

Remembering the recent past: the hippocampus and working memory

Neuroscientists believe there are two kinds of memory: long-term memory and "working memory," a temporary holding-place for information that is discarded when no longer needed. The hippocampus has been thought to be involved only in long-term memory. But researchers at Boston University's NSF-sponsored CELEST Science of Learning Center have discovered that the hippocampus is also involved in working memory.

Computer models developed by CELEST researchers, including one proposed by Michael Hasselmo, predict that the hippocampus would go into action when a person needs to remember multiple items held in working memory – and that the hippocampus would work harder the more items needed to be retrieved. Similar predictions come from models developed by CELEST scientists Daniel Bullock and Stephen Grossberg.

CELEST researchers Karin Schon and Chantal Stern and colleagues tested this prediction by placing healthy volunteers in an MRI machine and monitoring brain activity while they performed a task designed to activate working memory. In the task (see Figure 1), volunteers viewed a sequence of either two or four photographs. After a brief delay period of 4-8 seconds, subjects viewed either one of the photographs they had seen already, or a new photograph. They had to say whether the photograph was familiar or new. As predicted by computer models, Dr. Schon and her colleagues demonstrated that the hippocampus is active when information was retrieved from working memory.

The computer models also predicted that whenever items were stored as a sequence in working memory, remembering one of the items would require scanning through the entire sequence. The longer the sequence, the more work the hippocampus would have to do. This is exactly what Dr. Schon and colleagues found: when the participants needed to retrieve a sequence of four photographs rather than a sequence of just two, hippocampal activity was greater (see Figure 2).

Together with previous work by Drs. Schon, Hasselmo, and Stern, the data suggest the hippocampus may be part of the mechanism by which items pass from working memory to long-term memory.

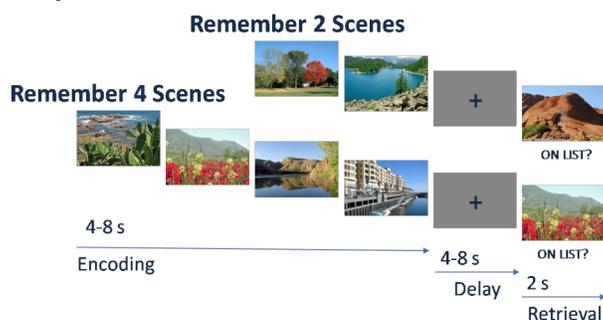


Figure 1. Task. s = seconds

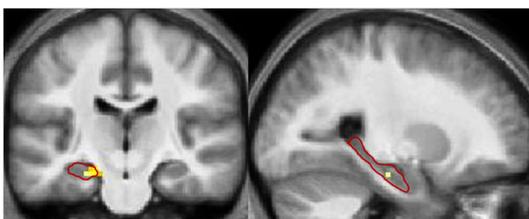


Figure 2. Hippocampal activation is displayed in yellow, and hippocampus is outlined in red.