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Discovery of Two Opposite Ways Humans Voluntarily Forget Unwanted Memories: *How the Brain Creates and Stores Substitute Memories*

ScienceDaily (Oct. 17, 2012) — If only there were a way to forget that humiliating faux pas at last night's dinner party. It turns out there's not one, but two opposite ways in which the brain allows us to voluntarily forget unwanted memories, according to a study published by Cell Press October 17 in the journal *Neuron*. The findings may explain how individuals can cope with undesirable experiences and could lead to the development of treatments to improve disorders of memory control.

"This study is the first demonstration of two distinct mechanisms that cause such forgetting: one by shutting down the remembering system, and **the other by facilitating the remembering system to occupy awareness with a substitute memory,**" says lead study author Roland Benoit of the MRC Cognition and Brain Sciences Unit at the University of Cambridge.

Previous studies have shown that individuals can voluntarily block memories from awareness. Although several neuroimaging studies have examined the brain systems involved in intentional forgetting, they have not revealed the cognitive tactics that people use or the precise neural underpinnings. Two possible ways to forget unwanted memories are to suppress them or to substitute them with more desirable memories, and these tactics could engage distinct neural pathways.

To test this possibility, Benoit and Michael Anderson of the MRC Cognition and Brain Sciences Unit used functional magnetic resonance imaging to examine the brain activity of volunteers who had learned associations between pairs of words and subsequently attempted to forget these memories by either blocking them out or recalling substitute memories.

Although the strategies were equally effective, they activated distinct neural circuits. During memory suppression, a brain structure called dorsolateral prefrontal cortex inhibited activity in the hippocampus, a region critical for recalling past events. **On the other hand, memory substitution was supported by caudal prefrontal cortex and midventrolateral prefrontal cortex -- two regions involved in bringing specific memories into awareness in the presence of distracting memories.**

"A better understanding of these mechanisms and how they break down may ultimately help understanding disorders that are characterized by a deficient regulation of memories, such as posttraumatic stress disorder," Benoit says. "Knowing that distinct processes contribute to forgetting may be helpful, because people may naturally be better at one approach or the other."

Journal Reference:

1. Roland G. Benoit, Michael C. Anderson. **Opposing Mechanisms Support the Voluntary Forgetting of Unwanted Memories.** *Neuron*, 2012; 76 (2): 450 DOI: [10.1016/j.neuron.2012.07.025](https://doi.org/10.1016/j.neuron.2012.07.025)

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