Memories serve as tools for learning and decision-making, new study shows

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(Medical Xpress) -- When humans learn, their brains relate new information with past experiences to derive new knowledge, according to psychology research from The University of Texas at Austin.

The study, led by Alison Preston, assistant professor of psychology and neurobiology, shows this memory-binding process allows people to better understand new concepts and make future decisions. The findings could lead to better teaching methods, as well as treatment of degenerative neurological disorders, such as dementia, Preston says.

"Memories are not just for reflecting on the past; they help us make the best decisions for the future," says Preston, a research affiliate in the Center for Learning and Memory, which is part of the university's College of Natural Sciences. "Here, we provide a direct link between these derived memories and the ability to make novel inferences."

The paper was published online in July in the journal *Neuron*. The authors include University of Texas at Austin researchers Dagmar Zeithamova and April Dominick.

In the study, 34 subjects were shown a series of paired images composed of different elements (for example, an object and an outdoor scene). Each of the paired images would then reappear in more presentations. A backpack, paired with a horse in the first presentation, would appear alongside a field in a later presentation. The overlap between the backpack and outdoor scenery (horse and field) would cause the viewer to associate the backpack with the horse and field. The researchers used this strategy to see how respondents would delve back to a recent memory while processing new information.

Using functional Magnetic Resonance Imaging (fMRI) equipment, the researchers were able to look at the subjects' brain activity as they looked at image presentations. Using this technique, Preston and her team were able to see how the respondents thought about past images while looking at overlapping images. For example, they studied how the respondents thought about a past image (a horse) when looking at the backpack and the field. The researchers found the subjects who reactivated related memories while looking at overlapping image pairs were able to make associations between individual items (i.e. the horse and the field) despite the fact that they had never studied those images together.

To illustrate the ways in which this cognitive process works, Preston describes an everyday scenario.

Imagine you see a new neighbor walking a Great Dane down the street. At a different time and place, you may see a woman walking the same dog in the park. When experiencing the woman walking her dog, the brain conjures images of the recent memory of the neighbor and his Great Dane, causing an association between the dog walkers to be formed in memory. The derived relationship between the dog walkers would then allow you to infer the woman is also a new neighbor even though you have never seen her in your neighborhood.

"This is just a simple example of how our brains store information that goes beyond the exact events we experience," Preston says. "By combining past events with new information, we're able to derive new knowledge and better anticipate what to expect in the future."

During the learning tasks, the researchers were able to pinpoint the brain regions that work in concert during the memory-binding process. They found the hippocampal-ventromedial prefrontal cortex (VMPFC) circuit is essential for binding reactivated memories with current experience.

Provided by University of Texas at Austin