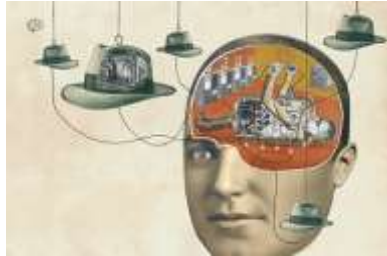


The Brain: How The Brain Rewires Itself

By Sharon Begley Friday, Jan. 19, 2007



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It was a fairly modest experiment, as these things go, with volunteers trooping into the lab at Harvard Medical School to learn and practice a little five-finger piano exercise. Neuroscientist Alvaro Pascual-Leone instructed the members of one group to play as fluidly as they could, trying to keep to the metronome's 60 beats per minute. Every day for five days, the volunteers practiced for two hours. Then they took a test.

At the end of each day's practice session, they sat beneath a coil of wire that sent a brief magnetic pulse into the motor cortex of their brain, located in a strip running from the crown of the head toward each ear. The so-called transcranial-magnetic-stimulation (TMS) test allows scientists to infer the function of neurons just beneath the coil. In the piano players, the TMS mapped how much of the motor cortex controlled the finger movements needed for the piano exercise. What the scientists found was that after a week of practice, the stretch of motor cortex devoted to these finger movements took over surrounding areas like dandelions on a suburban lawn.

The finding was in line with a growing number of discoveries at the time showing that greater use of a particular muscle causes the brain to devote more cortical real estate to it. But Pascual-Leone did not stop there. He extended the experiment by having another group of volunteers merely think about practicing the piano exercise. They played the simple piece of music in their head, holding their hands still while imagining how they would move their fingers. Then they too sat beneath the TMS coil.

When the scientists compared the TMS data on the two groups--those who actually tickled the ivories and those who only imagined doing so--they glimpsed a revolutionary idea about the brain: the ability of mere thought to alter the physical structure and function of our gray matter. For what

the TMS revealed was that the region of motor cortex that controls the piano-playing fingers also expanded in the brains of volunteers who imagined playing the music--just as it had in those who actually played it.

"Mental practice resulted in a similar reorganization" of the brain, Pascual-Leone later wrote. If his results hold for other forms of movement (and there is no reason to think they don't), then mentally practicing a golf swing or a forward pass or a swimming turn could lead to mastery with less physical practice. Even more profound, the discovery showed that mental training had the power to change the physical structure of the brain.

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