Theory of mind

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Abstract

The 'theory of mind' deficit account explains social and communication problems in autism as resulting from difficulty tracking others' thoughts. In this article I briefly describe the nature, history and implications of this influential account. The notion that people with autism show a sort of 'mind-blindness' refined our understanding of their social-communicative symptoms, allowed neuroimaging investigation of the brain basis of social difficulties in autism, led to new attempts at intervention and highlighted areas of social cognition not impaired in this group.

Introduction

The term 'theory of mind' refers to the everyday ability to attribute mental states (e.g., beliefs, desires, intentions) in order to predict and explain behaviour. For example, on seeing someone groping around in a drawer we instantly recognise that she wants something that she thinks is in the drawer. Importantly, we make this attribution automatically and effortlessly even if we know the object in question is no longer in the drawer; showing that we can represent others' beliefs even when different from our own. In many ways the term 'theory of mind', often abbreviated to 'ToM', is a misnomer since there is little conscious theorising involved in this automatic and intuitive ability, and alternative terms such as 'mentalising' have been proposed.

History of Theory of Mind research

The notion of testing whether an individual has ToM began in animals and specifically chimpanzees, with now classic work by Premack and Woodruff in the late 70s (1). The philosopher Daniel Dennett is credited with having suggested as the litmus test for ToM the ability to attribute a false belief, independent from one's own belief or reality. This notion was quickly taken up by developmental psychologists Perner and Wimmer (2), who tested young children's ability to track a mistaken belief in a simple story in which a character can be predicted to look for his chocolate where he left it rather than where it was moved to in his absence. Figure 1 shows the best-known version of this false belief test, which is usually passed (i.e., indicating Sally will look where she thinks the ball is, in her basket) by typically-developing children around the age of 3-4 years.

The first application of ToM tests with individuals with autism was prompted by theoretical work linking pretend play, which is notably absent or delayed in autism, with attribution of mental states. Alan Leslie, Uta Frith and their then-PhD student Simon Baron-Cohen made the novel prediction that children with autism might lack ToM and hence fail simple false belief tests. Their landmark paper (3), reporting failure on the Sally-Ann task (indicating Sally would look in the box, where the ball actually is; see figure 1) by 80% of children with autism in contrast to 86% success by less verbally-able children with Down Syndrome, radically altered conceptions of the social deficits in autism and started a now-vast research field on ToM in autism, and other clinical groups (4).

Theory of mind deficits in autism

The notion that individuals with autism spectrum disorder (ASD) were impaired in ToM and unable to represent the thoughts of others, was a radical change from previous conceptions of autism as a lack of sociability or failure of interpersonal connectedness. Thinking of ASD instead as a sort of 'mind-blindness' (akin to colour-blindness), made sense of the very specific pattern of social and communication difficulties seen in ASD (5). For example, children with ASD rarely tell lies, sugar-coat

the truth or keep secrets; these are behaviours that involve manipulating the contents of others' minds. However, children with ASD show patterns of attachment to their caregivers that are in line with their developmental level, and many young people and adults with ASD are keen to have friends even if they have difficulty developing real two-way friendships that are a 'meeting of minds'. Liking and caring about people do not require ToM. Communication difficulties too, could be viewed through the concept of ToM; young children with autism rarely use pointing to share interest, and rarely follow others' eye gaze to discover what interests them. Over-literal language in ASD (e.g., an adult puzzled by the expression 'give me a hand', a teenager incensed when his mother is not back in exactly 'two minutes') reminds us that as 'neurotypicals' we hear the speaker's intention rather than the actual words spoken. Teachers and parents found the ToM deficit account enlightening; their child's unusual behaviour made sense in the context of mind-blindness.

Over the last 30 years a huge number of studies have explored ToM in individuals with ASD. The early finding of impaired performance on false belief tasks was frequently replicated, but debates also arose as to the specificity and universality of ToM impairments in ASD (4). Other clinical groups, including those with intellectual disability and the congenitally deaf raised without sign-language, were reported also to fail ToM tests. However, these groups do not show the specific real-life social deficits characteristic of ASD, and (like typically developing pre-schoolers) may fail false belief tasks for other reasons such as poor executive functions (e.g., difficulty inhibiting an answer based on the actual location). The universality of ToM impairment in ASD was questioned, as higher-functioning and older ASD individuals often passed simple false belief tests. This led to development of tests of more advanced ToM; ordinary children can track what one character thinks another person knows, for example, by around age 5-7 years, as reflected in distinguishing joking from lying (only the latter intends to deceive the hearer). So-called 'second-order ToM' tests were developed (requiring tracking one person's thoughts about another's thoughts), along with written vignettes requiring recognition/explanation of faux pas, white lies, sarcasm, double bluff and so forth, and cartoon and video tests of complex mental state attribution (6). Such tasks reveal ToM impairments in many, but not all, people with ASD; task success has been attributed to learnt strategies or to consciously-calculated, 'explicit' ToM that is distinct from automatic and intuitive ToM. Research using eye-tracking has suggested that even when intelligent adults with ASD give the correct answer in ToM tests, their looking behaviour does not reflect implicit ToM processes (7). By contrast, typically–developing infants as young as 15 months show in their looking behaviour that they track false beliefs and anticipate behaviour accordingly (8). Many adults with ASD describe working out social interactions as like doing mental arithmetic; conscious calculation that is hard work, slow and tiring.

How the brain reads the mind

The ToM deficit account also opened new avenues for research. For the first time, functional neuroimaging techniques could be used to investigate what brain pathways might be implicated in ToM and, by implication, atypical in ASD. A wide array of paradigms have been used to elicit attribution of mental states in volunteers during fMRI scanning, including written stories, static cartoons, videos of humans or even animated shapes interacting (9). All these different ToM materials (when contrasted with non-ToM control tasks) reliably activate a set of areas including medial prefrontal cortex, superior temporal sulcus, temporal poles and amygdalar complex. Differences in the relative activation or functional connectivity of these regions has been reported from fMRI studies with volunteers with ASD (10).

Clinical implications of the ToM account

The ToM deficit account has a number of implications for diagnosis, intervention and clinical practice with individuals with ASD. Assessments for early recognition of ASD have included, for example, lack of pretend play as an indication of failure to represent thoughts (11). For diagnosis of additional mental health conditions (as newly allowed in DSM-5), the clinician should bear in mind communication difficulties related to mind-blindness. For example, when asked if he hears voices when no-one is there, an intelligent adult with ASD may answer 'yes' because he listens to the radio. Individuals with ASD may find it hard to introspect on their own mental states as well as to consider others' thoughts,

and may find it easier to report physical (e.g. sleep, eating) than mental (e.g. anxiety, depression) changes. Such difficulties 'reading own mind' (12) may also hamper some interventions or therapies requiring introspection.

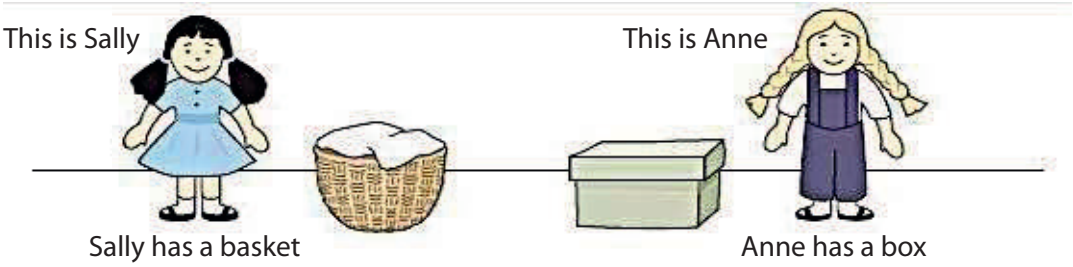
A number of attempts have been made to teach ToM to individuals with ASD, and a recent Cochrane review (13) of 22 RCTs with, in total, almost 700 participants found that gains were made on the specific ToM tasks studied but little generalization was found to other tests and everyday social skills.

Perhaps the greatest contribution of the ToM account has been to refine our understanding of ASD, from a lack of sociability to the lack of a specific social ability; the representation of mental states. While the term 'theory of mind' is sometimes loosely used to denote all of social cognition, this account more properly serves to highlight aspects of social interaction that are not impaired in ASD. These include attachment and, more controversially, at least some forms of imitation and emotional empathy (14).

While mind-blindness cannot explain all aspects of ASD (15), there is no doubt that the ToM deficit account has made the task of translating between the autistic and neurotypical views of the world somewhat easier for clinicians, teachers, relatives and those with ASD.

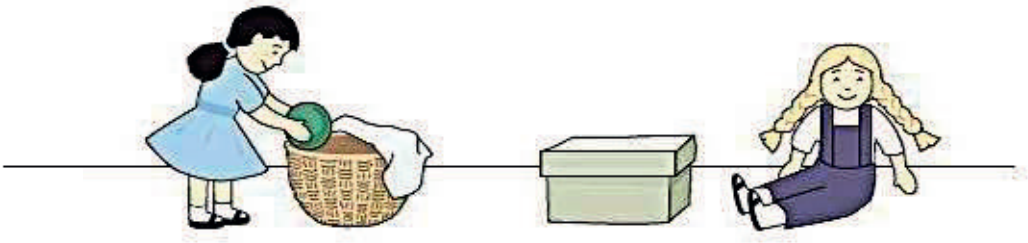
Figure 1. The 'Sally-Anne' false belief test for theory of mind (reproduced by kind permission of U. Frith).

The illustration shows the actions watched by the participant (acted out with dolls, puppets or people), at the end of which the participant is asked the test question: "Where does Sally think the ball is?" (or, sometimes: "Where will Sally look for the ball?"). The correct answer: "In the basket", shows the ability to track Sally's false belief; evidence of theory of mind. Individuals with autism often fail this test, answering instead: "In the box"; they do not represent Sally's thoughts and so answer on the basis of reality.

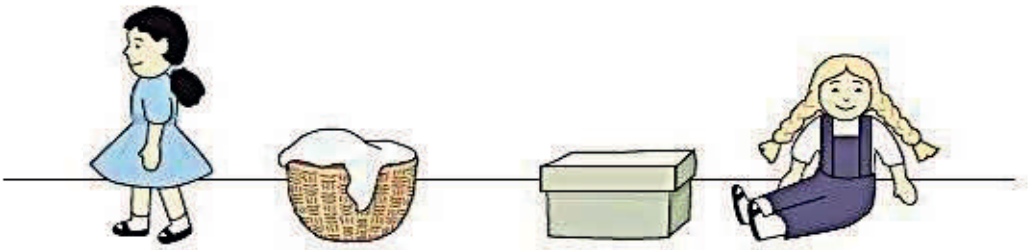


Sally has a basket

Anne has a box



Sally has a marble. She puts the marble into her basket



Sally goes out for a walk

Anne takes the marble out of the basket and puts it into the box

Now Sally comes back. She wants to play with her marble

Where will Sally look for her marble?

GP Comment.

What have I learned from this paper?

1. ASD characteristically involves a difficulty in understanding what other people are thinking and in tracking other people's thoughts. This has been referred to as "mind-blindness" or poorly developed "theory of mind".

2. I liked the concept of "mind blindness" in underpinning why people with ASD have such difficulty with social communication.

3. Mind-blindness can lead to literal interpretation of expressions such as "give me a hand"; this could cause chaos in social situations.

4. The example of the "Sally-Anne test" is a very clear way of communicating the idea of "theory of mind" or "mind-blindness".

5. The conclusion that people with ASD have poorly developed theory of mind has profound implications, not only for the individual but also for all those responsible for management of that individual. If parents, teachers and employers do not appreciate the difficulty that people with ASD have with theory of mind, major misunderstandings are likely to arise. On the other hand, having an understanding of theory of mind will enable those interacting with a person who has ASD to have the opportunity of bringing out the best in that individual and recognising their real strengths.

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