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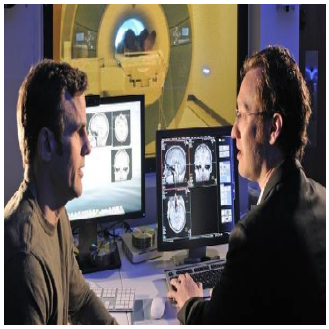
New MRI Diagnostic Test for Autism Spectrum Disorder



A new brain imaging technique developed by scientists at Virginia Tech Carilion Research Institute may be able to identify children with autism spectrum disorder in just two minutes. This technique offers promising diagnostic potential once it undergoes more research and evaluation. Usually, diagnosis — an unquantifiable process based on clinical judgment — is time-consuming and trying for children and their families. That may change with this new diagnostic test.

"Our brains have a perspective-tracking response that monitors, for example, whether it's your turn or my turn," said Read Montague, the VTCRI professor who led the study. "This response is removed from our emotional input, so it makes a great quantitative marker. We can use it to measure differences between people with and without autism spectrum disorder."

The finding, published online in *Clinical Psychological Science*, shows that the perspective-tracking response can be used to determine whether someone has autism spectrum disorder.

The path to this discovery has been a long, iterative one. In a 2006 study by Montague and colleagues, pairs of subjects had their brains scanned using functional magnetic resonance imaging (MRI) as they played a game requiring them to take turns. Analysis of those images showed that the middle cingulate cortex became more active when it was the subject's turn.

"A response in that part of the brain is not an emotional response, and we found that intriguing. We realised the middle cingulate cortex is responsible for distinguishing between self and others, and that's how it was able to keep track of whose turn it was," explained Montague, who also directs the Computational Psychiatry Unit at the VTCRI and is a professor of physics at Virginia Tech.

That realisation led scientists to examine how the middle cingulate cortex response differs in individuals at different developmental levels. In a 2008 study, Montague et al. asked athletes to watch a brief clip of a physical action, such as kicking a ball or dancing, while undergoing functional MRI.

The athletes were then asked either to replay the clips in their mind, like watching a movie, or to imagine themselves as participants in the clips. According to Professor Montague, "The athletes had the same responses as the game participants from our earlier study. The middle cingulate cortex was active when they imagined themselves dancing — in other words, when they needed to recognise themselves in the action."

The 2008 study also indicated that in subjects with autism spectrum disorder, the more subdued the response, the more severe the symptoms.

In 2012 Montague et al. designed another study to see whether they could elicit a brain response to help them compute the unquantifiable. Their experiment yielded positive results: By presenting self-images while scanning the brains of adults, they elicited the self-perspective response they had previously observed in social interaction games.

In the current study involving children, subjects were shown 15 images of themselves and 15 images of a child matched for age and gender for four seconds per image in a random order.

Like the control adults (2008 study), the control children had a high response in the middle cingulate cortex when viewing their own pictures. In contrast, children with autism spectrum disorder had a significantly diminished response. Notably, this difference in individuals could be detected using only a single image.

Montague and his team realised they had developed a single-stimulus functional MRI diagnostic technique. The single-stimulus part is important, Prof. Montague pointed out, as it enables speed. Children with autism spectrum disorder cannot stay in the scanner for long, so the test must be quick.

"We went from a slow, average depiction of brain activity in a cognitive challenge to a quick test that is significantly easier for children to do than spend hours under observation," the professor said. "The single-stimulus functional MRI could also open the door to developing MRI-based applications for screening of other cognitive disorders."

Source: Virginia Tech Carilion Research Institute
Image Credit: Virginia Tech Carilion Research Institute

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