

NEWS

Researchers grapple with mixed results from cognitive studies

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Cognitive control: People with autism can do well on tests measuring executive function skills — if those tests, like this challenge to remove a cork from a tall glass cylinder, don't require them to infer what an experimenter is thinking.

Some studies have suggested that people with autism have deficits in executive function, a set of complex mental processes involved in everyday life. But these results may instead reflect their difficulties imagining what other people are thinking, according to a provocative new hypothesis¹.

Executive function encompasses many mental activities, such as planning, problem solving, paying attention and blocking out distracting information. It is crucial for both mundane and complex tasks — everything from raising your hand and waiting until you're called on in the classroom to planning a long sequence of steps in order to finish a project on time.

People with autism commonly have difficulty with such skills in daily life, and over the past ten years there's been an explosion of research on executive function in people with the disorder. But study results have been inconsistent.

Some show that people with autism score poorly on tests of executive function in the laboratory², and others find no differences³, or even that people with autism are better at these tasks than controls are⁴.

In a new paper, published in May in the *Journal of Autism and Developmental Disorders*, **Sarah White**, a research fellow at the Institute of Cognitive Neuroscience at University College London, argues that when people with autism do poorly on tests of executive function, it's not that they can't do what the experimenter wants. It's that they don't know what the experimenter wants, because sometimes this is not explicitly stated in the instructions to the test.

"They were officially failing these tasks, but for unusual reasons," White says. "When you watched them do these tasks, it didn't feel like they had an impairment as such, it just felt like they had their own agenda."

Implicit information:

White posits that people with autism have trouble inferring implicit information, which is one aspect of **theory of mind**, the ability to intuit another person's state of mind.

"I think she's very likely to be right for certain types of executive function tasks," says **Paul Burgess**, professor of psychology at University College London and head of the executive function group at the Institute of Cognitive Neuroscience. "I'm less convinced that it's a true explanation of everything."

Still, Burgess and other researchers say that, at the very least, White has identified one reason for difficulties with executive function. They say this highlights the need for autism interventions that help with making inferences, rather than those aimed at building executive function skills alone.

White says her hypothesis grew out of her experience administering executive function tests to children with and without autism. Typically developing children know that when told to draw lines on a piece of paper and show how they would search for a key lost in a field, they should draw an efficient, comprehensive path of lines back and forth down the page.

"We never told the [children] to do it in the most efficient way possible, but the controls inferred that was the way the experimenter would expect them to behave," White says.

A child with autism, by contrast, might draw a line to the corner of the field, where he said there was a tree he had climbed earlier, then a squiggle to the center where he imagined he'd had a picnic.

In a 2009 study, White and her collaborators found that a group of 45 children with autism scored worse than a group of 27 controls on four of six 'open-ended' executive tasks, such as the key search⁵. But they did just as well as controls on six of eight 'constrained' tasks that don't require making inferences about what the experimenter is after, such as being challenged to get a cork out of a long tube without turning the tube upside down.

In her new paper, White reviewed more than two dozen studies of executive function in autism conducted by other researchers since 2004, particularly in two important aspects of executive function: cognitive flexibility, the ability to change one's actions in response to an evolving situation, and inhibition, the ability to prevent oneself from performing a particular action.

She found a similar pattern as in the 2009 study. "When you give them more explicit instructions, then they can do the task, no problem," she says.

Multiple demands:

White isn't the first to suggest that results of cognitive testing in autism aren't always straightforward.

For example, researchers at Johns Hopkins University in Baltimore have suggested that people with autism do poorly on one common test of spatial reasoning because they have difficulty **putting themselves in another person's shoes**.

However, a weakness of White's analysis is that she looks back at the tests in past studies and classifies them as explicit or implicit. The analysis would be stronger if this were based on some broadly agreed-upon criteria for distinguishing implicit and explicit tasks, says **Helen Tager-Flusberg**, professor of psychology at Boston University. But "we don't have an objective and independent metric of what makes a task implicit versus what makes a task explicit," she says.

One way to test White's hypothesis would be to give two different versions of the same test — one with explicit instructions and one with implicit ones — to a group of people with autism.

A number of other factors might also explain the inconsistent results. Deficits in executive function can vary greatly from person to person⁶, for instance, so studies with small sample sizes might yield inconsistent results just by chance, notes Burgess. Differences in age, intelligence quotient or language ability can also affect performance.

Other researchers point out that there are already some data that don't match up with White's hypothesis.

For example, children with autism have trouble with a task that requires them to filter out distracting information⁷, even though the task is highly structured — meaning that it doesn't require them to make inferences about the experimenter's intentions.

An **eye-tracking study** presented at this year's **International Meeting for Autism Research** found that the poorer a child performs on a test that requires both working memory and inhibition, the more he or she struggles in daily life.

“Impairments in executive function are most evident when we’re placing demands on multiple aspects of executive function,” says **Shawn Christ**, assistant professor of psychology at the University of Missouri, who led this research.

Still, Christ says, White’s work “reaffirms my belief that there’s a really close link between theory of mind and executive function.”

White argues that interventions for autism need to account for this link.

On their own, “therapies that try to boost cognitive control in these individuals are probably not going to help,” she says. They should instead help people with the disorder learn how to predict and interpret others’ mental states.

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