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How the brain keeps track of what we're doing

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"Working memory" is what we have to keep track of things moment to moment: driving on a highway and focusing on the vehicles around us, then forgetting them as we move on; remembering all the names at the dinner party while conversing with one person about her job.

Most psychologists explain working memory with a "controlled attention" model: one flexible system that directs the brain's focus to stimuli and tasks that are important and suppressing the rest. The capacity of working memory, they say, is limited by our ability to attend to only one thing at a time.

Now, in the August issue of *Current Directions in Psychological Science*, a journal published by the Association for Psychological Science, University of Edinburgh cognitive neuroscientist Robert H. Logie challenges this model.

"We have a range of different capacities, each with its own function, and they operate at the same time" when we perform a task or think about something, says Logie. Within this "multiple-component framework," working memory capacity is "the sum of the capacities of all these different functions."

This "workspace" in the brain, as Logie calls it, allows us to do something while other functions operate in the background or to apply ourselves to a single task involving more than one function. In reading, for instance, we both see words and process meaning. The "sum" of the

capacities isn't a gross measure, though, because we often tax one function more than another. In reading, processing has its shoulder to the grindstone, while vision takes it easy.

In addition to the attentional model of working memory, Logie critiques the experimental methods shaped by it. Example: Studies measuring capacity ask participants to read a sentence (process) and remember the sentence's last word (memory), then read several sentences and recall all the final words in order. How well a person does can predict performance on other tasks or exams. But the experiment, which assumes one big resource pouring into different tasks until it's used up, tests only one function, memory for words.

If you want to understand not just the capacity but the structure of working memory—which Logie considers a more fruitful avenue of research—there's a better experimental methodology: cognitive neuroscience. "Imaging data demonstrate that if you ask people to do one sort of task, you get one [brain] pattern, and if you ask them to do another, you get another pattern." Make the same task harder—say, remember word lists faster—and "you see increased activation in the same area."

Complicate it—add words to the sequence, and thus processing along with recall—and different networks fire.

The multiple-component model holds great practical promise, says Logie. In education, "if you assume there is a single general capacity," interventions for people struggling to learn are few. Assume multiple components to draw on, and those other resources stand ready for development.

Similarly, if you see general impairment in aging or after brain damage, you can give only generalized support. Look for decline or impairment

in specific functions—not just physical but cognitive—and you can exercise the still-robust functions, helping people live richer, more independent lives.

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