

Switchboard in the brain helps us learn and remember at the same time

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The healthy brain is in a constant struggle between learning new experiences and remembering old experiences, a new study in this week's *PLoS Biology* reports. Virtually all social interactions require the rapid exchange of new and old information. For instance, normal conversation requires that while listening to the new information another person is providing, we are already retrieving information in preparation of an appropriate reply. Yet, some memory theories assume that these different modes of memory cannot happen at the same time and compete for priority within our brain.

Brain researchers now provide the first clear evidence supporting a competition between learning and remembering. Their findings also suggest that one brain region can resolve the conflict by improving the rapid switch between learning and remembering. The researchers included Willem Huijbers, Cyriel Pennartz, and Sander Daselaar of the Netherlands' University of Amsterdam, and Roberto Cabeza of Duke University.

The researchers used a novel memory task that forced learning and remembering to occur within a brief period of time. In the study, a group of adults in their 20's looked at a set of regular words presented in the middle of a screen. Participants rapidly tried to remember whether the words had previously been studied or not. Simultaneously, a set of colorful pictures were presented in the background. Meanwhile, the participants' brains were scanned with functional magnetic resonance imaging (fMRI). After brain scanning, participants were surprised with another memory test including the colorful background pictures instead of the words.

In support of a memory competition, the surprise test showed that learning the pictures is much more difficult when simultaneously remembering a word. At the same time, learning the pictures

becomes easier when a word is forgotten. The brain scans revealed that the brain areas involved in learning of the pictures were also less activated when words were simultaneously remembered. In other words, the process of remembering appears to suppress the brain regions involved in learning, the authors note.

The researchers also found one region in the left frontal part of the brain that was only active when both learning and remembering succeeded. Interestingly, activity in this region was specific to those participants that showed minimal suppression of learning activity. In other words, whether they simultaneously remembered a word or not, it did not influence their brain activity during the learning of the background pictures.

This frontal region could function as a switchboard in the brain, the researchers suggest. As learning and remembering cannot happen at the same time, this region might help us to rapidly switch the state of our brain between "learn" and "remember" modes.

It was already thought from patient studies that this frontal region is important for rapid switching between tasks and rules. Patients with damage to this area have problems in rapidly adapting to new situations and tend to persevere in old rules. The same region is also affected in older adults.

Future research should reveal the extent and practical implications of impairments in switching between learning and remembering in patients and older adults, and whether we can improve our switchboard through training.

Citation: Huijbers W, Pennartz CM, Cabeza R, Daselaar SM (2009) When learning and remembering compete: A functional MRI study. *PLoS Biol* 7(1): e1000011. doi:10.1371/journal.pbio.1000011
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