NEWS

Motion-capture videos reveal atypical grooming in fragile X rats

BY **LAURA DATTARO**

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A Hollywood-inspired video tool can **capture the actions** of laboratory animals in three dimensions over days or weeks and reveal new subtleties in behavior, according to a new study. For instance, rats lacking the autism-linked gene **FMR1** groom differently than controls do, the researchers who designed the method found.

The system, dubbed CAPTURE (Continuous Appendicular and Postural Tracking Using Retroreflector Embedding), derives from the motion-capture technology **used in big-budget films** to add special effects or support animation. Motion capture tracks only movement, using reflective markers placed on an actor's body; animators then reconstruct a 3D model of the recorded motions.

Researchers who study animal behavior usually record traditional 2D videos. But these videos have such large file sizes that it limits how much data scientists can store and analyze, and it restricts studies to snippets of an animal's life.

Scientists have improved on that approach using **depth-sensing cameras** — which detect vertical as well as horizontal motions — and machine learning to break behaviors down into discrete 'syllables.' CAPTURE's technology is even more exact, and makes it possible to record longer time periods by storing only movement data.

"We can now really read the body language of these animals very precisely in ways that previously wasn't possible," says lead investigator **Bence Ölveczky**, professor of organismic and evolutionary biology at Harvard University. "It just opens up a new area of inquiry."

Motor activity:

The researchers attached 20 reflective markers to individual rats and filmed each animal continuously for at least one week.

The team also tested the system for several days in rats missing FMR1 and wildtype rats; in people, mutations in FMR1 cause **fragile X syndrome**, which is often accompanied by autism.

Both the wildtype and fragile X rats spent a similar amount of time moving around the cage, but the fragile X rats spent more time grooming, and groomed in a more repetitive manner. The findings were published in *Neuron* in December.

The system currently measures the behaviors of only one animal at a time, but it could be adapted to monitor interactions between two or more, the researchers say.

“Getting a fine-grained understanding of social interactions is going to be crucial,” says study investigator **Jesse Marshall**, a postdoctoral researcher at Harvard University. “The hope was to have something very carefully measured that could enable reproducibility.”

In the future, CAPTURE recordings could be combined with other methods, such as calcium imaging, to better understand the neural underpinnings of behaviors, Marshall says.

Quantifying behavior:

CAPTURE is part of a larger push to develop methods to **quantify behavior** and track how it changes over time — either in progressive conditions, such as **Rett syndrome**, or in response to treatments, says **Stewart Mostofsky**, director of the Center for Neurodevelopmental and Imaging Research at the Kennedy Krieger Institute in Baltimore, Maryland.

For instance, CAPTURE could help scientists identify subtle motor differences between autistic and non-autistic people, Ölveczky says. “That is something this technique enables uniquely.”

The technology Ölveczky and his colleagues used may be cumbersome if adapted for use with people, Mostofsky says. In 2020, he and his colleagues repurposed a video game console’s sensor for motion capture and found that autistic children **mimic others’ movements** less accurately than non-autistic children do.

But, he adds, “I really do envision, within the next five years or so, an ability to — in a really facile, seamless way — capture movement [and] activity from children across a range of diagnoses and be able to really identify specific patterns of action” that correlate with a person’s genetics.

CAPTURE and similar tools will enable researchers to study behavior in more natural settings than was previously possible, says **Abraham Palmer**, professor of psychiatry at the University of California, San Diego, who was not involved in the work. Most animal studies, for example, probe

how an animal responds to a human-created environment or task — contrivances that are not always relevant to conditions like autism.

“There’s an urgent need for us to be able to study behavior over longer time frames in a way that’s open-minded and doesn’t have a preconceived notion of which behaviors we’re trying to measure,” Palmer says.