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Autism's social struggles due to disrupted communication networks in brain

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Picking up on innuendo and social cues is a central component of engaging in conversation, but people with autism often struggle to determine another person's intentions in a social interaction. New research from Carnegie Mellon University sheds light on the neural mechanisms that are responsible for such social difficulties in autism, and on the workings of these social brain mechanisms in all of us.

According to the study, which is available on the Web site of the journal *Social Neuroscience*, inefficient pathways for transmitting information between certain brain regions are to blame. The research implicates abnormalities in the brain's inter-regional communication system, which connects the gray matter's computing centers.

"The communication between the frontal and posterior areas of the social brain network is impaired in autism, making it difficult to understand the intentions of others" said the study's senior author, Marcel Just, the D.O. Hebb Professor of Psychology at Carnegie Mellon.

The study is the first to measure the synchronization between the brain areas that make up the Theory of Mind (ToM) network, which is responsible for processing the intentions and thoughts of others. It is the first to provide such concrete evidence of faulty social network connections.

To measure the ToM network's effectiveness, the researchers asked 12 high-functioning autistic adults and 12 control participants to view

animations of interacting geometric figures, an example of which can be viewed at www.ccbi.cmu.edu/reprints/reprints.htm.

Participants then were asked to select the word from several choices that best described the interaction. For example, a large triangle would nudge a small triangle to move outside its enclosure, and the correct word choice would be "persuading." The control subjects were consistently better at inferring the intention from the action than the participants with autism were.

While the study participants were performing the task, the researchers used functional magnetic resonance imaging (fMRI) to measure activation levels in all of the cortical areas that compose the ToM network. Specifically, they simultaneously examined activation levels in several frontal and posterior brain regions to determine the synchronization levels in the network. The synchronization was reliably lower in the group with autism.

Furthermore, the autistic participants' brains showed much lower activation levels than their counterparts in the frontal regions. These measures of brain activity in autism, such as the activation level in the posterior part of the ToM network (located approximately behind one's right ear), were correlated with how well each autism participant performed in the Happe's Strange Story Test — a pencil-and-paper assessment of an individual's understanding of non-literal statements, such as figures of speech.

"This study offers compelling evidence that a lack of synchronization in the Theory of Mind network is largely responsible for social challenges in autism," said Just, director of Carnegie Mellon's Center for Cognitive Brain Imaging. "That evidence can provide the foundation for therapies that are more useful than current approaches."

The findings have the potential to guide the development of theoretically based interventions for autism that could target this particular shortfall, for example, by focusing on games and activities that would strengthen the connections. Eventually, it might be possible to tailor autism therapies to the brain communication deficit on a case-by-case basis. Measuring the connectivity before and after an intervention also could be used to determine effectiveness.

Source: Carnegie Mellon University