Despite brain damage, working memory functions -- within limits

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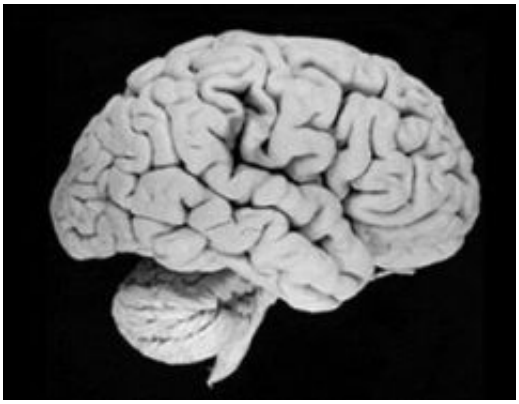

Modern human brain. Credit: Univ. of Wisconsin-Madison Brain Collection.

Researchers at the University of California, San Diego School of Medicine, led by Larry R. Squire, PhD, professor of psychiatry, psychology and neurosciences at UC San Diego and a scientist at the VA San Diego Healthcare System, report that working memory of relational information – where an object is located, for example – remains intact even if key brain structures like the hippocampus are damaged.

The findings, published in the October 13, 2010 issue of *The Journal of* Neuroscience, run contrary to previous research that suggested spatial information, especially if it's linked to other kinds of information, necessarily involves the hippocampus and other regions associated with memory.

Working memory is the mental ability to hold small amounts of information in an active, readily available state for a short period of time, typically a few seconds. Conversely, long-term memory involves storing a potentially unlimited amount of information for an indefinite period of time.

Squire and colleagues examined four memory-impaired patients with damage to their medial temporal lobes (MTL), a region of the cerebral cortex containing the hippocampus and linked to long-term memory formation.

The four patients were asked to briefly study an arrangement of objects on a table, then reproduce the objects' relative positions on another table. When the number of objects was three or less, the patients' ability to recall was similar to that of control subjects without brain damage. The impaired patients easily remembered where the objects had been placed in relation to each other.

But "their performance abruptly collapsed when the limit of working memory was reached," said Squire. The patients could not remember the locations of four or more objects because doing so involved tapping into long-term memory functions in the medial temporal lobe.

"The findings provide strong evidence for a fundamental distinction in the brain between working memory and long-term memory, even in the realm of spatial information and spatial-object associations," Squire said.

The work has practical and clinical significance as well, according to Squire.

"It indicates that patients with memory impairment due to MTL damage, including early stage Alzheimer's disease, have a narrower difficulty than what one might have thought. They have an intact ability to hold

information in mind, and an ability to work with it on a temporary basis."

Provided by University of California -- San Diego