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Why (smart) practice makes perfect

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Struggling with your chip shot? Constant drills with your wedge may not help much, but mixing in longer drives will, and a new study shows why.

Previous studies have shown that variable practice improves the brain's memory of most skills better than practice focused on a single task. Cognitive neuroscientists at USC and UCLA describe the neural basis for this paradox in a new study in Nature Neuroscience.

The researchers split 59 volunteers into six groups: three groups were asked to practice a challenging arm movement, while the other three groups practiced the movement and related tasks in a variable practice structure.

Volunteers in the variable practice group showed better retention of the skill. The process of consolidating memory of the skill engaged a part of the brain - the prefrontal cortex - associated with higher level planning.

The group assigned to constant practice of the arm movement retained the skill to a lesser degree through consolidation that engaged a part of the brain - the primary motor cortex - associated with simple motor learning.

"In the variable practice structure condition, you're basically solving the motor problem anew each time. If I'm just repeating the same thing over and over again as in the constant practice condition, I don't have to process it very deeply," said study senior author Carolee Winstein, professor of biokinesiology and physical therapy at USC.

"We gravitate toward a simple, rote practice structure because we're basically lazy, and we don't want to work hard. But it turns out that memory is enhanced when we engage in practice that is more challenging and requires us to reconstruct the activity," Winstein said.

Winstein's team, led by Shailesh Kantak, a graduate student in biokinesiology at the time of the study, verified the neural circuits involved through harmless magnetic interference applied immediately after practice.

Volunteers in the variable practice group who received magnetic stimulation in the prefrontal cortex failed to retain or "consolidate" the arm movement as well as those in the same group who did not receive magnetic stimulation.

This implied that the prefrontal cortex was necessary for consolidating the memory.

Likewise, constant practice volunteers who received magnetic stimulation in the primary motor cortex failed to retain the arm movement as well as volunteers in the same group who did not receive magnetic stimulation.

"While it may be harder during practice to switch between tasks … you end up remembering the tasks better later than you do if you engage in this drill-like practice," Winstein said.

"In motor skills training they know this, in educational programs where they're teaching the kids cursive hand writing, they know this."

Winstein described the study as "the linking of motor neuroscience to behavioral movement science to better understand the neural substrates that mediate motor learning through optimal practice structures. No one had done this before in this way."

The magnetic interference tests also helped define the time window for the brain to consolidate skills. For volunteers chosen to receive interference four hours after practice, the procedure had no effect on learning. This suggested the brain already had done its consolidation.

Provided by University of Southern California

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