New research shows memory is a dynamic and interactive process

May 28 2014

Research presented by Morris Moscovitch, from the Rotman Research Institute at the University of Toronto, shows that memory is more dynamic and changeable than previously thought. Dr. Moscovich's results reveal that important interactions between the hippocampus and the neocortex, two regions of the brain, have different yet complementary roles in remembering places and events. These results highlight that different forms of memories exist in the brain, and that these are encoded in different, but interacting parts of the brain. Dr. Moscovitch proposes a novel theory to explain these interactions, that furthers our understanding of what we remember, and could be useful for treatment and management of people with memory disorders.

These results were presented at the 8th Annual Meeting of the Canadian Association for Neuroscience held in Montreal, Canada May 25 to 28th 2014.

By studying how humans remember events and places in the short and long term, and how rodents remember and navigate through familiar and unfamiliar environment, Dr. Moscovitch and others have revealed differences between what they call "episodic memory", which is a form of memory rich in contextual details, dependent on a brain region called the hippocampus, and another form of memory, called "semantic memory" which relies primarily on neocortex, and which is a more general memory, recording the gist of the initial episodic memory.

Studies in animals and humans have shown that the hippocampus, a

brain region located deep inside the brain, has a central role in recent and remote episodic memory. Patients with hippocampal loss, including the famous Henry Molaison (patient HM) and Kent Cochrane (patient KC), were shown to be unable to make new memories, but they retained the ability to recall earlier events, in a schematic, general fashion. Dr. Moscovitch, investigating how rich, recent memories are often converted to more schematic, remote memories has elaborated a theory he has termed "multiple trace/transformation theory".

According to multiple trace/transformation theory, each time an episodic memory is retrieved, it is automatically re-encoded by the hippocampus along with the new context in which retrieval occurs. Over time, and with every retrieval, multiple memory traces accumulate; the neocortex extracts similarities from these traces to form a generalized memory, the semantic memory. By this process, the memory is transformed over time, from a mostly hippocampus dependent, context-rich memory, to a more general memory, a recording of the essential elements of the memory, that captures the gist of the initial episodic memory.

Dr. Moscovitch presented results that show that the same processes apply to memory about places and the environment. Initially dependent on the hippocampus, they also are transformed, and become schematic memories that can be retrieved without the involvement of the hippocampus. As it was previously thought that the hippocampus was always involved in remembering places, this discovery sheds new light on the different forms of memory that exist.

"Spatial representations provide the framework in which events unfold, so that they interact with each other to form rich episodic memories that have both spatial and event elements" says Dr. Moscovitch. "Memory for events is facilitated if they occur in familiar rather than unfamiliar places. These findings could be used to help ameliorate memory problems in older adults, and in people with dementia, who have to leave

their home and move into new living quarters."

More information: www.can-acn.org/meeting2014

Provided by Canadian Association for Neuroscience