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What Is the Memory Capacity of the Human Brain?

Paul Reber, professor of psychology at Northwestern University, replies

By Paul Reber | Monday, April 19, 2010 | 44 comments

What is the memory capacity of the human brain? Is there a physical limit to the amount of information it can store?

—*J. Hawes, Huntington Beach, Calif.*

Paul Reber, professor of psychology at Northwestern University, replies:

“Mr. Osborne, may I be excused? My brain is full,” a student with a particularly tiny head asks his classroom teacher in a classic *Far Side* comic by Gary Larson. The deadpan answer to this question would be, “No, your brain is almost certainly not full.” Although there must be a physical limit to how many memories we can store, it is extremely large. We don’t have to worry about running out of space in our lifetime.

The human brain consists of about one billion neurons. Each neuron forms about 1,000 connections to other neurons, amounting to more than a trillion connections. If each neuron could only help store a single memory, running out of space would be a problem. You might have only a few gigabytes of storage space, similar to the space in an iPod or a USB flash drive. Yet neurons combine so that each one helps with many memories at a time, exponentially increasing the brain’s memory storage capacity to something closer to around 2.5 petabytes (or a million gigabytes). For comparison, if your brain worked like a digital video recorder in a television, 2.5 petabytes would be enough to hold three million hours of TV shows. You would have to leave the TV running continuously for more than 300 years to use up all that storage.

The brain’s exact storage capacity for memories is difficult to calculate. First, we do not know how to measure the size of a memory. Second, certain memories involve more details and thus take up more space; other memories are forgotten and thus free up space. Additionally, some information is just not worth remembering in the first place.

This is good news because our brain can keep up as we seek new experiences over our lifetime. If the human life span were significantly extended, could we fill our brains? I’m not sure. Ask me again in 100 years.