A-ha! The neural mechanisms of insight

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Although it is quite common for a brief, unique experience to become part of our long-term memory, the underlying brain mechanisms associated with this type of learning are not well understood. Now, a new brain-imaging study looks at the neural activity associated with a specific type of rapid learning, insight. The research, published by Cell Press in the March 10 issue of the journal *Neuron,* reveals specific brain activity that occurs during an "A-ha!" moment that may help encode the new information in long-term memory.

"In daily life, information that results from moments of insight is, almost by definition, incorporated in long-term memory: once we have realized a new way to solve a problem, or to perform a task better and faster, we are not likely to forget that insight easily," explains senior study author, Dr. Nava Rubin, from the Center for Neural Science at New York University. "We were interested in determining the neural basis of this long-lasting nature of insight."

Dr. Rubin, along with collaborators Rachel Ludmer and Dr. Yadin Dudai, designed a model system for studying memory formation associated with perceptual insight. Perceptual insight is where the sudden realization of a solution to a visual puzzle is triggered by an external cue. Study participants viewed a real-world image that had been degraded almost beyond recognition. After a few moments the original image was revealed, transforming the previously meaningless arrangement of ink blots to a coherent scene (the "A-ha!"). Memory was tested a week later when participants were shown the degraded image again and asked to recall detailed perceptual information about the original image. Brain imaging allowed the researchers to capture the neural activity associated with the original moment of insight and relate it to the subsequent fate of the image in memory.

During moments of insight, there was significant activity in the amygdala, a brain structure best known for its role in emotional learning. The researchers discovered that higher activity in the amygdala during the moment of insight predicted more successful performance in the memory task a week later, even though the images in and of themselves were not emotional at all. "We propose that the amygdala plays an important role in signaling to different cortical regions that an internal event of significant neural reorganization has occurred," concludes Dr. Rubin. "Our findings extend the known roles of the amygdala in memory to include promoting of long-term memory of the sudden reorganization of internal representations."

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