Neurofeedback may 'remaster' the brain for clarity of thought

The sweep of a needle across the grooves of a worn vinyl record carries distinct sounds: hisses, scratches, even the echo of skips. For many years, though, those yearning to hear Frank Sinatra sing "Fly Me to the Moon" have been able to listen to his light baritone with clarity, courtesy of the increased signal-to-noise ratio of digital remasterings.

Now, with advances in neurofeedback techniques, the signal-to-noise ratio of the brain activity underlying our thoughts can be remastered as well, according to a recent discovery detailed in the Proceedings of the National Academy of Sciences by a research team led by Stephen LaConte, an assistant professor at the Virginia Tech Carilion Research Institute.

Scientists used real-time functional magnetic resonance imaging to understand the neural underpinnings of brain-computer interface control. Two dozen subjects were asked to control a visual interface by silently counting numbers at fast and slow rates. For half the tasks, the subjects were told to use their thoughts to control the movement of the needle on the device they were observing; for the other tasks, they simply watched the needle.

The scientists discovered a feedback effect that LaConte said he had long suspected existed but had found elusive: the subjects who were in control of the needle achieved a better whole-brain signal-to-noise ratio than those who simply watched the needle move.

This enhanced signal-to-noise ratio, LaConte said, carries implications for brain rehabilitation.

"When people undergoing real-time brain scans get feedback on their own brain activity patterns, they can devise ways to exert greater control of their mental processes," LaConte said. "This, in turn, gives them the opportunity to aid in their own healing. Ultimately, we want to use this effect to find better ways to treat brain injuries and psychiatric and neurological disorders."