF. People want

good things in life, and to keep getting those good things, they have to compare what's going on now versus the decisions made in the past."

Sommer noted that defining such concepts related to metacognition, like consciousness, has been difficult for decades. He sees his research and future work related to studying metacognition as one step in a systematic process of working toward a better understanding of consciousness. By studying metacognition, he says, he reduces the big problem of studying a "train of thought" into a simpler component: examining how one cognitive process influences another.

"Why aren't our thoughts independent of each other? Why don't we just live in the moment? For a healthy person, it's impossible to live in the moment. It's a nice thing to say in terms of seizing the day and enjoying life, but our inner lives and experiences are much richer than that."

So far, patients with mental disorders have not been tested on these tasks, but Sommer is interested to see how SEF and other [brain areas](#) might be disrupted in these disorders.

"With schizophrenia and Alzheimer's disease, there is a fracturing of the thought process. It is constantly disrupted, and despite trying to keep a thought going, one is distracted very easily," Sommers said. "Patients with these disorders have trouble sustaining a memory of past decisions to guide later behavior, suggesting a problem with metacognition."

Provided by University of Pittsburgh

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