VIEWPOINT

Studies of gaze could improve diagnosis, treatment of autism

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Autistic people look at the world differently than others do. Even the earliest descriptions of autism noted atypical gaze as a key feature of the condition. Since then, it has become accepted that people with autism do not make the type of **eye contact** others generally expect — sometimes it's too little, sometimes too much.

Yet there has been considerable debate as to whether **gaze differences** actually exist, what they look like and whether they are important to understand. Is studying gaze in autism just an academic pursuit, or could it enhance the lives of people on the spectrum?

Our work suggests that gaze differences exist and that understanding them can improve the lives of people with autism.

Over the past 20 years, more than 120 studies have focused on gaze in autism, and most have found differences in the way people with autism look at their world. Reviews of these studies, including meta-analyses, have revealed that people with autism tend to look at faces less than neurotypical people do. And when they do look at faces, they tend to look less at the upper face region, which contains much of the social and emotional information[1]. They also tend to look at objects or items that hold no social cues.

These findings are consistent with studies showing that altered gaze patterns in autistic children are apparent even in infancy[2]. They also support the idea that we could diagnose autism by age 2, with gaze and attention differences being important early signs.

Gaze metric:

Motivated by these differences, my colleagues and I wondered whether we could parlay advances

in **eye-tracking** technology into an objective way to identify autism in a child.

Standard diagnostic tools for autism are subjective and mostly based on observations from parents and clinicians. They have been useful in screening and standardizing autism diagnosis. But they often are costly, time-consuming and require substantial training. Brief, easy-to-administer, objective measures could greatly improve early diagnosis of autism.

In a study published last year, my team described one of these measures. We tracked gaze in 91 children with autism and 110 typical children, aged 18 months to 17 years, while they watched six-minute videos. We used technology that records the direction of gaze even in young children who have trouble sitting still[3].

We found that children with autism show distinct patterns in where they look, for how long and the number of places they look at in a scene. A statistical combination of these and other measures could differentiate autistic children from typical ones or from children with other brain conditions more than 80 percent of the time.

We are testing this metric in children who visit community clinics as opposed to specialty centers or research labs. We have tested more than 50 children so far and plan to expand that number to a few hundred.

If our initial findings are confirmed, clinicians might use the measure, or a similar one, as an aid to early diagnosis of autism, informing and improving clinical judgement.

Word pictures:

Eye-tracking technology could also help clinicians assess language skills in people being evaluated for possible developmental disabilities. Many of these individuals are uncomfortable with standard instruments because they may not like interacting with a stranger or become upset at a change in their routine. Some get anxious or shut down. People with motor difficulties may also struggle with traditional tests of language that require a motor response, such as pointing.

But evaluating language ability, especially the ability to understand words and phrases, is important because it is a good predictor of a person’s overall outcome and can help chart their treatments and progress.

In a study that is in press, my colleagues and I presented six panels of pictures to 48 autistic children and 66 children with other developmental conditions, aged 18 months to 17 years. Each display has four to eight pictures, half of which are targets and half distractors.

One at a time, we asked children to look at a target picture, using a word that was appropriate to the child’s age to describe the picture. If the child knew the word, she would presumably look at

the picture corresponding to it. How long the child looks at the correct picture reflects her ability to understand the word.

We compared the children's performance on this gaze test with scores on standard tests of this ability, which require the child to point to the correct picture. We found that the two scores generally agree. However, the gaze test is fast: It takes less than 2 minutes, compared with 20 to 40 minutes for the standard test.

Tracking success:

We have also considered the use of eye-tracking for measuring clinical improvements.

Drugs for autism and related conditions have had **limited success in clinical trials**, perhaps in part because the measures used to detect improvement may not be sensitive to real change. Some of these studies have used parent reports of autism traits, which may be biased. For example, parents sometimes see changes simply because they are **hoping to see them**.

Objective measures of autism traits, such as gaze patterns, could help solve this problem.

We are investigating whether gaze patterns could be used to gauge autism severity. An increase in a person's tendency to look at social information, for instance, could indicate that a treatment is working; no change might indicate a need to adjust the treatment dose, frequency or type.

Our work suggests that gaze measures could help clinicians diagnose autism accurately in young children and provide a quick way of assessing language ability. This technology could also help researchers gauge progress in clinical trials. If additional studies validate these applications, eye-tracking could speed the delivery of effective treatments to people with autism, ultimately improving their lives.

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