Micromovements hold hidden information about severity of autism, researchers report

December 2 2013

Movements so minute they cannot be detected by the human eye are being analyzed by researchers to diagnose autism spectrum disorder and determine its severity in children and young adults, according to research presented at the 2013 Society for Neuroscience annual meeting in November.

The research is the work of Jorge V. José, Ph.D., vice president of research at Indiana University, and Elizabeth Torres, Ph.D., the principal investigator for the study and an assistant professor in the Department of Psychology in the School of Arts and Sciences at Rutgers University. They are building on earlier findings involving the random nature of movements of people with autism. The work was presented in a poster by biophysics and neuroscience Ph.D. graduate student Di Wu, who works in Dr. José's lab.

Earlier research looked at the speed maximum and randomness of movement during a computer exercise that involved tracking the motions of youths with autism when touching an image on the screen to indicate a decision. That research was reported in July in the Nature journal *Frontiers of Neuroscience*.

In the new study, the researchers looked at the entire movement involved in raising and extending a hand to touch a computer screen. The device they use can record 240 frames per second, which allows them to measure speed changes in the millisecond range.

"We looked at the curve going up and the curve going down and studied the micromovements," said Dr. José, who also is the James H. Rudy Distinguished Professor of Physics in the IU Bloomington College of Arts and Sciences and a professor of cellular and integrative physiology at the IU School of Medicine.

"When a person reaches for an object, the speed trajectory is not one smooth curve; it has some irregular random movements we call 'jitter,'" he said. "We looked at the properties of those very small fluctuations and identified patterns." Those patterns or signatures also identify the degree of the severity of the person's autism spectrum disorder, he said.

"Often in movement research, such fluctuations are considered a nuisance," Dr. José said. "People averaged them away over repeated movements, but we decided instead to analyze the movements on a smaller time scale and found they hold lots of information to help diagnose the continuum of autism spectrum disorder.

"Looking at the speed versus time curves of the motion in much more detail, we noticed that in general many smaller oscillations or fluctuations occur even when the hand is resting in the lap. We decided to carefully study that jitter. Our remarkable finding is that the fluctuations in this jitter are not just random fluctuations, but they do correspond to unique characteristics of the degree of autism each child has."

Wu said the more detailed information allows subtyping autism spectrum disorder, Asperger's and identify typically developing individuals much better than what had been done before in terms of the global distribution of movements.

The next step is to compare the output of the new methodology in individuals with autism of idiopathic origins with those with autism of

known etiology. The new refinement may help advance research in autism spectrum disorder to develop treatments tailored to the individual's needs and capabilities. A collaborative effort with the Torres lab at Rutgers is underway.

Provided by Indiana University