New research looks at the promise of 'digital neuropsychology'

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Cognitive tests conducted with smartphones might improve upon traditional 'pencil-and-paper' tests. Credit: McLean Hospital

In a new paper published in *The Clinical Neuropsychologist*, McLean Hospital's Laura Germine, Ph.D., and her colleagues describe the many

ways in which cognitive tests conducted with computers and smartphones might improve upon traditional "pencil-and-paper" tests. The researchers also present a critical overview of modern testing technology to help neuropsychologists understand and benefit from new methods.

"Digital technology could improve cognitive testing and might change the way we understand and measure brain functioning in health and disease," said Germine.

Germine, who is the technical director of the McLean Institute for Technology in Psychiatry and director of the Laboratory for Brain and Cognitive Health Technology, explained that "digital neuropsychology," or the assessment of neuropsychological function using digital devices such as smartphones, represents "a critical and potentially game-changing set of methodologies that can get at aspects of cognitive functioning that were previously inaccessible."

"We can, for example, measure the way cognition might change or fluctuate over time, or be affected by different sorts of environments," she said.

Germine said that tests conducted on digital platforms can capture subtle and important information about test takers—information that would be impossible to capture with paper-and-pencil assessments.

"You can measure moment-to-moment changes as a person moves their finger across the touch screen," said Germine. "If that movement is not smooth, if there's jerkiness, we can get all that. We can record certain dynamics or 'micro behaviors' with digital assessment. It's amazing."

In the paper, Germine and her colleagues also explain how digital tools allow researchers to test people's neuropsychological functions in their

natural environments. This is significant, she said, because "much of neuropsychological testing is getting at someone's optimal performance, determining how well could they do if you structured everything right." However, according to Germine, digital testing "lets you ask the question of how well they actually do in their everyday environments." This ability to assess cognition in everyday life, she said, has long been a goal of clinicians, researchers, and computer scientists.

The paper grew out more than ten years of work by Germine and her colleagues to deploy digital tools in the service of cognitive testing. With research funding coming from the National Institutes of Health and other sources, Germine and her fellow researchers have consulted on projects to evaluate or recommend digital tools for measuring neuropsychological functioning.

In addition, the researchers worked to create of one of the first online neuropsychological research laboratories in 2005 and launch the testing website TestMyBrain.org in 2008. The site, she explained, "is now being used across more than 150 research and education sites internationally, and more than 2 million people have completed tests on the site."

Despite years of work showing the great promise of digital neuropsychology, Germine and her colleagues are calling on clinicians and researchers to be cautious as they move forward. She pointed out that "variations in devices, hardware, and software and how we interact with them could be in some ways greater than with paper and pencil, and taking a test on a laptop as opposed to a smartphone could yield different results." The researchers encourage neuropsychologists to "maintain the right degree of skepticism and understand the scope of what is possible."

"The paper was meant to be a primer for clinical researchers and neuropsychologists and introduce them to these new opportunities in digital neuropsychology," said Germine. The authors, she explained,

"also hope to help software and technology developers build the right tools that solve the right problems for neuropsychologists."

Building on this work, Germine and her colleagues are now engaged in a large-scale project with the National Institute of Aging for developing a nationwide infrastructure to perform neuropsychological testing with mobile devices "We're bringing together the brightest minds and innovators to create a standard set of tools for mobile devices that will help move the needle in our understanding of brain health and how neuropsychological functioning contributes to physical and mental disorders," said Germine.

Provided by McLean Hospital