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# Scientists discover how brains change with new skills

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(Medical Xpress)—The phrase "practice makes perfect" has a neural basis in the brain. Researchers have discovered a set of common changes in the brain upon learning a new skill. They have essentially detected a neural marker for the reorganization the brain undergoes when a person practices and become proficient at a task.

Successful training not only prompts skill-specific changes in the brain, but also more global changes that are consistent across many different types of skills training, the researchers report in the journal *Neurorehabilitation and Neural Repair* (Vol. 27:3). Their results indicate that as you become more adept at a skill, your brain no longer needs to work as hard at it. The brain, they report, shifts from more controlled to more automatic processing as a skill is learned, regardless of the specific type of training, they said.

"The training-related changes we found – that signify a shift to a more 'efficient' configuration of brain networks – provide a potential new brain marker for training effectiveness," said neuroscientist Nathan Spreng, assistant professor of human development and the Rebecca Q. and James C. Morgan Sesquicentennial Faculty Fellow in Cornell's College of Human Ecology. "Such neural markers are increasingly being used to inform the design of new or more-targeted interventions to improve cognitive and motor functioning in aging, brain injury or disease," he added.

The study is the most comprehensive review of the neural correlates of training to date and the first to associate training with alterations in large-scale brain networks, said Spreng, who was awarded the distinction of "rising star" in March by the Association for Psychological Science.

The researchers conducted a systematic meta-analysis of 38 neuroimaging studies of cognitive and motor skills training interventions in healthy young adults – more than 500 participants in all. Using a quantitative literature review method, they analyzed functional neuroimaging data and mapped the patterns of brain activity changes before and after the training across the individual experiments.

The researchers found that the brain regions that are involved in attention-demanding activities are less active after training compared with before, whereas the brain regions that typically are at rest (known as the default network), became more active.

Specifically, training resulted in decreased activity in brain regions involved in effortful control and attention that closely overlap with the frontoparietal control and dorsal attention networks. Increased activity was found after training, however, in the default network that is involved in self-reflective activities, including future planning or even day dreaming. Thus, skill mastery is associated with increased activity in areas not engaged in skill performance, and this shift can be detected in the large-scale networks of the brain.

"The power of meta-analysis methods to systematically and quantitatively review neuroimaging studies makes possible discoveries such as ours that can provide new insights into how the brain functions; this helps us lay the foundation for better treatments of brain disorders in the future," said Spreng.

"There have now been over 100,000 neuroimaging papers published, so these types of meta-analytic reviews offer new opportunities to identify common patterns of brain activity across a larger and more diverse array of studies," he added.

Spreng co-authored the study, "Functional Brain Changes Following Cognitive and Motor Skills Training: A Quantitative Meta-analysis," with first author Ronak Patel of Ryerson University and with Gary R. Turner, York University.

Provided by Cornell University

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