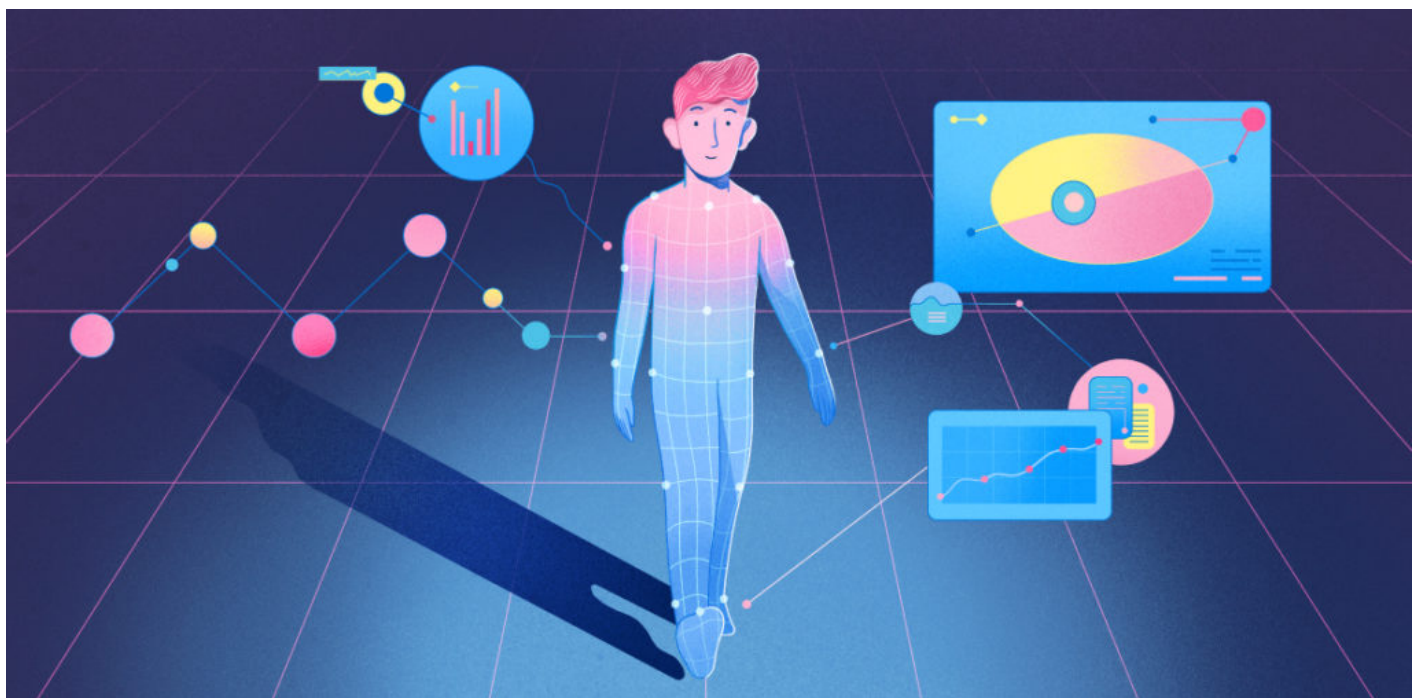


VIEWPOINT

Quantitative tests of motor skills could improve autism care

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Every week, I see children with autism in my behavioral neurology clinic, and I am struck by the huge variety of motor difficulties they have. Poor coordination or clumsy walking, among other issues, often appear early in life, persist for a lifetime and may even herald the core traits of autism.

Trained as a neurologist, I quickly learned that the usual diagnostic approach — an in-depth neurological exam paired with brain imaging — often does not work for individuals with autism. The **motor problems seen in autism** are complex and diffuse. Clinical brain imaging does not always reveal them. Terms such as spasticity, ataxia and dysmetria commonly used in neurological examinations often do not apply. Instead, I found myself using broad descriptive phrases, such as ‘uncoordinated,’ ‘clumsy’ and ‘odd postures.’ From these clinical observations, I was driven to

understand more about these motor difficulties.

Motor issues in autism may include difficulties with pointing, grasping, running, balance and keeping up with peers during organized physical activity. These difficulties affect how children engage with their environment, which in turn affects their social communication, language, cognitive abilities and peer relationships.

Motor problems are not a diagnostic criterion for autism, but they are prevalent. Standardized ways of assessing motor skills do not capture these broad motor abnormalities, however. These assessments often emphasize motor skills acquisition or motor milestones — for example, whether a child is walking — instead of a descriptive analysis of motor skills. Also, assessments that depend on a child following verbal instructions or complex commands may conflate cognitive or language problems with motor ones.

We need to develop assessments that can capture and characterize motor difficulties in individuals with autism who have varying cognitive abilities. Having such assessments could help us understand why motor difficulties occur in autism and how they affect core autism traits, which could have a tremendous impact on autism research and treatment. Improving motor skills in autistic individuals is likely to change how they interact with their environment and target multiple areas of development.

Wish list:

To better understand motor problems in autism, I embedded motor assessments in my team's studies. We chose a standardized assessment that seemed promising and used it to evaluate autistic people from 3 to 18 years of age with a range of intellectual and behavioral function.

After months of data collection, we found that nearly all of these children received this test's lowest possible score; 60 percent scored low because of their inability to understand a task, to complete many trials of a task or to attend to the tasks. The low scores indicate that these children are different than typical children, but they don't reveal anything about the children's motor abilities or difficulties.

I was surprised at the limitations of the assessment. Scouring the literature for alternatives, I found that most of the standard motor measures have similar shortcomings. They do not take into account common nonmotor, cognitive or communication difficulties in autism, and they do not capture the heterogeneity of motor problems in autism¹. These tests are especially limited for assessing people with intellectual disabilities. Although there is a rich history of research focused on motor function in autism, we need better ways of characterizing motor skills in people with autism and similar conditions.

My wish list includes methods that can screen and evaluate infants, children and adults with a wide

range of developmental and intellectual abilities, and methods that can measure the subtle and specific qualitative motor differences that I witness every day.

As a first step, my team and I have adapted a quantitative method to analyze the balance and gait of children with autism with and without genetic syndromes. The method consists of a mat with **embedded pressure sensors** that pick up the pressure of footsteps when people walk on it. My team has also developed a protocol that allows us to assess gait in all of the study participants. The system does not require that a person follow complicated instructions. As a result, we can use it and other quantitative methods to assess individuals with profound intellectual disability and severe behavioral impairments.

The method also captures specific qualitative differences in these children. For example, we found that the gait of children with specific genetic syndromes and autism is slower, involves wider steps and is more variable than that of either typical children or other autistic children.

We are beginning to tease apart the heterogeneity in motor skills across individuals with autism. We hope to gain a better understanding of how distinct motor difficulties might manifest in different forms of the condition, and how they relate to its core traits and other areas of development.

Tailored treatments:

I would like to see quantitative, objective motor assessments become the standard in autism assessments. Ideally, these assessments would finely characterize motor issues across a range of individuals with neurodevelopmental conditions². Ongoing work in quantitative analysis should pave the way for developing motor assessments and screening tools for clinical use in people with autism or at risk for autism.

Better measures will teach us a lot about autism. They may reveal the earliest motor differences in autism, which motor problems are specific to the condition, how these problems relate to core traits, and the relationship of specific motor issues to brain differences.

A clear picture of motor differences in autism along with systematic screening for them in infancy, early childhood and across a lifespan should allow for a better understanding of brain mechanisms related to these motor differences and lead to improved prognosis and treatments.

With good clinical measures, we can tailor treatments to the individual, by matching the specific motor problems a child has to a therapy plan. The plan may include physical therapy and occupational therapy. However, I also hope to see new therapies targeted to motor impairments specific to autism. In addition, participation in adapted sports programs and physical activity can help improve motor skills, build relationships and confidence, and reduce sedentary behavior in people with autism³.

Improved motor assessments can also lead to more accurate screening and aid in early detection. It is imperative that diagnosticians routinely screen for motor differences, so that any that are found can be addressed quickly. Because motor skills aid engagement with the world, the treatment of motor problems is likely to have ripple effects for social, intellectual and other important life skills.

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