

*This article appeared in Demos Quarterly, Special edition on Evolution and Human Behaviour (H. Cronin, ed), 10, 28-29, (1996)*

# **How the study of autism can reveal evolved mechanisms in the mind**

Simon Baron-Cohen

Departments of Experimental Psychology and Psychiatry,

University of Cambridge, Downing St,

Cambridge, CB2 3EB, UK.

Scientists study psychiatric conditions for all sorts of reasons. The most obvious reasons are to discover their causes, and investigate if suffering can be alleviated. But a less well-known reason for studying psychiatric conditions is because such naturally occurring phenomena can throw light on how the mind works. This sounds paradoxical, since one might think that to understand how the mind works it would seem more straight forward to study the ‘normal’ mind, not the ‘diseased’, ‘damaged’, or ‘abnormal’ mind. But studying the normal mind turns out to be enormously difficult, as different aspects of the mind blend in seamlessly with each other. Indeed, this is a characteristic of normal functioning. All parts work in harmony, so that to the outside observer it is hard to see how to “carve nature at its joints”. In psychiatric conditions, aspects of the mind malfunction, revealing the joints more easily. This is true not only of psychiatric conditions. It is also true of other kinds of neurological conditions (e.g., following acquired brain damage, where specific mental functions might be lost, whilst others are retained virtually intact). Such “experiments of nature” can reveal the structure of the mind.

For a Darwinian, a structure in the mind is likely to have a function, and the function is likely to have been adaptive at some point in the evolution of the mind. In this article, I summarize some work on the psychology of autism, and explain how this has revealed structures in the mind, and consider the evolution of such mental mechanisms.

*Autism*

Autism is a childhood psychiatric condition, meaning that it starts early in childhood, and affects mental development. It is diagnosed on the basis of 3 symptoms: abnormal social development, abnormal development of communication, and impoverished development of imagination. These are sometimes called the “triad” of symptoms (Wing & Gould, 1979). The last of these, limited imagination, also often goes hand in hand with the presence of extreme repetitive behaviour, or what Leo Kanner (the discoverer of autism) called “an insistence on sameness” (Kanner, 1943). That is, such children not only fail to connect socially with others - hence the name ‘autism’, from the greek word for ‘self’ - but they find change in their environment very upsetting, and seek to maintain a strict order in their lives by withdrawing into a world of repetition and sameness. This might be by immersing themselves in repetitive material (such as lists of objects, timetables, or calenders), or it might be by acting in highly repetitive ways (performing rituals and routines in all aspects of their life).

In some respects, the parents of such children suffer even more than do their children, for whilst their child may simply act as if they are oblivious of others, and withdraw into a world of objects and repeating routines, their parents work tirelessly to socialize their child, seeking some recognition from their child that personal relationships mean something, and that the child values the relationship with their parent in particular.

Unlike the normal child, who wears their heart on their sleeve, revealing in a thousand ways to their parent that their relationship matters, the child with autism may act as if the presence of the parent is unimportant. There is an indifference to people.

Parents of such children know that they matter more than do strangers, in that children with autism do form 'attachments' to familiar adults. But the normal two-way exchange in the relationship just isn't there. The child will approach the parent when he or she needs something, but otherwise appear self-sufficient in their activities with the non-human world, typically a world of objects, machines, and routines. Whereas the normal child takes pleasure in an exchange of smiles, an exchange of humour, a shared game or activity, or a conversation, the child with autism shows no interest in such social chit-chat.

*What might be causing this lack of interest in other people?*

We know from studies of normal development that during the preschool years, children show specific social behaviours. They smile in response to eye-contact at 2 months old, they stay close to their parents at 9-12 months old. Reports of children with autism also suggest such behaviours may be present (though the accounts are usually retrospective). So it is unlikely that an absence of the 'social smile' in infancy, or absence of attachment at a year old, can be involved in the cause of autism.

But the normal child does much more than this. At 14 months old, he or she actively monitors where someone else is looking, by turning to look in the same direction as another person when that person turns to look at something. This is called 'joint attention' (Bruner, 1983). At 14 months, the normal child also points at different things in the environment, and looks across to their parent or caregiver to check if the other person has turned to look at what they are pointing at. This is another example of joint attention, because the child's pointing gesture redirects someone else's attention onto the child's focus or topic.

At 14 months, the normal child also turns to look at what someone else is pointing at - yet more joint attention, this time with the child refocusing his or her attention on what someone else finds interesting. Finally, at 14 months, the normal child brings things over to their parent or caregiver, simply to show the object to them. Such 'showing behaviour'

is the last example of joint attention. All of these behaviours serve to bring the child and adult into a shared focus in space - what (Butterworth, 1991) calls “a meeting of minds”.

Crucially, such joint attention behaviours are largely missing in children with autism at 18 months of age (Baron-Cohen, Allen & Gillberg, 1992; Baron-Cohen et al., 1996), and this lack of joint attention persists well into the school years (Leekam, Baron-Cohen, Brown, Perrett & Milders, in press; Sigman, Mundy, Ungerer & Sherman, 1986).

At 14 months old, the normal child is also doing other things in their social interactions. They are monitoring if another person is being serious or playful, threatening or affectionately teasing (Reddy, 1991). They do this by checking the other person’s facial expression of emotion, and their gaze-direction. Children with autism do little of this (Phillips, Baron-Cohen & Rutter, 1992).

At 14 months, the normal child also starts to engage in pretend play with others (Leslie, 1987). That is, during a playful exchange with their parent or caregiver, the child and parent may pretend one object is now something else. For example, the child may pretend a coat is a blanket, and put it over their doll. Or they might pretend there is food on a spoon, and put the spoon to the doll’s lips. Or they might pretend a book is hat, and smilingly put the book on their own head! Again, such spontaneous pretence by children with autism is absent at 18 months (Baron-Cohen et al., 1992; Baron-Cohen et al., 1996), and still absent in the school-age years (Baron-Cohen, 1987; Leekam et al., in press; Ungerer & Sigman, 1981; Wing & Gould, 1979).

*What does this tell us about the infant's mind?*

Let's pause at this point to consider what all this might mean. Here we see a catalogue of things that the normal child is doing at 14 months, and which the child with autism is failing to do by 18 months old - and continues to fail to do for many years. What do all of these behaviours have in common? Joint attention is all about taking account of what another person is attending to, what they are interested in - or to put it colloquially, what is going on in another person's mind. Monitoring if another person is being serious or joking, being aggressive or teasing is also all about taking account of another person's goals - some might even say their intentions. Again, paying attention to what is going on in another person's mind.

Finally, pretend play is a fascinating case of where the child suspends reality *in their own mind*, or recognizes that reality has been suspended *in another person's mind*. To be able to play the pretend game, you need to keep track of the real identity of objects (the book, the coat, the empty spoon), and the identity of these same objects in the mind of the person who is pretending (the book is now a hat, the coat is now a blanket, the empty spoon now has pretend food on it). You need to keep track of what is going on in the mind, not just in reality. It is as if, by the tender age of 14 months, children are recognizing that there are two realities: the physical world, and the world as someone might be construing it in their mind.

In short, the normal child has begun to mindread. All the while, the child with autism appears to be delayed in this important development. Instead of mindreading, he or she is mindblind (Baron-Cohen, 1995).

*Mindreading and mindblindness beyond the infancy period*

So far we have only considered what the normal child is doing in their social relations up to about 14 month of age, and what the child with autism is failing to do at this point in infancy. But what about the years beyond this? If the normal child can be considered a mindreader, and the child with autism suffers in some respect from degrees of mindblindness, then we should expect to see this expressed in other areas of behaviour at later ages.

This is exactly what we do find. By 30 months, the normal child is talking - and what is he or she talking about? Not surprisingly, early speech is full of reference to the physical world (cups, cars, shoes, and animals), and full of reference to the social world (mummy, daddy, eyes, actions), but more relevant to the earlier discussion, early speech is also full of words that refer to what is in people's minds (thoughts, desires, pretence, goals). Many studies of early normal speech have documented this remarkable precocity in young children's acquisition of 'mental-state terms' (Wellman, 1990). By 3 years old, normal children say things like "Mummy thinks I'm sleeping, but I'm just pretending!", referring to the contents of mummy's mind as well as to the contents of their own mind. More mindreading. Children with autism, when they do start to speak (and many are delayed in

this) seem to talk about just one level of existence: the physical. They use few, if any, words that refer to the contents of people's minds (Tager-Flusberg, 1993). Further evidence for their mindblindness.

By 4 years old, normal children are being even more sophisticated. They not only monitor what another person might think, but they attempt to mislead people by planting false beliefs into their minds. They begin to deceive. This might be playful (as in hide-and-seek) or it might be for opportunistic reasons. Whilst we might frown on such behaviour in terms of its morality, it is further evidence of the very human ability to mindread. Again, children with autism, by this age, have real difficulties in understanding deception, and rarely if ever lie themselves (Baron-Cohen, 1992; Sodian & Frith, 1992). Yet further signs of their mindblindness.

#### *What autism reveals about evolved mechanisms of the mind*

One conclusion from all of the above is that in observing such abilities and disabilities, we see the outline of a natural structure or mechanism in the mind - namely, we see the existence in the normal mind of a mechanism for mindreading, brought into sharp relief by its absence (in degrees) in children with autism. Currently the new neuroimaging techniques are being used to hunt down where in the brain this mechanism is located, but the clear evidence of its ontogeny in the normal infant and preschooler, and its impairment in infants and preschool children with autism, shows it must be there. Existing evidence points to different areas of prefrontal cortex for this important ability

(Baron-Cohen & Ring, 1994; Fletcher et al., 1995; Goel, Grafman, Sadato & Hallett, 1995).

How do we know such a mechanism must have evolved? Well, we can infer this from several lines of evidence. First, autism is a genetic condition (Folstein & Rutter, 1977; Folstein & Rutter, 1988), so mindreading might be genetically coded. Genes are the raw material which natural selection works with. Secondly, normal infants and preschoolers are not explicitly taught to mindread. They just do it. More clues that mindreading might be innately coded. Thirdly, no other species appears to engage in mindreading at human levels (e.g., flexible deception and communication), which suggests mindreading has evolved further in the human case (Whiten, 1991).

Fourthly, it is easy to imagine the adaptive importance of mindreading - just try to imagine how much social life one would be capable of without such an ability. Our social lives would either be highly constrained (like ants or bees), displaying rigid patterns; or our social lives would be limited to physical interactions (like many species of monkey or ape). What would be impossible would be such important social interactions as teaching, persuading, empathizing, communicating flexibly, and deceiving, since all of these require a consideration of another person's mind.

Finally, in the context of human survival, if you want a picture of how well one might cope without an ability to mindread when all around you there are people who can, you

need look no further than the child with autism. He or she can survive physically, but is socially largely cut off.

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