Brain activation in sleeping toddlers shows memory for words

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Very young children learn words at a tremendous rate. Now researchers at the Center for Mind and Brain at the University of California, Davis, have for the first time seen how specific brain regions activate as two-

year-olds remember newly learned words—while the children were sleeping. The work is published Oct. 19 in *Current Biology*.

"We can now leverage sleep to look at basic mechanisms of learning new words," said Simona Ghetti, professor at the Center for Mind and Brain and UC Davis Department of Psychology.

At two to three years old, children enter a unique age in memory development, Ghetti said. But young children are challenging to study, and they especially dislike being in a functional MRI scanner.

"The scariest things to small children are darkness and loud noises, and that's what it's like during an MRI scan," Ghetti said.

Ghetti's team had previously found that if children fell asleep in a scanner while it wasn't working, they could later start the scan and see brain activation in response to songs the children had heard earlier.

In the new study, they looked at how toddlers retained memories of words.

Graduate student Elliott Johnson and Ghetti created a series of made-up, but realistic sounding words as names for a series of objects and puppets. In the first session, two-year-olds were introduced to two objects and two puppets, then tested on their memory of the names after a few minutes. A week later, they returned and were tested on whether they remembered the names of the objects and puppets. Soon after the second test, they slept overnight in an MRI scanner. The researchers played back the words the children had learned, as well as other words, as they slept.

Activation of the hippocampus in learning

The researchers found activation of the hippocampus and the anterior medial temporal lobe when the sleeping children were played words they had previously learned. This activation correlated with how well they had performed when they initially learned the words a week earlier.

"This suggests that the hippocampus is particularly important for laying down the initial memory for words," Ghetti said. "This compares quite well with findings from older children and adults, where the hippocampus is associated with learning and with recalling recent memories" Johnson added.

Although young children are rapidly forming memories of new words, they are also losing a lot of memories. When we form a memory, it includes the context: where, when, what else was going on. But if we just learned the name of an object, we don't need to remember the context to use the word again. That extra detail can go.

It's not clear how children remember some things, such as names, while losing the rest. Ghetti suspects that overlapping learning experiences interfere with each other and cancel out the unneeded details. Future research will focus on the memory processes that support these changes.

More information: Elliott Gray Johnson, Activation for Newly Learned Words in Left Medial-Temporal Lobe During Toddlers' Sleep is Associated with Memory for Words, *Current Biology* (2021). DOI: 10.1016/j.cub.2021.09.058. www.cell.com/current-biology/f … 0960-9822(21)01314-2

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