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Autism and ‘theory of mind’: an introduction and review

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A theory of mind is the ability to infer mental states (beliefs, desires, intentions, imagination, emotions, etc.). We seem to do this an enormous amount, as a natural way of thinking about why people do what they do.

For example, you might wonder why someone hasn't phoned you in a while: You speculate that maybe you've *offended* them in some way, or at least they *think* you have. Or maybe they're *trying* to avoid you because they *feel* the friendship is suffocating. Or maybe they just *want* more space. So you phone them up and they say that everything is fine. You start wondering whether, when they say that, do they actually *mean* it? Perhaps they're *intending* to keep things polite but really *wish* the friendship was over?

In the above paragraph, you can see that there are lots of words referring to what goes on in one's own and other people's minds. Psychologists call this using a 'theory' of mind simply because often there is little if any evidence for what the other person is actually thinking or feeling, so people speculate (theorize) in just this way. But this theorizing about what might be in someone's mind is a crucial way to help us make sense of behaviour, and predict what that person might do next. In brief, a theory of mind is the ability to be able to reflect on the contents of one's own and other's minds.

Abnormalities in understanding other minds is not the only psychological feature of autism spectrum disorders, but it seems to be a core and possibly universal abnormality among such individuals. Some people with autism lack almost all signs of a theory of mind. One might think of such extreme cases as a form of 'mindblindness'. More

commonly, people with autism have some of the basics of a theory of mind, but have some difficulties in using it at a level that one would expect, given their intelligence in other areas. If you like, their social intelligence is lagging behind their non-social intelligence. In their case, one might say they have degrees of mindblindness, ranging from severe, through to moderate, or even just very mild.

This article describes some of the manifestations of this, and emphasizes how developmentally appropriate tests of this are needed in order to reveal it. Note that the terms ‘theory of mind’, ‘mindreading’, and ‘understanding other minds’ can to some extent be used synonymously.

The mental-physical distinction

Perhaps the best place to start is with the mental-physical distinction since many consider that this distinction is a fundamental cornerstone of our theory of mind. The test for this is a good way to convey what it is. The test involves the child listening to stories in which one character is having a mental experience (e.g., thinking about a dog) whilst a second character is having a physical experience (e.g., holding a dog). The experimenter then asks the subject to judge which of the two characters can perform different actions (e.g., which character can stroke the dog?). 3-4 year old normal children can easily make these judgments (e.g., they can judge that it is only the character that is holding the dog that can stroke it), thereby demonstrating their good grasp of the distinction between

mental and physical things. Children with severe autism have difficulty making such judgments ¹.

Understanding the functions of the brain

Normally developing 3-4 year olds also already know that the brain has a set of mental functions, such as dreaming, wanting, thinking, keeping secrets, etc. Some also know it has physical functions (such as making you move, or helping you stay alive, etc.). In contrast, children with autism (but who have a mental age above a 4 year old level) appear to know about the physical functions, but most fail to mention any mental function of the brain ¹.

The appearance-reality distinction

Children from about the age of 4 years old normally are able to distinguish between appearance and reality, that is, talk about objects which might have misleading identities. For example, they may say, when presented with a candle fashioned in the shape of an apple, that it looks like an apple but is really a candle. Children with autism, presented with the same sorts of tests, may not talk about objects in the same way, instead saying the object really is an apple, or really is a candle, but not capture the object's dual identity in their spontaneous descriptions ¹. Given that this requires being able to simultaneously keep track how an object appears (to your mind) versus what it actually is, this is an additional clue that in autism there is a difficulty in the development of a

theory of mind. Alternative interpretations of this difficulty are certainly possible however, since this task relies on quite complex language skills.

First-order false belief tests

These are the by now well-known tests of understanding that different people can have different thoughts about the same situation. They are called first order tests because they only involve inferring one person's mental state. (See below for discussion of second-order tests). Normally developing 4 year olds can keep track of how different people might think different things about the world. For example, when interpreting well-known stories such as Little Red Riding Hood or Snow White, even 4 year olds will say in response to the picture shown in Figure 1 that "Little Red Riding Hood *thinks* that it's her grandmother in the bed, but really it's the wicked wolf!"; or in response to the picture shown in Figure 2, that "Snow White thinks the old woman is giving her a nice juicy apple. She doesn't *know* that it's really her wicked step-mother all dressed up, and that the apple is poisoned!". A large number of studies have repeatedly demonstrated that children with autism have difficulties in shifting their perspective to judge what someone else might think, instead simply reporting what they themselves know 2-8.

insert Figures 1 and 2 here

"Seeing leads to knowing"

Yet another corner stone of the normal child's theory of mind is understanding where knowledge comes from, so that they can work out who knows what, and more importantly, who doesn't know what. This is a key development simply because it underpins appropriate communication (telling people what they don't know - informing others - rather than telling them what they already know). It also underpins understanding of deception, since before considering changing someone's beliefs about what is true, one first has to work out what they know or don't know about. Deception obviously fails if you cannot keep track of what the other person might know or not know. (We return to discuss deception later).

Normally developing 3 year olds can understand the seeing-leads-to-knowing principle, in that when given a story about 2 characters, one of whom looks into a box and the other of whom touches a box, they can work out that it is only the one who looked who knows what's in the box. In contrast, children with autism are virtually at chance on this test, as much likely to pick one character as the other when asked "Which one knows what's in the box?"^{9, 10}. (See Figure 3 for a schematic illustration of the experiment).

insert Figure 3 here

Recognizing mental state words

It turns out that by 4 years old, normally developing children can also pick out words from a word-list that refer to what goes on in the mind, or what the mind can do. These words include "think", "know", "dream", "pretend", "hope", "wish", and "imagine". These are easily distinguished from other kinds of (non-mental) verbs like "jump", "eat", or "move", or other kinds of (non-mental) nouns, like "door", "school", or "computer". Children with autism have much more difficulty in making this judgment¹¹. This is really a test of their mental vocabulary, but this may well be an indicator that conceptual development in this domain is also less well developed than would be expected for the child's general mental age.

Mental state words in spontaneous speech

The previous finding dovetails with reports that children with autism produce fewer mental state words in their spontaneous descriptions of picture stories involving action and deception, compared to their normal counterparts^{3, 12}. Of course, just because they don't use these words so readily, this may not necessarily reflect a lack of competence. It may be simply a lack of interest. But when taken together with other experimental evidence summarized in this article, the likelihood is that this reflects delays or difficulties in comprehension of mental state concepts, or at the very least, reduced attention to such phenomena.

Spontaneous pretend play

Many studies over 20 years have reported a lower frequency of pretend play in the spontaneous play of children with autism ¹³⁻¹⁶. This is interpreted in various ways. For example, it might reflect a failure to reflect on one's own imagination - a mindreading difficulty ¹⁷. Or it might reflect a failure to switch attention flexibly from 'reality mode' to 'pretend mode', as a result of some aspect of what is called executive function ¹⁸. Or both.

Understanding causes of emotion

Emotions can be caused by physical events (e.g., falling over causes you to cry, or being given a present causes you to feel happy). But emotions can also be caused by mental states such as desires and beliefs. For example, you can be happy because you get what you *want*, or because you *think* you are getting what you want. Normally developing 4-6 year olds understand all 3 types of emotional causes. In contrast, studies show that children with autism with this mental age have difficulty with the more complex (mental states as) causes of emotion ^{19, 20}.

Inferring from gaze-direction when a person is thinking, or what a person might want

Why do we spend so much time looking at people's eyes? Until recently, it was not clear what the information around someone's eyes conveyed to another person. We now know that from gaze-direction even young normal children (age 4 years) can work out when someone is thinking about something (e.g., gaze directed upwards and away, at nothing in particular, strongly signifies the person is thinking - see Figure 4). Gaze-direction also allows young normal children of the same age to work out which of several objects a person wants (see Figure 5). Children with autism in contrast are relatively blind to such information from gaze-direction, even though they can answer the explicit question "What is Charlie looking at?" ²¹⁻²⁵. Mentalistic interpretation of the eyes of another person does not seem to come naturally to them.

insert Figures 4 and 5 here

Monitoring one's own intentions

We have covered a number of tests of understanding other people's thoughts, but another important class of mental states obviously is intentions. Working out why people behave as they do is all about keeping track of people's intentions, since tracking actions alone gives you a description of what people do, but not why they do it. In a novel test of this, 4 year old normal children were asked to shoot a toy gun at one of six targets, stating their intended target. Then, unbeknownst to the child, the outcome was manipulated by the experimenter, such that sometimes the child hit their chosen target, and sometimes they did not. Normally developing 4 year olds could correctly answer the question "Which

one did you mean to hit?”, even when they did not get what they intended, but children with autism often made the error of answering by reference to the actual outcome²⁶. The equipment to assess this understanding is shown in Figure 6.

insert Figure 6 here

Deception

Deception is relevant to understanding other minds simply because it involves trying to make someone else *believe* that something is true when in fact it is false. In other words, it is all about trying to change someone else’s mind. By the age of 4 years old the normally developing child is showing both an interest in deception, and beginning to be more adept at it. Leaving the moral aspects aside, such signs of deception can be taken as a yardstick that the child is understanding other minds. Of course, the child’s early attempts at deception may be clumsy and ineffective, such as the young child claiming that they did not take the chocolate cookies, whilst the tell-tale evidence is all over all over his face; or the young child in a game of hide-and-seek, calling out from her hiding place behind the curtains to “come and find me!”. In these instances, the child is arguably trying to deceive, but is not keeping track of the clues that would lead the other person to know the truth.

Children with autism have been shown to have difficulties both in production of deception, but also in understanding when someone else is deceiving them²⁷⁻²⁹. An

example of one test is the “penny-hiding game”, where the aim of the game is to not reveal in which hand you have hidden a penny. Young children with autism, despite having a mental age of above a 4 year old level, often make errors in this game, which suggest they do not understand how to deceive very well. Examples of their errors include hiding the penny in one hand, but leaving the other hand open; or between trials, transferring the penny from one closed fist, to the other; or putting the penny out of sight, and then telling the other person “it’s in here!”, etc.,²⁷.

Understanding metaphor, sarcasm, and irony

Happe ³⁰ has tested if children with autism understand figurative speech through story comprehension. Figurative speech of course also requires an understanding of the speaker’s intentions, in order to move beyond the literal level of simply mapping words onto their referents. Examples of figurative language include sarcasm (“How clean your room looks today!”, uttered by an exasperated parent to her child), and metaphor (“she’s got a sharp tongue!”). Results suggest that this more advanced mindreading test (pitched at the level of a normal 8 year old) reveals more subtle mindreading difficulties in higher-functioning individuals with autism spectrum conditions. A similar finding using a simpler test comes from a study of normal preschoolers based on testing if they can understand someone’s intention to joke. Children as young as 3 years old heard utterances like “This is a shoe”, spoken by the experimenter whilst pointing at a cup, and asked why the experimenter said that. Whereas even normal children referred in their

explanation to “joking” and “pretending”, children with autism tended to refer to the speaker having got it wrong (“it’s not a shoe, it’s a cup” etc.)³¹.

Pragmatics

Understanding figurative speech and humour is just a subset of pragmatics, or the use of language appropriately to the social context. Pragmatics includes at least the following:

- tailoring one’s speech to a particular listener;
- adapting the content of one’s speech to what your listener already knows or needs to know;
- respecting conversational principles such as being truthful, relevant, concise, and polite;
- turn-taking appropriately so that there is space for both participants in the dialogue;
- being sensitive to the other person’s contribution to the conversation;
- recognizing what is the wrong or right thing to say in a particular context;
- staying on topic; and
- appropriately helping your listener to follow when a topic change is occurring.

Almost every aspect of pragmatics involves sensitivity to speaker and listener mental states, and hence mindreading, though it is important to note that pragmatics also involves using context. This means that a difficulty in pragmatics could occur for at least two different reasons: some degree of mindblindness, or some degree of what Uta Frith

calls ‘weak central coherence’ (use of context). Two experimental studies of pragmatics in children with autism have included a test of whether the principles of conversational relevance can be recognized ^{32, 33}, and a test of recognizing when someone said the wrong thing (faux pas) ³⁴. Both studies suggest that children with autism have difficulties in this area ³⁵.

Imagination

We discussed the relevance of pretend play earlier, but of course this is only one possible way that imagination can be expressed. More broadly, imagination is relevant to theory of mind since it involves building an unreal world that exists purely in your own mind, and being able to reflect on this virtual world. One study of children with autism investigated the ability to draw pictures of unreal or impossible objects (such as two-headed people), and found that children with autism were either reluctant or less able to produce such drawings ³⁶.

This may be due to so-called ‘executive function’ (the need to suppress routine approaches to drawing, and override these with novel approaches)³⁷. However, there is evidence for persisting imagination impairments in both children with autism and Asperger Syndrome, on a range of tasks not restricted to drawing (such as story telling, and standard creativity measures)³⁸. This experimental evidence is clearly in line with the clinical descriptions of impaired imagination in people with an autism spectrum condition, and as specified in most diagnostic classification systems.

Correlation with real-life social skills

One might raise the concern that theory of mind tasks simply measure aspects of social understanding under laboratory conditions, and as such have no relevance to social impairment in the real world. For this reason, Frith and colleagues have examined the correlation of theory of mind skills in children with autism in relation to real-world behaviour ³⁹. They report that these are indeed significantly correlated, providing some measure of validity of the tests.

Second-order false belief tests

The universality of theory of mind difficulties in autism have been questioned simply because a proportion of children with autism or Asperger Syndrome pass first-order tests. First-order tests, including most of those reviewed above, involve simply inferring one person's mental state. Happe points out that this need not mean these abnormalities are not universal, since there are no reported cases of autism spectrum disorder who pass first order theory of mind tests at the right mental age. Thus, a high functioning individual with an autism spectrum condition (e.g., with Asperger Syndrome) who has normal intelligence, should be able to pass such tests at 3-4 years of age. Typically however, they are older than this when they pass such tests. Equally, with children with autism, Happe finds that on average a mental age of 9 years old is needed before passing of such tests is

seen, and that the youngest mental age of an individual with autism passing such tests is 5.5 yrs ⁴⁰.

As one might expect, as a result of a delay in acquiring first order theory of mind competence, these individuals often fail second-order false belief tests ⁴¹. Second-order tests involve considering embedded mental states (e.g., one person's thoughts about another person's thoughts). Whereas first-order tests correspond to a 4 year old mental age level, second-order tests correspond to a 6 year old mental age level. This may be another way of revealing if there is a specific developmental delay in theory of mind at a point later in development. Some individuals with autism or Asperger Syndrome who are high functioning (in terms of IQ and language level), and who are usually adults, may pass even second-order false belief tests ⁴²⁻⁴⁴. Those who can pass such second-order tests however may have difficulties in more advanced theory of mind tests such as inferring complex mental states such as bluff and double bluff in story characters - an 8 year mental age level test ³⁰, or in decoding complex mental states from the expression in the eye-region of the face ^{45, 46}.

Conclusions

Difficulties in mindreading in autism spectrum conditions appear to be early occurring (from at least the end of the first year of life, if one includes joint attention abnormalities, such as not following what other's are interested in). They also appear to be universal (if

one tests for these either at the right point in development, or in the case of high-functioning, older individuals by using sensitive, age-appropriate tests).

Some clues relating to the brain basis of the theory of mind difficulties in autism are being gathered from both functional neuroimaging, and studies of acquired brain damage. It is hoped that future research in this area will refine both the techniques for studying this skill, and make further headway in understanding the underlying mechanisms essential for mindreading. Finally, most importantly, much of the basic research in this field may have clinical applications in the areas of both intervention or diagnosis. This is an area which needs systematic exploration.

Figure Legends

Figure 1: A false belief scene in “Little Red Riding Hood”. Reproduced with permission from Ladybird.

Figure 2: A false belief scene from “Snow White”. Reproduced with permission from Ladybird.

Figure 3: A schematic illustration of the seeing-leads-to-knowing test.

Figure 4: The test of “Which one is thinking?”.

Figure 5: The test of “Which one does Charlie want?”.

Figure 6: The target shooting equipment (for testing recall of one’s intentions).

From Phillips et al (in press).

References

1. Baron-Cohen, S. *Journal of Autism and Developmental Disorders* **19**, 579-600 (1989).
2. Baron-Cohen, S., Leslie, A.M. & Frith, U. *Cognition* **21**, 37-46 (1985).
3. Baron-Cohen, S., Leslie, A.M. & Frith, U. *British Journal of Developmental Psychology* **4**, 113-125 (1986).
4. Perner, J., Frith, U., Leslie, A.M. & Leekam, S. *Child Development* **60**, 689-700 (1989).
5. Swettenham, J., Baron-Cohen, S., Gomez, J.-C. & Walsh, S. *Cognitive Neuropsychiatry* **1**, 73-88 (1996).
6. Reed, T. & Peterson, C. *Journal of Autism and Developmental Disorders* **20**, 555-568 (1990).
7. Leekam, S. & Perner, J. *Cognition* **40**, 203-218 (1991).
8. Swettenham, J. *Journal of Child Psychology and Psychiatry* **37**, 157-165 (1996).
9. Baron-Cohen, S. & Goodhart, F. *British Journal of Developmental Psychology* **12**, 397-402 (1994).
10. Leslie, A.M. & Frith, U. *British Journal of Developmental Psychology* **6**, 315-324 (1988).
11. Baron-Cohen, S., *et al.* *British Journal of Psychiatry* **165**, 640-649 (1994).
12. Tager-Flusberg, H. *Child Development* **63**, 161-172 (1992).
13. Baron-Cohen, S. *British Journal of Developmental Psychology* **5**, 139-148 (1987).

14. Wing, L. & Gould, J. *Journal of Autism and Developmental Disorders* **9**, 11-29 (1979).
15. Lewis, V. & Boucher, J. *British Journal of Developmental Psychology* **6**, 325-339 (1988).
16. Ungerer, J. & Sigman, M. *Journal of the American Academy of Child Psychiatry* **20**, 318-337 (1981).
17. Leslie, A.M. *Psychological Review* **94**, 412-426 (1987).
18. Russell, J. (Oxford University Press, Oxford, 1997).
19. Baron-Cohen, S. *Child Development* **62**, 385-395 (1991).
20. Baron-Cohen, S., Spitz, A. & Cross, P. *Cognition and Emotion* **7**, 507-516 (1993).
21. Baron-Cohen, S. & Cross, P. *Mind and Language* **6**, 173-186 (1992).
22. Baron-Cohen, S., Campbell, R., Karmiloff-Smith, A., Grant, J. & Walker, J. *British Journal of Developmental Psychology* **13**, 379-398 (1995).
23. Baron-Cohen, S. *British Journal of Developmental Psychology* **7**, 113-127 (1989).
24. Hobson, R.P. *Journal of Autism and Developmental Disorders* **14**, 85-104 (1984).
25. Leekam, S., Baron-Cohen, S., Brown, S., Perrett, D. & Milders, M. *British Journal of Developmental Psychology* **15**, 77-95 (1997).
26. Phillips, W., Baron-Cohen, S. & Rutter, M. (in press).
27. Baron-Cohen, S. *Journal of Child Psychology and Psychiatry* **33**, 1141-1155. (1992).
28. Sodian, B. & Frith, U. *Journal of Child Psychology and Psychiatry* **33**, 591-606 (1992).

29. Yirmiya, N., Solomonica-Levi, D. & Shulman, C. *Developmental Psychology* **32**, 62-69 (1996).
30. Happe, F. *Journal of Autism and Development Disorders* **24**, 129-154 (1994).
31. Baron-Cohen, S. *Israel Journal of Psychiatry* **34**, 174-178 (1997).
32. Baron-Cohen, S. *Journal of Autism and Developmental Disorders* **18**, 379-402 (1988).
33. Tager-Flusberg, H. in *Understanding other minds: perspectives from autism* (eds. Baron-Cohen, S., Tager-Flusberg, H. & Cohen, D.J.) (Oxford University Press, 1993).
34. Baron-Cohen, S., O'Riordan, M., Jones, R., Stone, V. & Plaistead, K. (submitted).
35. Surian, L., Baron-Cohen, S. & Van der Lely, H. *Cognitive Neuropsychiatry* **1**, 55-72 (1996).
36. Scott, F. & Baron-Cohen, S. *Journal of Cognitive Neuroscience* **8**, 400-411 (1996).
37. Leavers, H. & Harris, P. *Journal of Child Psychology and Psychiatry* **39**, 399-410 (1998).
38. Craig, J. (University of Cambridge, 1997).
39. Frith, U., Happe, F. & Siddons, F. *Social Development* **3**, 108-124 (1994).
40. Happe, F. *Child Development* **66**, 843-855 (1995).
41. Baron-Cohen, S. *Journal of Child Psychology and Psychiatry* **30**, 285-298 (1989).
42. Bowler, D.M. *Journal of Child Psychology and Psychiatry* (1992).
43. Ozonoff, S., Pennington, B. & Rogers, S. *Journal of Child Psychology and Psychiatry* **32**, 1081-1106 (1991).

44. Happe, F. *Cognition* **48**, 101-119 (1993).
45. Baron-Cohen, S., Wheelwright, S. & Jolliffe, T. *Visual Cognition* **4**, 311-331 (1997).
46. Baron-Cohen, S., Jolliffe, T., Mortimore, C. & Robertson, M. *Journal of Child Psychology and Psychiatry* **38**, 813-822 (1997).