

NEWS

For people with autism, unforeseen events come as no surprise

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People with autism are less surprised by unexpected occurrences than are typical adults, according to a new study¹. That may be because they see the world as highly changeable, and expect the unexpected.

The researchers measured reaction times to unexpected cues that came up during a simple picture-naming task. Typical adults pause in response to such surprises. But people with autism pause less, indicating that they don't register the odd cues.

"The findings suggest individuals with autism learn about and estimate environmental change quite differently" than others do, says **Rebecca Lawson**, postdoctoral fellow in Geraint Rees' lab at University College London, who did the work. (Rees was not available for comment.)

As a consequence, they may make predictions based largely on sensory information rather than on learning cause-and-effect relationships — that, for example, a ringing doorbell means someone is at the door or that a refrigerator contains food, not shoes.

The findings are in line with the '**magical world**' theory, which proposes that people with autism have difficulty predicting what comes next, says **Pawan Sinha**, a professor of vision and computational neuroscience at MIT, who was not involved with the new study.

"To a person with autism, it seems as if they live in a magical world where things are happening seemingly without cause," Sinha says. "If everything is magical, then even the truly magical things would not be seen as too out of the ordinary."

Expected events:

In the new study, 24 adults with autism and 25 controls performed a straightforward task. In the task, participants see a series of pictures flash briefly on a monitor, and have to decide whether each picture is of a house or a face. A distinctive sound precedes each type of image. After a few rounds of this task, participants implicitly learn to associate each image with its sound, and become quicker in classifying them.

In some rounds, however, the researchers pair the images with the wrong sound. In response, typical participants pause briefly, and their reactions take longer. "You stall for a brief but measurable second when something violates your expectations," Lawson says.

Individuals with autism pause for less time than controls, however, indicating less surprise.

The researchers then applied a computational model to the data. The model infers how the brain combines past beliefs and new information to predict what comes next.

The analysis revealed that individuals with autism learn about changeability of the environment faster than neurotypical people do. When making a decision, they also tend to discount information from the past, Lawson says.

The researchers also found that those who were the least surprised have the greatest difficulties in

communication, as measured by the Autism Diagnostic Observation Schedule. The study appeared 31 July in *Nature Neuroscience*.

Core difficulty:

Poor predictive skills could underlie a variety of autism traits, such as language and social problems, sensory sensitivity, **repetitive behaviors** and insistence on sameness, says **Margaret Kjelgaard**, professor at Rocky Mountain University of Health Professions, who was not involved with the new study.

Difficulty predicting what's next could explain sensory overload, a prominent feature in autism. Similarly, intolerance of change, one of the diagnostic criteria for autism, could be a coping mechanism for dealing with a world where everything is unstable, Kjelgaard says.

"All of those traits seem so unrelated on the surface, but we think problems with learning and prediction can be a core difficulty underlying these symptoms," she says.

Not being able to anticipate how people typically respond to things you say or do can also make social interactions difficult. "There is a tentative suggestion here that differences in how expectations alter basic reaction-time behavior might relate meaningfully to difficulties with social-communication behaviors," Lawson says.

Several research teams are testing whether children with autism or toddlers who are at risk for the condition also have poor predictive skills, Sinha says: "It would be really interesting to see if these patterns start to happen early in life."

Lawson and her colleagues aim to parlay their computational models of learning into an instrument that could help identify children with autism by the predictive properties of their brains.

REFERENCES:

1. Lawson R.P. *et al. Nat. Neurosci.* Epub ahead of print (2017) **PubMed**