

Habit Leads To Learning, New VA/UCSD Study Shows

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Humans have a "robust" capacity to learn and retain new information unconsciously, retaining so-called habit memory even when conscious or declarative learning is absent, memory experts at the University of California, San Diego School of Medicine and the San Diego Veterans Affairs Health System report in the July 28, 2005 issue of *Nature*.

"We know there is habit learning and have studied it extensively in animal models, but we don't understand the process as clearly in humans because our declarative memory is so dominant," said Larry Squire, professor of neurosciences, psychiatry and psychology at the VAMC and UCSD.

Declarative memory is based on active learning and memorization, and is dependent on a region of the brain in the temporal lobe that includes the hippocampus. When the hippocampus and related structures are destroyed, the human patient loses the ability to learn new memories and to access recent memories.

Habit learning occurs when information is stored unconsciously, through repetition and trial-and-error learning. These memories are believed to be retained in a different region of the brain, called the basal ganglia. In monkeys with lesions in the hippocampus, it had been shown that in contrast to humans with similar hippocampal lesions due to injury or disease who have difficulty learning certain tasks over a certain time period, the monkeys can learn the tasks at a normal rate, apparently as habits.

"We have speculated that humans might have the same capacity to acquire habit memory, but that this capability is ordinarily obscured by our excellent capacity to learn by conscious memorization," said Squire.

In the study reported in *Nature*, two human volunteers with amnesia, called EP and GP, participated in a series of simple object discrimination tasks. Both individuals have severe memory impairment, due to temporal lobe damage caused by herpes simplex encephalitis.

The volunteers were presented with the same series of 8 pairs of miscellaneous objects and asked to select the correct one of each pair, in several sessions conducted over several weeks. The word "correct" was on the bottom of the correct object, and could be read after the object was picked up and turned over.

At the beginning of each session, the volunteers had no recollection of having performed the task previously, and even after several sessions they could not explain what they were being asked to do or why. But, after several sessions of repeating the exercise with the same pairs of objects, the volunteers unconsciously selected the correct item in each pair with increasing accuracy.

The ability to select the correct object appeared to be automatic. In fact, during the course of the study as they were able to select the correct object, the subjects wondered aloud, "How am I doing this?". When asked how he knew which object to select, one of the subjects pointed to his head and replied "It's here, and somehow or another the hand goes for it." By the end of the study they were scoring 95% and 100% in their selection of the correct item.

"These findings help explain how patients with profound memory loss can still do what they do, for example, why the amnesia patient EP can take a walk around his neighborhood without getting lost," said Squire. "Humans clearly can acquire and retain knowledge through repetition. This also reminds us that we have this habit learning system that's working all the time behind the scenes, independently shaping who we are and how we behave, in addition to our conscious learning system."

Co-authors of the study are Peter J. Bayley, and Jennifer C. Frascino, of the UCSD Department of Psychiatry. The study was supported by the Medical Research Service of the Department of Veterans Affairs, the National Institute of Mental Health and the Metropolitan Life Foundation.

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