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Minding the memory

UW researchers work to understand how our brains store information

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JAY RATH For the State Journal

Soon after they met, Sherlock Holmes told Dr. Watson, "I consider that a man's brain originally is like a little empty attic."

You have to be careful what you store there, the detective said in 1887, in "A Study in Scarlet." Otherwise useful knowledge "gets crowded out, or at best is jumbled up with a lot of other things."

Today, 120 years later, it turns out that Holmes was right, in a way. But proving it has hardly been elementary, dear Watson. It's taking cutting-edge research at the UW-Madison to demonstrate Holmes' brain "attic."

Why is it that we forget? Do memories decay or do they just get jumbled?

Using a technique called "transcranial magnetic stimulation," UW researchers may have found the answer.

"Psychologists have known for decades that the intuitive notion of decay is probably less of a factor in forgetting than is interference," says Brad Postle, UW assistant professor of psychology.

Interference occurs, he says, when other remembered information disrupts or competes with information we want to remember.

Viewing this process is, of course, impossible -- or it was until now.

"It's hard to test decisively because what we would need to do is present some information to somebody and then, you know, put them in a sensory isolation tank, and also prevent them from thinking for five years, and then see if they can remember," jokes Postle. "But to the extent that it can be controlled, it seems that interference -- more than the mere passage of time and this idea of decay -- is really what's responsible for a lot of forgetting."

Without a good sorting mechanism, the tremendous number of observations, ideas and memories we have stored would confuse our brains. How and where in the mind the interference occurs has been studied by Postle, along with Guilio Tononi, of the UW School of Medicine and Public Health, and Eva Federoes, a researcher in the UW Department of Psychology. They published their results in December, in "Proceedings of the National Academy of Sciences."

The UW experiments were simplified versions of common memory challenges, Postle says.

"In essence, what our study was about was trying to get at the neural mechanisms of how we prevent previous information from interfering with what we need to do in the present," he says.

The team looked at how part of the brain can reduce the effects of interference. From brain scans, scientists already knew that the part called the inferior frontal gyrus, or IFG, is active when volunteers take memory tests while confronting interference. What the IFG was doing, though, was a mystery. Was it controlling interference, or just adding more brain horsepower to memory tasks?

To answer that question, the researchers temporarily disrupted the IFG using transcranial magnetic stimulation (TMS).

"TMS is a technique that allows the induction of a current in the brain using a magnetic field that passes through the scalp and the skull safely and painlessly," says Tononi. "TMS can be used to briefly scramble' neural activity in the underlying brain area for a short time, typically a second or so. This scrambling is fully reversible, and after the pulsing, the targeted brain area becomes fully functional again."

The study proved that the IFG is essential to blocking interference, Postle says. Memory accuracy plummeted when the IFG got a brief jolt of magnetic stimulation at the exact moment when the subject was confronting confusion.

"What it suggests is that, for normal individuals, we're pretty good at not being distracted by what happened previously, so that we're able to concentrate on what's happening in the here and now," says Postle.

So long as the IFG is working, that is.

"That may be one of the abilities that we lose as we start to get older," Postle says.

In other words, memory doesn't just fade away. It's interference that is the problem.

These were tests of short-term memory, not long-term, but Postle says there may not be much reason to question the difference between the two.

"One of the things that my group has been working on, and other people at other institutions, is kind of revisiting this question, and start to see that, in fact, there are many commonalities, to the point where short-term memory and long-term memory may not be as different as commonly assumed by psychologists and neuroscientists for the last three or four decades," he says.

From a practical standpoint, he notes, "One can imagine this leading to improved understanding and, hopefully, improved treatment of Attention Deficit Hyperactivity Disorder, for example, which is associated with not being able to concentrate on the task at hand and being easily distracted."

Of course, for all of us, distractions to memory are just a fact of daily life.

"The big-picture hope is that as we gain better understanding," Postle says. "With that ought to come the knowledge that will help us develop either treatments or compensatory environmental aides."

And then there was Sherlock Holmes' way of dealing with unwanted information.

As he told Watson, "Now that I do know it I shall do my best to forget it."