

Understanding of autism grows as Pittsburgh researchers track brain action

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By Mark Roth, Pittsburgh Post Gazette

People with autism have been described as being cut off from the world around them.

But a series of studies done at Carnegie Mellon University and the University of Pittsburgh have now shown that in a very real way, autistic people are also cut off from themselves.

Scans done by Carnegie Mellon's Center for Cognitive Brain Imaging show that various regions in the brains of high-functioning autistics don't communicate with each other as well as they do in typical people's brains.

This basic breakdown could help explain everything from why people with autism often lack common-sense reasoning to why they don't understand emotions and have trouble recognizing faces.

In a breakthrough study three years ago, researchers at Carnegie Mellon and Pitt found that more advanced autistics were good at knowing words and their definitions, but poor at understanding the meaning of complex sentences.

Using functional magnetic resonance imaging, which measures blood flow to different parts of the brain in real time, they showed that the language-processing areas of autistics' brains were poorly synchronized compared with nonautistic subjects.

Since then, the two research centers have shown the same poor connectivity in autistics' brains when they were playing a geometric game, and when they were at rest.

A study publicized by Carnegie Mellon last fall offers an explanation for why this might be happening.

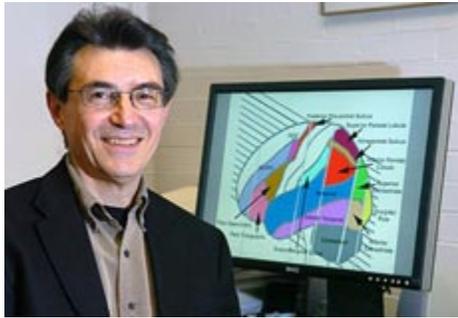
After examining how water flowed through the connective white matter that makes up about half the brain, researchers discovered that those brain cells were much more poorly organized in people with autism.

The white matter sends electrical signals from one part of the brain to another, said Marcel Just, director of Carnegie Mellon's brain imaging center.

"So why are autistics' brain poorly synchronized?" he said. "Maybe because the cables are not quite right."

Other types of brain tests have shown the same kind of connectivity problems.

At the University of Washington, researcher Michael Murias used EEGs to measure the brain waves of 18 people with autism and 18 without it. The readings from 124 electrodes on each person's scalp showed the brain waves in people with autism were much less coordinated, particularly between the frontal lobes, where rational analysis takes place, and the rest of the brain, Dr. Murias said.



Lake Fong, Post-Gazette
Professor Marcel Just, director of the Center for Cognitive Brain Imaging at Carnegie Mellon University, has shown that people with autism have poor connections between the rational frontal lobes of the brain, on the left in the picture behind him, and the posterior and temporal lobes of the brain, shown at the right.

The imaging done during language tests a few years ago helped explain a phenomenon that autism researchers have long known about, said Nancy Minshew, director of Pitt's Collaborative Programs of Excellence in Autism.

"What we see in our verbal [autistic] people across a lot of areas is that they have trouble with higher-level interpretations or understandings. They can read stories and have incredible vocabularies, but they don't understand the real meaning of stories."

They can be especially confused if the stories don't follow certain axioms they've learned, Dr. Minshew said.

She knows one young autistic man, for instance, who has read Shakespeare's "Romeo and Juliet" more than once, "but he says, 'I still don't understand why Romeo and Juliet got married; it's against the rules.'"

They also have trouble with metaphors and other symbolic meanings of words, she said.

She recalled sitting with a 9-year-old autistic patient one day when she told him, "We'd better get busy or we'll be in the doghouse with your mom, and he started looking around for the doghouse."

In autistics' brain images, the centers that recognize words and remember their definitions are often brightly lit up, Dr. Just said, but the areas of the cortex that discern the meaning of whole sentences are underactive.

People with autism have the same kind of processing problems when they try to recognize people or objects, said Mark Strauss, a research psychologist at Pitt.

During normal development, babies learn at a young age to identify the differences in men's and women's faces, and that ability improves as they get older.

Autistic children can do the same thing, Dr. Strauss said, but rather than looking at the whole face, they tend to use certain details, such as the thickness of the eyebrows or the size of the nose.

If a face is not strongly masculine or feminine, but somewhere in between, he said, people with autism have a much harder time identifying the gender.

A recent study he did showed people with autism had the same kind of problem with objects. Asked to categorize pictures as either couches or chairs, the autistics did fine until they encountered a more ambiguous item such as a love seat.

"Imagine I showed you a category you've never seen before, like llamas," Dr. Strauss said. "After several examples, you'll have extracted a general representation of what llamas look like, but autistics have great difficulty making those kinds of abstractions."

This also plays a big role in why those with autism have trouble interpreting emotions, he said.

Normally, we detect subtle cues in someone's facial expression and then use our sense of how we feel in certain situations to interpret how the other person is feeling, he said.

But people with autism have trouble reading complex facial expressions and interpreting the feelings they signal.

While they may have no problem sensing someone who is genuinely happy because they can see a big smile, it can be almost impossible for them to detect when someone is giving them a false smile, because they can't see that the eyes aren't as crinkled and they don't know what that says about the person's true feelings.

The ability to interpret faces and intentions is a key part of separate studies that are coming up at both Carnegie Mellon and Pitt.

Carnegie Mellon has constructed computerized faces to test how good people with autism will be at detecting liars and truth tellers.

The lying "avatar," or animated face, doesn't make as much eye contact, doesn't move his head as much, and when he makes a statement like "If you buy my lunch today, I'll treat you tomorrow," there is an awkward gap between the last two words.

Researchers want to see whether people with autism have more trouble identifying the lying avatars, Dr. Just said, and then want to see if they can be trained to detect the differences between liars and truth tellers. After that, the researchers will check to see how the training has changed brain activity.

At Pitt, Dr. Strauss is planning a study of the younger siblings of autistic children. Surveys have shown that about 10 percent to 20 percent of those babies will show autistic symptoms themselves, and he wants to see if that can be detected early and whether the babies' brains can be retrained to counteract the autism.

Autism affects about three out of every 1,000 children born in the United States, according to the National Institute of Mental Health. It is believed to have a strong genetic component, although the specific genes that trigger it have not been fully identified.

Despite worries in recent years that the mercury preservative in some vaccines may have caused many autism cases, a major national study found no evidence for that or any other clear environmental cause for the disorder.

The reported incidence of autism is 10 times greater than it was several decades ago, a 2005 British study noted, but most of that increase is believed to be due to greater awareness of the disorder and better detection methods.

The Carnegie Mellon findings of poor anatomical connections in the brains of autistic people might seem to deal a big blow to hopes for any remedy, but the experts don't see it that way.

Dr. Strauss noted that poor thinking patterns in autistic children may contribute to the connection difficulties seen later on in brain imaging, so that correcting some of those processing problems might help reverse the abnormal connections.

And Dr. Just said the brain scans offer clues on to how to attack the problems people with autism face.

"It seems to me knowing anything is better than knowing nothing," he said. "You can then ask what kind of behavioral remediation could you engage in to overcome this."

"Every five years or so, what we have to offer autistic children is better," Dr. Minshew added. "So I think there are great things to come. I think the world our children will live in will be much different than ours."