

People learn new information more effectively when brain activity is consistent, research shows

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People are more likely to remember specific information such as faces or words if the pattern of activity in their brain is similar each time they study that information, according to new research from a University of Texas at Austin psychologist and his colleagues.

The findings by Russell Poldrack, published online today in the journal *Science*, challenge psychologists' long-held belief that people retain information more effectively when they study it several times under different contexts and, thus, give their brains multiple cues to remember it.

"This helps us begin to understand what makes for effective studying," says Poldrack, director of the Imaging Research Center (IRC) at The University of Texas at Austin. "Sometimes we study and remember things, sometimes we don't and this helps explain why."

Until now, scientists have used [functional magnetic resonance imaging](#) (fMRI) technology to examine activity in large regions of the [brain](#) when studying [memory](#). The research represents the first time scientists have analyzed human memory by examining the pattern of activity across many different parts of the image called voxels. The new technique allows them to probe more deeply into the relationship between the mind and the brain.

Poldrack is a professor in the Section of [Neurobiology](#) and Department of Psychology. His co-authors include Jeanette Mumford, a statistician at The University of Texas at Austin; Gui Xue of the University of Southern California and Beijing Normal University; Qi Dong of Beijing Normal University; Zhong-Lin Lu of the University of Southern California (USC); and Chuansheng Chen of the University of California, Irvine.

"The question is how practice makes perfect. If you precisely reactivate the same pattern each time, then you are going to remember better," says Xue, a research assistant professor of psychology at USC.

The researchers conducted three studies at Beijing Normal University in which subjects were shown different sets of photographs or words multiple times in different orders. The scientists recorded subjects' [brain activity](#) while they studied the material. They were asked to recall or recognize those items between 30 minutes and six hours later, in order to test the decades-old "encoding variability theory."

That theory suggests people will remember something more effectively — the name of the third President of the United States, for example — if they study it at different times in different contexts — a dorm room, the library, a coffee shop — than if they review it several times in one sitting. The different sensory experiences will give the brain various reminders of that information and multiple routes to access Thomas Jefferson's identity.

Based on that theory, Poldrack and his colleagues predicted subjects would retain memories of the photos or words more effectively if their brains were activated in different ways while studying that information multiple times.

Instead, the scientists found the subjects' memories were better when

their pattern of brain activity was more similar across the different study episodes.

Xue cautioned that the study does not disprove the effect of variable contexts during learning in enhancing memory.

It's unclear what prompts the brain to exhibit these different patterns of activity when studying the same information minutes apart. That activity could be triggered by anything from the previous image the person saw, to sounds or smells around him or even simple daydreaming, Poldrack says.

"These results are very important in providing a challenge to this well established theory," Poldrack says. "There's something that's clearly still right about the theory, but this challenges psychologists to reconsider what we know about it."

More information: Xue, G. et al. *Science*
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