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Dementia May Result from Incomplete Memories

Memory difficulties such as those seen in dementia may arise because the brain forms incomplete memories that are more easily confused, new research from the University of Cambridge has found.

The findings are published December 2 in the journal *Science*.

Currently, memory problems are typically perceived to be the result of forgetting previously encountered items or events. The new research (using an animal model of amnesia), however, found that the ability of the brain to maintain complete, detailed memories is disrupted. The remaining, less detailed memories are relatively easily confused, leading to an increased likelihood of falsely remembering information that was not encountered.

Dr. Lisa Saksida, from the Department of Experimental Psychology at the University of Cambridge, said: "This study suggests that a major component of memory problems may actually be confusion between memories, rather than loss of memories per se".

"This is consistent with reports of memory distortions in dementia -- for example, patients may not switch off the cooker, or may fail to take their medication, not because they have forgotten that they should do these things, but because they think they have already done so."

Previous research on memory found that amnesic animals couldn't distinguish between a new and an old object. However, these studies didn't demonstrate whether the animal was unable to distinguish between the objects because it saw the old object as being new (it has forgotten something that occurred), or because it saw the new object as being old (false memory).

In order to examine which is indeed the case, the researchers developed a new experimental method that allows them to analyze responses to the new and the old objects separately. Animals were allowed to look at an object and then, after an hour, were given a memory test in which they were either shown the same object again, or

a new object. Normal animals spent more time exploring the new object, indicating that they remembered the old object.

Amnesic animals, however, performed poorly on the memory task, as they spent an equal amount of time exploring the old and the new object. Interestingly, the amnesic animals explored the new object less than the normal animals did, indicating false memory for the new object.

The researchers concluded that the memory problems were the result of the brain's inability to register complete memories of the objects, and that the remaining, less detailed memories were more easily confused.

The scientists, funded by the Biotechnology and Biological Sciences Research Council (BBSRC), then used this knowledge to examine whether they could improve performance on the memory task if there were not other memories to confuse the brain. To do this, they placed the animals in a dark, quiet space (rather than the usual busy environment) before the memory test. Amnesic animals who showed no recollection when they spent the time before the memory test in normal, busy conditions, showed perfect memory when they spent the time before the memory test in a dark, quiet environment.

Dr. Saksida continued, "One thing that we found very surprising about our results was the extent of the memory recovery, achieved simply by reducing the incoming information prior to the memory test.

"Not only does this result confound our expectations, but it also gives us a clearer understanding of the possible nature of the memory impairment underlying amnesia and certain types of dementia, which is critical to developing more sophisticated and effective treatments."

"This also tells us something about how detrimental interference from other things can be when we are trying to remember something, an issue that may be increasingly relevant as the number of potential distractions in our daily lives seems to be on the rise."

The researchers hope that their research could lead to new treatments that reduce the confusion between memories, perhaps with the development of drugs that can enhance the complex, detailed representations that are required to separate memories.

Dr. Saksida commented on the possibility of new treatments, stating: "Alternatively, deliberate and intentional use of the details differentiating objects and events might be a strategy that could prolong independence and help to improve daily functioning for patients".

"Even more exciting would be the ability to develop treatments that could stop the disease in the early stages, rather than treatments that address the symptoms once dementia has set in. Early detection of memory impairment is critical for the development of such treatments, and a better understanding of the nature of the impairment, as we have found here, is critical to such early detection."

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Journal Reference: 1. S. M. McTighe, R. A. Cowell, B. D. Winters, T. J. Bussey, L. M. Saksida. Paradoxical False Memory for Objects After Brain Damage. *Science*, 2010; 330 (6009): 1408 DOI: 10.1126/science.1194780