

How Much Can Your Mind Keep Track Of?

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Cooking shows on TV usually give a Web address where you can find, read, and print out the recipe of the dish created on that day's show. The reason is obvious: It's too hard to just follow along with what the chef is doing, let alone remember it all. There are too many directions and ingredients — too many variables and steps in the process to keep track of quickly.

New research shows why it doesn't take much for a new problem or an unfamiliar task to tax our thinking. According to University of Queensland cognitive science researchers Graeme S. Halford, Rosemary Baker, Julie E. McCredden and John D. Bain of Griffith University, the number of individual variables we can mentally handle while trying to solve a problem (like baking a lemon meringue pie) is relatively small: Four variables are difficult; five are nearly impossible.

Their report, "How Many Variables Can Humans Process?" is published in the January 2005 issue of *Psychological Science*, a journal of the American Psychological Society.

It's difficult to measure the limits of processing capacity because most people automatically use problem solving skills to break down large complex problems into small, manageable "chunks." A baker, for example, will treat "cream butter, sugar and egg together" as a single chunk — a single step in the process — rather than thinking of each ingredient separately. Likewise she won't think, "break egg one into bowl, break egg two into bowl." She'll just think, "add all of the eggs."

To keep test subjects from breaking down problems into bite-size



chunks, researchers needed to create problems that they weren't familiar with. In their experiment, 30 academics were presented with incomplete verbal descriptions of statistical interactions between fictitious variables, with an accompanying set of graphs that represented the interactions. The interactions varied in complexity — involving as few as two variables up to as many as five. The participants were timed as they attempted to complete the given sentences to correctly describe the interactions the graphs were showing. After each problem, they also indicated how confident they were of their solutions.

The researchers found that, as the problems got more complex, participants performed less well and were less confident. They were significantly less able to accurately solve the problems involving fourway interactions than the ones involving three-way interactions, and they were (not surprisingly) less confident of their solutions. And five-way interactions? Forget it. Their performance was no better than chance.

After the four- and five-way interactions, participants said things like, "I kept losing information," and "I just lost track."

Halford et al concluded from these results that people — academics accustomed to interpreting the type of data used in the experiment problems — cannot process more than four variables at a time. Recognizing these human limitations can make a difference when designing high-stress work environments—such as air-traffic control centers—where employees must keep in mind several variables all at once.

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