

DEEP DIVE

# ‘Theory of mind’ in autism: A research field reborn

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*Illustration by Alexander Glandien*

The scientific process is rarely linear. New discoveries can redirect theories or derail them completely — and even disproven ideas are sometimes resurrected in new forms.

One such example is the notion that autistic people have difficulty with ‘**theory of mind**,’ the ability to understand other people’s thoughts and emotions. Originally proposed in 1985, the theory steadily gained attention from the research community into the 1990s. Some researchers went so far as to assert that it explained everything about autism. But eventually, many came to view it as passé, and it was largely abandoned.

Over the past decade or so, though, theory of mind has attracted new interest from scientists who say that some aspects of the original concept, if not all of it, may still be relevant to autism.

“People thought it was all done and dusted,” says **Uta Frith**, emeritus professor of cognitive development at University College London in the United Kingdom, and one of the first to show that autistic people perform poorly on standard theory of mind tasks. But, she says, the field might not be finished with the theory after all.

## A unifying concept:

Frith’s interest in theory of mind in autism began with a test to identify the age at which children can **reason about other people’s mindsets**. She and her colleagues adapted the test using a story about two dolls, **Sally and Anne**: Sally puts a marble into a basket and then leaves. Anne takes the marble out of the basket and places it inside a box. When Sally returns, the clinician asks the child where Sally will look for the marble.

By age 4, most non-autistic children and those with Down syndrome can answer correctly that Sally will look in the basket, Frith and her colleagues found. The children understand that Sally holds a ‘false belief’: She does not know that Anne has moved her marble. By contrast, most of the autistic children they assessed, including those older than 4, could not answer correctly, suggesting the difficulty was somehow **specific to autism**.

“Suddenly, these kind of puzzling things about autism slotted in and made sense.”  
Francesca Happé

“It was really a captivating idea,” says **Noah Sasson**, professor of psychology at the University of Texas at Dallas, who studies social interactions in autism.

The proposed theory seemed to explain social difficulties in autism, as well as why autistic people tend not to lie or keep secrets, says **Francesca Happé**, professor of cognitive neuroscience at King’s College London. “Before that, we really just had this notion that autistic people weren’t very interested in social stuff. It was really that amorphous. Suddenly, these kind of puzzling things about autism slotted in and made sense.”

#### Related papers:

- **Beliefs about beliefs**: Representation and constraining function of wrong beliefs in young children’s understanding of deception (1983)
- Does the autistic child have a “**theory of mind**”? (1985)

#### ‘Mindblindness’:

A “sort of bumper crop of interesting research” followed Frith’s initial findings, says **Matthew Lerner**, research director of the Autism Initiative at Stony Brook University in Long Island, New York. “At least early on, it was fairly fruitful.”

Studies quickly showed that autistic children are uniquely challenged in their ability to **take another person’s perspective** and to understand when they **held a false belief**. And they performed worse than non-autistic children on tests that required more complex, ‘**second order**’ **perspective-taking**, according to a 1989 study by **Simon Baron-Cohen**, director of the Autism Research Centre at Cambridge University in the U.K., who co-authored the 1985 Sally-Anne study: Saying where Sally thinks the marble is turns out to be different from saying where Mary thinks

Sally thinks the marble is.

“There was a sort of bumper crop of interesting research, where people did find these differences.” Matthew Lerner

In 1990, Baron-Cohen proposed that difficulty with theory of mind is a core feature of autism — one that gives rise to other social challenges. As such, he said, autism could be described as a “**cognitive disorder of mind-blindness**,” and he went on to write a popular book, “Mindblindness,” to support the claim.

Other researchers soon reported various hints that autistic children differ in their understanding of others’ mindsets: The children’s spontaneous speech contains relatively few phrases and **words that denote mental states**; those who pass basic theory of mind tests may still have trouble interpreting **non-literal speech**, such as sarcasm; and autistic children are less likely than their non-autistic peers to ascribe ‘**appropriate**’ **emotions** to pairs of animated triangles that act out a scene.

### Related papers:

- The autistic child’s theory of mind: A case of **specific developmental delay** (1989)
- Exploration of the autistic child’s theory of mind: **Knowledge, belief, and communication** (1989)
- Autism: A specific cognitive disorder of ‘**mind-blindness**’ (1990)
- The ‘windows task’ as a measure of **strategic deception** in preschoolers and autistic subjects (1991)
- Autistic children’s talk about psychological states: Deficits in the **early acquisition of a theory of mind** (1992)
- An **advanced test of theory of mind**: Understanding of story characters’ thoughts and feelings by able autistic, mentally handicapped, and normal children and adults (1994)
- Do triangles play tricks? **Attribution of mental states** to animated shapes in normal and abnormal development (2000)

### The empathy question:

During this period, Baron-Cohen and his colleagues also found that, compared with non-autistic people and those with Tourette syndrome, autistic people seemed less adept at interpreting other

people's states of mind — at least in terms of ascribing an emotion to an image of a person's eyes. Autistic people also scored lower on an **assessment of empathy**, leading the team to propose in a 2004 paper that autism is an “empathy disorder.”

Baron-Cohen updated his theory of mindblindness accordingly, suggesting that theory of mind is just part of the larger skill of empathy. In autism, he proposed, there is an **imbalance between empathizing and systemizing**, or the ability to understand how systems, rather than people, work.

“Many [autistic people] will say they have too much emotional empathy.” Francesca Happé

Autistic people are not uncaring, Baron-Cohen says. “They may have difficulty with reading emotions and mental states,” he says, but they still have other forms of empathy, and this message has at times been misinterpreted by the autistic community.

Some researchers and autistic people suggest that the idea they lack empathy has contributed to **harmful stereotypes about autism**. “Many [autistic people] will say they have too much emotional empathy and they resonate too much with people's emotions,” Happé says.

### Related papers:

- Another **advanced test** of theory of mind: Evidence from very high functioning adults with autism or Asperger syndrome (1997)
- The **extreme male brain** theory of autism (2002)
- The **empathy quotient**: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences (2004)
- Testing **the empathizing-systemizing theory** of sex differences and the extreme male brain theory of autism in half a million people (2018)

### Cracks in the theory:

Backlash against the idea that autistic people lack empathy, along with shifting definitions of autism over time, stalled the pace of results.

“People just stopped finding these effects,” Lerner says — in part because as the heterogeneity of a population increases and assessments become more specific, “your effect size melts away.”

“If you look at behavioral performance [on a theory of mind task] versus what’s actually happening for this kid at school, on the playground with their friends, those behaviors don’t necessarily match up.” **Erin Libsack**

In addition, theory of mind tests started to prove problematic. The initial studies were small and inconsistent; as Frith and others had described, plenty of autistic people who have **atypical social behavior in everyday life** still pass theory of mind tests. And it wasn’t clear just what the lab tests actually measure.

“If you look at behavioral performance [on a theory of mind task] versus what’s actually happening for this kid at school, on the playground with their friends, those behaviors don’t necessarily match up,” says **Erin Libsack**, a graduate student in Lerner’s lab.

**Language ability**, for example, seemed to affect scores on a false-belief test and on **Baron-Cohen’s eye-reading test** more than having autism did. An autistic person’s **performance on one theory of mind test** seemed to have no bearing on her performance on other tests. And many theory of mind tests, it turned out, **did not hold up over time**: A person’s performance on false-belief and affective empathy tests changes.

### Related papers:

- “**Theory of mind**” in Asperger’s syndrome (1992)
- Language promotes **false-belief understanding**: Evidence from learners of a new sign language (2009)
- **Empathic brain responses** in insula are modulated by levels of alexithymia but not autism (2010)
- Decoding moral judgments from **neural representations of intentions** (2013)
- Can children with autism read emotions from the eyes? The **Eyes Test revisited** (2014)
- Explaining variance in **social symptoms** of children with autism spectrum disorder (2020)
- Brief Report: **Test-retest reliability** of cognitive, affective, and spontaneous theory of mind tasks among school-aged children with autism spectrum disorder (2021)

### Repair attempts:

To try to plug the cracks, researchers have tapped imaging data. **Functional magnetic resonance imaging** (fMRI) hints that non-autistic people, but not autistic ones, respond differently to thinking about a story in which they intentionally versus unintentionally cause another person harm. So too, non-autistic people, but not autistic ones, show high levels of brain activity when **evaluating an ironic statement**. But fMRI also shows that the brains of autistic and non-autistic people respond

similarly **to a false-belief task**.

“We really thought that if autistic people were trying to solve a theory of mind test differently than neurotypical people, we should see that they were using different brain areas — maybe generalized frontal areas or something. And we haven’t really found that,” Happé says.

Some researchers have suggested that **alexithymia** — difficulty recognizing one’s own emotions — confounds theory of mind effects in autism. Others posit that theory of mind can be broken down into **multiple cognitive components**, and that autistic people have difficulty with only a subset of those.

Autism’s heterogeneity also likely obscures these effects further, researchers say: Some autistic people may be unable to perform a task, some may have weak skills, and some may be indistinguishable from non-autistic participants in their performance.

As a result, designing a single theory of mind test that autistic people universally fail may be impossible, Frith says. Instead, she says, the field needs approaches that allow for individual differences in performance, which can explain individual differences in social and communication skills.

### Related papers:

- **Mindblind eyes**: An absence of spontaneous theory of mind in Asperger syndrome (2009)
- Brain function differences in **language processing** in children and adults with autism (2013)
- **Decoding moral judgments** from neural representations of intentions (2013)
- Similar brain activation during **false belief tasks** in a large sample of adults with and without autism (2013)

### Metarepresentation:

Over the past year or so, researchers have **turned to genetics**, the **study of individual neurons**, and electroencephalography (EEG) to explain some of these differences.

In June of last year, Lerner, Libsack and their colleagues identified **a component of the EEG response** that, for both autistic and non-autistic participants, differed based on the person’s performance on a theory of mind task. The response, which previous studies have linked to metarepresentation in the brain, was also correlated with the participants’ autism trait severity, the team found — suggesting that the skill may be shaping a person’s social behavior.

The idea that autistic people tend to be **worse at metarepresentation** is exactly what some theory of mind researchers hypothesized back in the 1980s, Lerner says. Others in the field questioned the idea for years because there was no marker, but this finding points to a “neural blip” that might

map to it, he says.

Figuring out whether this marker is also related to other aspects of autistic people's lives, such as how they perform daily tasks, could help predict a person's future outcomes, Libsack says.

### Related papers:

- Pretense and representation: **The origins of “theory of mind”** (1987)
- **Genome-wide analyses** of self-reported empathy: Correlations with autism, schizophrenia, and anorexia nervosa (2018)
- **Single-neuronal predictions** of others' beliefs in humans (2021)
- An **electrocortical measure** associated with metarepresentation mediates the relationship between autism symptoms and theory of mind (2021)

### Double empathy:

A growing contingent of researchers are expanding theory of mind research in a new direction entirely, asking how such difficulties with ‘mind-reading’ might be a two-way street between autistic and non-autistic people. **Damian Milton**, an autism researcher and chair of the Participatory Autism Research Collective, who is autistic himself, has dubbed this idea the ‘**double empathy problem**.’

“It feels like quite a revolutionary time.” Elizabeth Sheppard

Non-autistic people, it turns out, are ‘impaired’ when it comes to **reading autistic people's minds**, according to research by **Elizabeth Sheppard**, assistant professor of psychology at the University of Nottingham in the United Kingdom.

This area of research is still in its early stages, Sheppard says. But support is growing, particularly among autistic people who felt little connection to theories that invoked a lack of empathy.

“It feels like quite a revolutionary time,” Sheppard says.

This new way of thinking can bring new insight to the field, Frith and Baron-Cohen say, but they stand by the idea that autistic people have difficulty with theory of mind in ways that shape the condition's hallmark social behaviors.

### Related papers:

- How easy is it to **read the minds** of people with autism spectrum disorder? (2015)
- Does theory of mind training enhance **empathy in autism**? (2018)

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