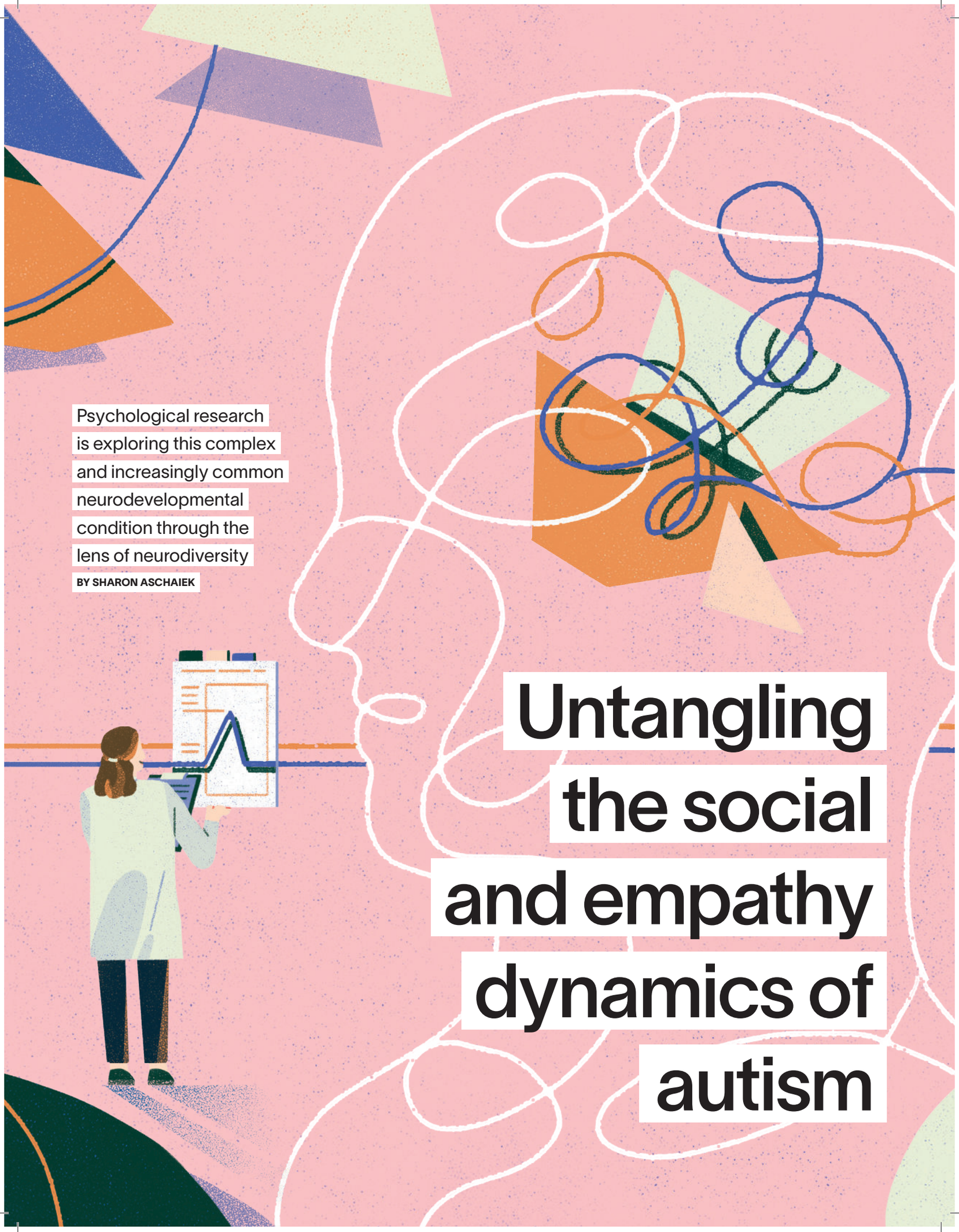


Untangling the social and empathy dynamics of autism

Psychological research is exploring this complex and increasingly common neurodevelopmental condition through the lens of neurodiversity

BY SHARON ASCHAIEK

ILLUSTRATION BY JEANNIE PHAN

Over the last two decades, autism spectrum disorder (ASD) has become the fastest-growing developmental disability worldwide. In 2020, the Centers for Disease Control and Prevention in the United States identified one in 54 children as having ASD, a neurological condition causing social and communication delays and restricted, repetitive behaviours. The diagnosis rate has tripled since 2000, when it was one in 150, and grown more than tenfold since the 1990s, when it was one in 1,000. This steep rise in prevalence has transformed autism into a public health crisis requiring more attention from government leaders, health professionals and educators. It has also fuelled significantly more research into autism, particularly its contributing factors—genetic mutations, poorly functioning gut bacteria and, possibly, environmental pollution.

But Yonat Rum and Anat Perry are asking different questions about autism, ones that consider the perspectives, abilities and life experiences of those on the autism spectrum. More specifically, these psychology researchers at the Hebrew University of Jerusalem (HUJI) approach autism through the lens of neurodiversity, an increasingly accepted theoretical perspective that views autism not as a problem to be solved, but as the result of natural variations in the human brain. This approach is leading to greater recognition of the strengths of autistic individuals, and allowing for the development of policies and practices to include them in society.

"When I started researching autism, I found that most studies focus on the deficits or impairments of people on the spectrum. But there are many insights we can gain about the positive aspects of autism," Rum says.

THE SIBLING FACTOR IN SOCIALIZATION

Rum's interest in autism stems from her education and work experiences in special education, and in 2013, it became the subject of her PhD research, which she completed as an Azrieli Graduate Studies Fellow at Tel Aviv University. She had noticed a dearth of knowledge in the field about how the social communication abilities of children with autism may be shaped by interactions with their neurotypical (NT) siblings. Rum decided to tackle the subject for her doctoral dissertation. Her research included three studies that examined the relationships and interactions between children with ASD and their older NT sibling. She shared her findings in a co-authored study that was published last November in the *International Journal of Behavioral Development:* "Prosocial behaviors of children with autism spectrum disorder (ASD) during interactions with their typically developing siblings."

For one observational, naturalistic study, Rum watched and video-recorded 28 sibling pairs, each including a child with ASD and an older NT sibling, engaging in free play together at home. Her goals were to assess the level of collaboration in these interactions and detect the characteristics of prosocial behaviours, play-related behaviours, fighting, discourse and imitation. Subsequent coding and analysis of these interactions using a frame-by-frame computerized analytic tool revealed

collaborative play to be present in 78 per cent of the sibling pairs. Prosocial behaviours were identified as the second most frequent type of behaviour observed, after play-related behaviours. The number of prosocial behaviours displayed by the ASD sibling was closely associated with the number of prosocial behaviours displayed by the NT sibling.

"We concluded that a child with autism benefits from the relationship with an NT sibling, because it provides a social role model and an opportunity to practise social behaviours in a generally collaborative and accepting environment," says Rum, who is currently conducting postdoctoral research at the Autism Research Centre at the University of Cambridge under renowned autism expert Simon Baron-Cohen. "Often, children with autism are busy participating in therapies instructed by adults, but this study shows there is also value in these natural interactions of free play at home with their siblings."

THE LITERATURE ON AUTISM AND EMPATHY

Recently, Rum has shifted her attention to how empathy presents in adults with autism. This has led to research collaborations with Azrieli Faculty Fellow Anat Perry, founder and director of the Social Cognitive Neuroscience Lab at HUJI. Perry and her team study the social, cognitive and neural aspects of social behaviours in healthy and clinical populations in two main areas: neural mechanisms that enable empathy, and interpersonal distance in social interactions. Rum's and Perry's overlapping research interests led them to partner on "Empathic Accuracy in Clinical Populations" (*Frontiers in Psychiatry,* June 2020), a review of 34 peer-reviewed studies, published between 1997 and 2019, on empathic accuracy—the ability to accurately judge others' thoughts and feelings—in individuals with autism or another neurological or behavioural disorder.

The overall findings from the eight studies involving autism suggest that empathic accuracy is reduced in individuals with ASD. However, Rum and Perry note a number of factors that complicate the validity of this finding. To start with, the body of research is too small to support broad conclusions about empathic accuracy and autism. Also, females were significantly underrepresented in these studies, which makes it impossible to generalize the results among the wider population. Another mitigating factor is that empathic accuracy can be more difficult for individuals with ASD due to challenges with attention, executive functioning and motor skills. Rum and Perry say it is unclear to what extent this was taken into account during the development of the eight studies. Altogether, they say, these factors reflect the need for more research into autism and empathic accuracy that considers these variables.

To discern how we understand other people's emotions, Perry has developed a naturalistic yet controlled empathic accuracy paradigm. She applied this approach in "The contribution of linguistic and visual cues to physiological synchrony and empathic accuracy" (*Cortex,* November 2020). The goal of this study, which involved neurotypical participants, was to better understand the behavioural and physiological dynamics of two main aspects of empathy: mentalizing, which is understanding another person's emotional state through context, and experience sharing, which is resonating with another person's emotions.

The study consisted of two phases. The first involved video-recording 28 male and female individuals—the "targets"—conducting an empathic accuracy task: telling an emotional story about their lives. The stories focused on topics such as the illness of a family member, a romantic breakup or a conflict with a friend. During their storytelling, each target's heart rate was tracked with an electrocardiogram. The targets were then asked to watch their own story and continuously rate their affective valence (how positive or negative they felt) when telling the story. They also reported the specific emotions they felt, and rated

"Empathy is a mutual process that requires understanding by both sides."

→ Psychology researcher Yonat Rum has identified distinct social communication benefits that arise for children with autism when interacting with their neurotypical siblings.

→ Hebrew University of Jerusalem psychology researcher Anat Perry is using the empathic accuracy paradigm she developed to examine how we come to understand the emotions of others.

PHOTOGRAPHS BY BOAZ PERLSTEIN (LOWER) AND SHAULI LENDNER (TOP)

the intensity of each on a scale from one (not at all) to nine (a lot).

In the second phase, the same stories were presented to 72 new participant "observers" in one of three ways: video with audio, video only or audio only. The observers each watched and/or listened to nine stories and were asked to continuously rate each target's affective valence with the same measure previously used by the targets. Following each story, they were asked to specify the emotions they inferred that the target had felt. Their heart rates were recorded throughout the experiment. Lastly, all of the observers completed two well-established empathy questionnaires.

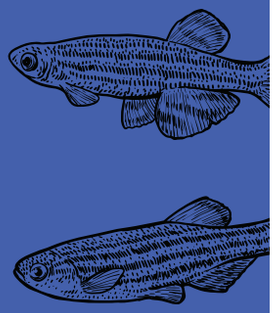
Perry and her research team had hypothesized that empathic accuracy would be greater when audio was present, and that physiological synchrony, a proxy for experience sharing, would be greater with the video-only versions. Their key findings revealed that, indeed, when there were audio cues, either alone or with video, observers showed high empathic accuracy, meaning they recognized the targets' emotions well. This may be because words are so influential that when they are present, one relies mostly on them to make inferences. When visual cues were presented alone, empathic accuracy scores were much lower but still better than chance. However, with visual cues only, heart rate synchrony was highest, meaning that observers' heart rates were in sync with those of the targets. Without words, one needs to interpret emotions from body language alone, which may elevate the importance of physiological synchrony as an indicator of empathy.

"This study was our first using this naturalistic empathic accuracy paradigm. We can now leverage this paradigm to study how different information channels contribute to or hinder empathy in diverse populations, from people with attention deficits to stroke patients and, of course, in people on the autism spectrum," says Perry, whose Azrieli Fellowship is funding one of her research programs in this area, called "Empathic accuracy and its dysfunction in autism: neurobehavioural characterization and potential modulation."

Perry and Rum will now conduct a new study that uses the same format but involves individuals with autism, as both observers and targets. Their investigations will include a specific focus on females with ASD, an understudied clinical population that is just starting to be acknowledged by the scientific community.

"Yonat helped me realize that, yes, people with ASD may have deficits in understanding others, but no one studies how well we understand them," Perry says. "British sociologist Damian Milton refers to this as the 'double empathy problem'—empathy involves reciprocity between two social actors. Both sides need to understand each other."

Echoes Rum: "Empathy is a mutual process that requires understanding by both sides. If a neurotypical person observes an autistic person, how much will they empathize? That's what we want to find out." ■



Learning about the social brain from zebrafish

Individuals with autism typically socialize in ways outside the norm. Most scientific literature labels this difference a "deficit"; "difference" is the term used by proponents of the science-based neurodiversity movement, which supports acknowledging and respecting natural human brain variations. Either way, the resulting impact on the autistic person is, regrettably, often negative: social disconnection in our still neurotypically oriented world, making it harder for them to maintain relationships, achieve goals and participate in their communities.

One solution being investigated by brain and behaviour researchers lies in better understanding the hormones involved in our brain chemistry, particularly oxytocin. Produced by the hypothalamus and secreted by the pituitary gland, this neuropeptide helps us form close ties with others. A substantial body of research confirms oxytocin's efficacy at promoting the prosocial traits of trust, generosity and gregariousness.

Oxytocin and social functioning in relation to autism is the focus of behavioural neuroscientist Soaleha Shams. She studies the brain of the zebrafish, which serves as a useful animal model because it is highly social. As a postdoctoral fellow in the Department of Pharmacology at Sweden's University of Gothenburg, she mapped the location of oxytocin neurons and studied the function of two oxytocin receptors in the zebrafish's social behavioural network to determine their involvement in social and non-social tasks. Last June, she shared her findings at the annual conference of the International Society for Autism Research in a presentation called "Responses of Oxytocin-Receptor-Mutant Zebrafish to Social Stimulation in Groups and Individually: Support for Zebrafish Autism Model."

For the experiment, the CRISPR-Cas9 gene-editing tool was used to remove either of the two oxytocin receptor genes, called *oxtr* and *oxtrl,* from adult male and female zebrafish. Shams then placed each fish in a tank with three other modified fish, and each non-modified fish with three others, for 30 minutes. She observed that the non-modified zebrafish spent most of their time shoaling (being together), which is typical. However, the mutant fish stayed twice as far from each other as their non-modified peers, and they made frequent excursions from the group, ultimately spending only half as much time with the others. These findings reflect a marked decrease in the socialization of the fish missing an oxytocin receptor. Shams is now preparing to submit her study for publication.

Shams will build on her research into autism, zebrafish and socialization this fall as an Azrieli International Postdoctoral Fellow in The Levkowitz Lab at the Weizmann Institute of Science in Israel. Her endgame is to provide the scientific foundations for more effective pharmacological agents to support social regulation in individuals with autism and other clinical populations.

"I want to really understand what the social brain is," Shams says. "There is such variety on the autism spectrum, and for those who struggle with anxiety, depression or just connecting with others, what do their brains need to thrive?" **—SHARON ASCHAIEK**