

# Autism

*Autistic people suffer from a biological defect. Although they cannot be cured, much can be done to improve their lives*

by Uta Frith



## The Author

UTA FRITH is a senior scientist in the Cognitive Development Unit of the Medical Research Council in London. Born in Germany, she took a degree in psychology in 1964 at the University of the Saarland in Saarbrücken, where she also studied the history of art. Four years later she obtained her Ph.D. in psychology at the University of London. Besides autism, her interests include reading development and dyslexia. She has edited a book in the field of reading development, *Cognitive Processes in Spelling*, and is the author of *Autism: Explaining the Enigma*.

The "glass shell" metaphor for autism is misleading.



The image often invoked to describe autism is that of a beautiful child imprisoned in a glass shell. For decades, many parents have clung to this view, hoping that one day a means might be found to break the invisible barrier. Cures have been proclaimed, but not one of them has been backed by evidence. The shell remains intact. Perhaps the time has come for the whole image to be shattered. Then at last we might be able to catch a glimpse of what the minds of autistic individuals are truly like.

Psychological and physiological research has shown that autistic people are not living in rich inner worlds but instead are victims of a biological defect that makes their minds very different from those of normal individuals. Happily, however, autistic people are not beyond the reach of emotional contact and attachment to others.

Thus, we can make the world more hospitable for autistic individuals just as we can, say, for the blind. To do so, we need to understand what autism is like—a most challenging task. We can imagine being blind, but autism seems unfathomable. For centuries, we have known that blindness is often a peripheral defect at the sensory-motor level of the nervous system, but only recently has autism been appreciated as a central defect at the highest level of cognitive processing. Autism, like blindness, persists throughout life, and it responds to special efforts in compensatory education. It can give rise to triumphant feats of coping but can also lead to disastrous secondary consequences—anxiety, panic and depression. Much can be done to prevent problems. Understanding the nature of the handicap must be the first step in any such effort.

Autism existed long before it was described and named by Leo Kanner of the Johns Hopkins Children's Psychiatric Clinic. Kanner published his landmark paper in 1943 after he had observed 11 children

who seemed to him to form a recognizable group. All had in common four traits: a preference for aloneness, an insistence on sameness, a liking for elaborate routines and some abilities that seemed remarkable compared with the deficits.

Concurrently, though quite independently, Hans Asperger of the University Pediatric Clinic in Vienna prepared his doctoral thesis on the same type of child. He also used the term "autism" to refer to the core features of the disorder. Both men borrowed the label from adult psychiatry, where it had been used to refer to the progressive loss of contact with the outside world experienced by schizophrenics. Autistic children seemed to suffer such a lack of contact with the world around them from a very early age.

Kanner's first case, Donald, has long served as a prototype for diagnosis. It had been evident early in life that the boy was different from other children. At two years of age, he could hum and sing tunes accurately from memory. Soon he learned to count to 100 and to recite both the alphabet and the 25 questions and answers of the Presbyterian catechism. Yet he had a mania for making toys and other objects spin. Instead of playing like other toddlers, he arranged beads and other things in groups of different colors or threw them on the floor, delighting in the sounds they made. Words for him had a literal, inflexible meaning.

Donald was first seen by Kanner at age five. Kanner observed that the boy paid no attention to people around him. When someone interfered with his solitary activities, he was never angry with the interfering person but impatiently removed the hand that was in his way. His mother was the only person with whom he had any significant contact, and that seemed attributable mainly to the great effort she made to share activities with him. By the time Donald was about eight years old, his conversation consisted largely of repetitive questions. His relation to people remained limited to his immediate wants and needs, and his attempts at contact stopped as soon as he was told or given what he had asked for.

Some of the other children Kanner described were mute, and he found that even those who spoke did not really communicate but used language in a very odd way. For example, Paul, who was five, would parrot speech verbatim. He would say "You want

**CHARACTERISTIC ALONENESS** of autistic children is exhibited by a boy at the Association in Manhattan for Autistic Children, Inc. All the accompanying photographs were taken there.

candy” when he meant “I want candy.” He was in the habit of repeating, almost every day, “Don’t throw the dog off the balcony,” an utterance his mother traced to an earlier incident with a toy dog.

Twenty years after he had first seen them, Kanner reassessed the members of his original group of children. Some of them seemed to have adapted socially much better than others, although their failure to communicate and to form relationships remained, as did their pedantry and single-mindedness. Two prerequisites for better adjustment, though

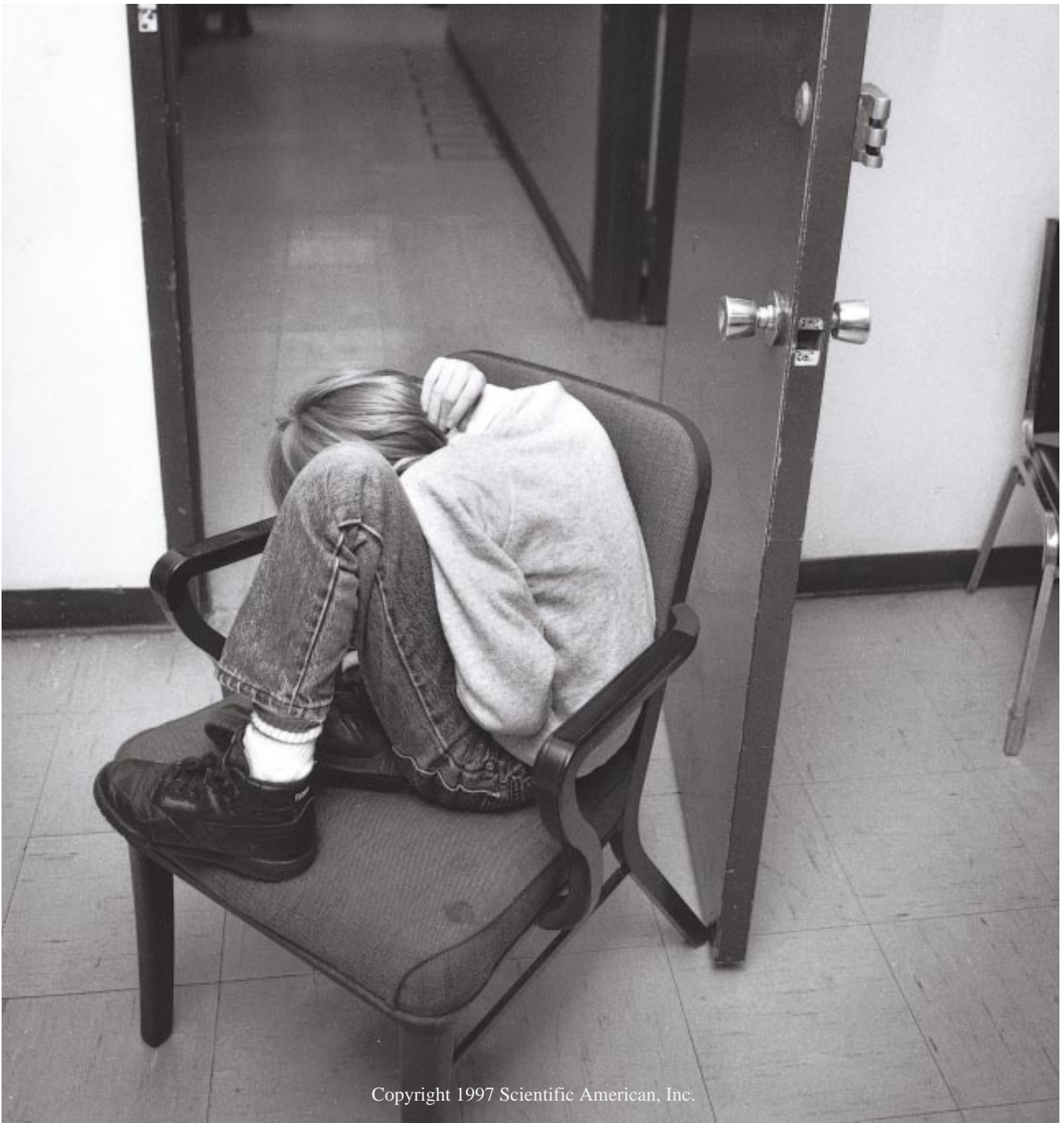
no guarantees of it, were the presence of speech before age five and relatively high intellectual ability. The brightest autistic individuals had, in their teens, become uneasily aware of their peculiarities and had made conscious efforts to conform. Nevertheless, even the best adapted were rarely able to be self-reliant or to form friendships. The one circumstance that seemed to be helpful in all the cases was an extremely structured environment.

As soon as the work of the pioneers became known, every major clinic began to identify autistic children. It was

found that such children, in addition to their social impairments, have substantial intellectual handicaps. Although many of them perform relatively well on certain tests, such as copying mosaic patterns with blocks, even the most able tend to do badly on test questions that can be answered only by the application of common sense.

Autism is rare. According to the strict criteria applied by Kanner, it appears in four of every 10,000 births. With the somewhat wider criteria used in current diagnostic practice, the incidence is much higher: one or two in 1,000 births,

ABRAHAM MENASHE



## Autistic Behavior

The traits most characteristic of autistic people are aloneness, an insistence on sameness and a liking for elaborate routines. At the same time, some autistic individuals can perform complicated tasks, provided that the activity does not require them to judge what some other person might be thinking. These traits lead to characteristic forms of behavior, a number of which are portrayed here. —U.F.



*Displays indifference*



*Indicates needs by using an adult's hand*



*Parrots words*



*Laughs and giggles inappropriately*



*Does not make eye contact*



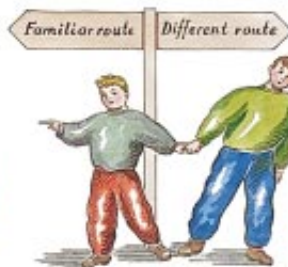
*Does not pretend in playing*



*Joins in only if an adult insists and assists*



*Does not play with other children*



*Prefers sameness*



*Is one-sided in interactions*



*Talks incessantly about one topic*



*Behaves in bizarre ways*



*Handles or spins objects*



*Yet some do certain things well if the task does not involve social understanding.*

about the same as Down's syndrome. Two to four times as many boys as girls are affected.

For many years, autism was thought to be a purely psychological disorder without an organic basis. At first, no obvious neurological problems were found. The autistic children did not necessarily have low intellectual ability, and they often looked physically normal. For these reasons, psychogenic theories were pro-

posed and taken seriously for many years. They focused on the idea that a child could become autistic because of some existentially threatening experience. A lack of maternal bonding or a disastrous experience of rejection, so the theory went, might drive an infant to withdraw into an inner world of fantasy that the outside world never penetrates.

These theories are unsupported by any empirical evidence. They are unlikely to

be supported because there are many instances of extreme rejection and deprivation in childhood, none of which have resulted in autism. Unfortunately, therapies vaguely based on such notions are still putting pressure on parents to accept a burden of guilt for the supposedly avoidable and reversible breakdown of interpersonal interactions. In contrast, well-structured behavior modification programs have often helped fami-



lies in the management of autistic children, especially children with severe behavior problems. Such programs do not claim to reinstate normal development in the children.

The insupportability of the psychogenic explanation of autism led a number of workers to search for a biological cause. Their efforts implicate a defective structure in the brain, but that structure has not yet been identified. The defect is believed to affect the thinking of autistic people, making them unable to evaluate their own thoughts or to perceive clearly what might be going on in someone else's mind.

Autism appears to be closely associated with several other clinical and medical conditions. They include maternal rubella and chromosomal abnormality, as well as early injury to the brain and infantile seizures. Most impressive, perhaps, are studies showing that autism can have a genetic basis. Both identical twins are much more likely to be autistic than are both fraternal twins. Moreover, the likelihood that autism will occur twice in the same family is 50 to 100 times greater than would be expected by chance alone.

### Defect in Frontal Lobes

Structural abnormalities in the brains of autistic individuals have turned up in anatomic studies and brain-imaging procedures. Both epidemiological and neuropsychological studies have demonstrated that autism is strongly correlated with mental retardation, which is itself clearly linked to physiological abnormality. This fact fits well with the idea that autism results from a distinct brain abnormality that is often part of more extensive damage. If the abnormality is pervasive, the mental retardation will be more severe, and the likelihood of damage to the critical brain system will increase. Conversely, it is possible for the critical system alone to be damaged. In such cases, autism is not accompanied by mental retardation.

Neuropsychological testing has also contributed evidence for the existence of a fairly circumscribed brain abnormality. Autistic individuals who are otherwise able show specific and extensive deficits on certain tests that involve planning, initiative and spontaneous generation of new ideas. The same deficits appear in patients who have frontal lobe lesions. Therefore, it seems plausible that whatever the defective brain

structure or system is, the frontal lobes are implicated.

Population studies carried out by Lorna Wing and her colleagues at the Medical Research Council's Social Psychiatry Unit in London reveal that the different symptoms of autism do not occur together simply by coincidence. Three core features in particular—impairments in communication, imagination and socialization—form a distinct triad. The impairment in communication includes such diverse phenomena as muteness and delay in learning to talk,

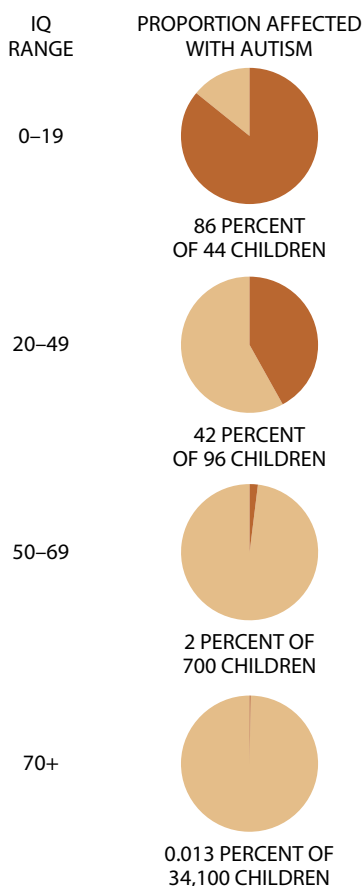
as well as problems in comprehending or using nonverbal body language. Other autistic individuals speak fluently but are overliteral in their understanding of language. The impairment in imagination appears in young autistic children as repetitive play with objects and in some autistic adults as an obsessive interest in facts. The impairment in socialization includes ineptness and inappropriate behavior in a wide range of reciprocal interactions, such as the ability to make and keep friends. Nevertheless, many autistic individuals prefer to have company and are eager to please.

The question is why these impairments, and only these, occur together. The challenge to psychological theorists was clear: to search for a single cognitive component that would explain the deficits yet still allow for the abilities that autistic people display in certain aspects of interpersonal interactions. My colleagues at the Medical Research Council's Cognitive Development Unit in London and I think we have identified just such a component. It is a cognitive mechanism of a highly complex and abstract nature that could be described in computational terms. As a shorthand, one can refer to this component by one of its main functions, namely, the ability to think about thoughts or to imagine another individual's state of mind. We propose that this component is damaged in autism. Furthermore, we suggest that this mental component is innate and has a unique brain substrate. If it were possible to pinpoint that substrate—whether it is in fact an anatomical structure, a physiological system or a chemical pathway—one might be able to identify the biological origin of autism.

The power of this component in normal development becomes obvious very early. From the end of the first year onward, infants begin to participate in what has been called shared attention. For example, a normal child will point to something for no reason other than to share his interest in it with someone else. Autistic children do not show shared attention. Indeed, the absence of this behavior may well be one of the earliest signs of autism. When an autistic child points at an object, it is only because he wants it.

In the second year of life, a particularly dramatic manifestation of the critical component can be seen in normal children: the emergence of pretense, or the ability to engage in fantasy and pretend play. Autistic children cannot un-

## Autism and Mental Retardation



SOURCE: Lorna Wing, Medical Research Council, London

CLOSE LINK between autism and mental retardation is reflected in this chart. The percentage of children showing the social impairments typical of autism is highest at low levels of intelligence as measured by tests in which an intelligence quotient (IQ) below 70 is subnormal. For example, 86 percent of 44 children in the lowest IQ range showed the social impairments of autism. The data are drawn from a population of about 35,000 children aged under 15 years.

JARFED SCHNEIDMAN DESIGN



ABRAHAM MENASHE

**UNUSUAL BEHAVIOR** is often displayed by autistic individuals. Autistic children, for example, tend to fixate on making toys and other objects spin and to play repetitively.

derstand pretense and do not pretend when they are playing. The difference can be seen in such a typical nursery game as “feeding” a teddy bear or a doll with an empty spoon. The normal child goes through the appropriate motions of feeding and accompanies the action with appropriate slurping noises. The autistic child merely twiddles or flicks the spoon repetitively. It is precisely the absence of early and simple communicative behaviors, such as shared attention and make-believe play, that often creates the first nagging doubts in the minds of the parents about the development of their child. They rightly feel that they cannot engage the child in the emotional to-and-fro of ordinary life.

My colleague Alan M. Leslie devised a theoretical model of the cognitive mechanisms underlying the key abilities of shared attention and pretense. He postulates an innate mechanism whose function is to form and use what we might call second-order representations. The world around us consists not only of visible bodies and events, captured by first-order representations, but also of invisible minds and mental events, which require second-order representation. Both types of representation have to be kept in mind and kept separate from each other.

pretending (a second-order representation) that her mother is engaging simultaneously in an imaginary activity and a real one.

As Leslie describes the mental process, pretending should be understood as computing a three-term relation between an actual situation, an imaginary situation and an agent who does the pretending. The imaginary situation is then not treated as the real situation. Believing can be understood in the same way as pretending. This insight enabled us to predict that autistic children would not be able to understand that someone can have a mistaken belief about the world.

Together with our colleague Simon Baron-Cohen, we tested this prediction by adapting an experiment originally devised by two Austrian developmental psychologists, Heinz Wimmer and Josef Perner. The test has become known as the Sally-Anne task. Sally and Anne are playing together. Sally has a marble that she puts in a basket before leaving the room. While she is out, Anne moves the marble to a box. When Sally returns, wanting to retrieve the marble, she of course looks in the basket. If this scenario is presented as, say, a puppet show to normal children who are four years of age or more, they understand that Sally will look in the basket even though they know the marble is not there. In other words, they can represent Sally’s erroneous belief as well as the true state of things. Yet in our test, 16 of 20 autistic children with a mean mental age of nine failed the task—answering that Sally would look in the box—in spite of

being able to answer correctly a variety of other questions relating to the facts of the episode. They could not conceptualize the possibility that Sally believed something that was not true.

Many comparable experiments have been carried out in other laboratories, largely confirming our prediction: autistic children are specifically impaired in their understanding of mental states. They appear to lack the innate component underlying this ability. This component, when it works normally, has the most far-reaching consequences for higher-order conscious processes. It underpins the special feature of the human mind: the ability to reflect on itself. Thus, the triad of impairments in autism—in communication, imagination and socialization—is explained by the failure of a single cognitive mechanism. In everyday life, even very able autistic individuals find it hard to keep in mind simultaneously a reality and the fact that someone else may hold a misconception of that reality.

The automatic ability of normal people to judge mental states enables us to be, in a sense, mind readers. With sufficient experience we can form and use a theory of mind that allows us to speculate about psychological motives for our behavior and to manipulate other people’s opinions, beliefs and attitudes. Autistic individuals lack the automatic ability to represent beliefs, and therefore they also lack a theory of mind. They cannot understand how behavior is caused by mental states or how beliefs and attitudes can be manipulated. Hence, they find it difficult to understand deception. The psychological undercurrents of real life as well as literature—in short, all that gives spice to social relations—for them remain a closed book. “People talk to each other with their eyes,” said one observant autistic youth. “What is it that they are saying?”

### Theory of Mind

Lacking a mechanism for a theory of mind, autistic children develop quite differently from normal ones. Most children acquire more and more sophisticated social and communicative skills as they develop other cognitive abilities. For example, children learn to be aware that there are faked and genuine expressions of feeling. Similarly, they become adept at that essential aspect of human communication—reading between the lines. They learn how to produce and

understand humor and irony. In sum, our ability to engage in imaginative ideas, to interpret feelings and to understand intentions beyond the literal content of speech are all accomplishments

that depend ultimately on an innate cognitive mechanism. Autistic children find it difficult or impossible to achieve any of these things. We believe this is because the mechanism is faulty.

This cognitive explanation for autism is specific. As a result, it enables us to distinguish the types of situations in which the autistic person will and will not have problems. It does not preclude

## Explaining Autism's Variability

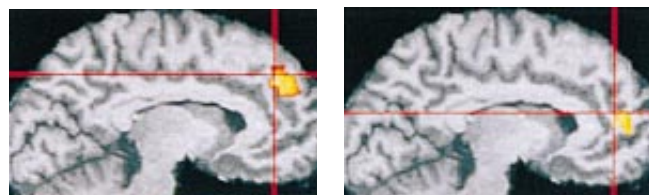
**T**he astonishing variability in the signs and symptoms of autism is only beginning to be fully appreciated. Some autistic individuals never develop speech or nonverbal communication, whereas others become fluent and can pass for normal in social interactions. A screening test that identifies the lack of shared attention, pretend play and eye contact characteristic of autism—developed by Simon Baron-Cohen of the University of Cambridge and his colleagues at Guys Hospital in London—appears to be remarkably successful in predicting autism in children as young as 18 months.

The most severe cases of autism are associated with mental retardation, but IQ does not consistently correlate with abilities and special talents. Some studies report that up to 10 percent of the autistic population has a savant skill—exceptional ability in one area, such as playing the piano, drawing or mathematics. Significantly, almost all savants are diagnosed as autistic.

One of the most important advances in the field has been the growing recognition of a subgroup of autistic individuals who possess high verbal ability and develop a high degree of social awareness by utilizing an acquired, nonintuitive theory of mind. This variant of autism is called Asperger syndrome, and some individuals who exhibit it have successful academic careers in spite of their interpersonal communication problems, obsessive tendencies and restricted interests. Although autistic individuals with normal or higher IQs can show a high degree of social adaptation, even the most compensated have some difficulty in the give and take of everyday conversation and are unlikely to have intimate friends.

The theory of mind—that autistic individuals lack the ability to understand the role of mental states in others—proved to be a crucial step in explaining how the social and communication deficits of autism could coexist with good general abilities. This hypothesis also predicts that there is a specific substrate or pathway in the brain that gives us the ability to conceive of mental states, and recent brain imaging studies indicate that such an area may be located in the left medial prefrontal cortex. Yet the theory of mind is unable to account for all aspects of autism, such as stereotyped behavior and the desire for sameness or the exceptional talents present in a significant proportion of autistic individuals. Two additional hypotheses have been proposed.

Bruce F. Pennington of the University of Denver and others in the U.S., as well as James Russell and his colleagues at the University of Cambridge in the U.K., have put forward the executive dysfunction hypothe-



FRANCESCA HAPPE ET AL.

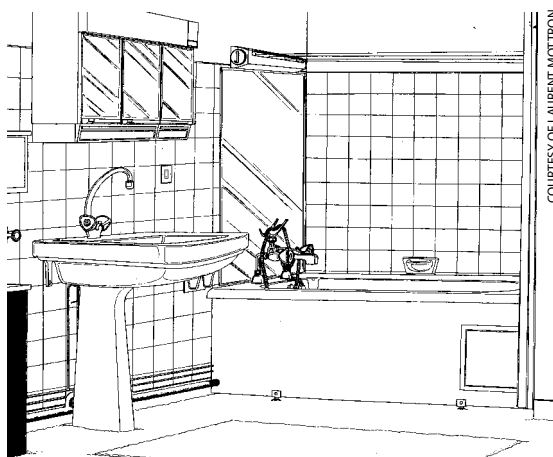
**BRAIN SCANS** show differences in activity between normal and autistic people. In normal persons reading a story that requires inferring the mental state of others, the left medial prefrontal cortex of the brain was active (*left*). In persons with Asperger syndrome performing the same task, an adjacent lower area was active instead (*right*). The left medial prefrontal cortex may be a key component of the theory of mind capability.

sis, which proposes that autistic individuals have a deficit in executive functions such as planning and working memory, impulse control, and initiation and monitoring of action. The processing of executive functions is thought to occur in the prefrontal cortex, and poor performance of these functions is directly related to repetitive thought and stereotyped, rigid behavior in autistic individuals.

Francesca Happé of London University and I have proposed the weak central coherence hypothesis as an explanation for the exceptional talents and restricted interests displayed by some autistic individuals. Weak central coherence refers to a preference by autistic individuals for segmental over

holistic information processing. How the brain integrates information is obscure, but long-range connections between the hemispheres may well be involved. There is some evidence that people with autism process information in piecemeal fashion—the total attention of the autistic individual often is captured by fragments or selective features usually of little interest to normal persons. Surprisingly, autistic persons tend to be less susceptible to visual illusions, perhaps because they are less affected by the context in which the figure is embedded.

Because it provides a model for the ability to conceive of mental states, research into autism is stimulating philosophical debate on self-consciousness. Future studies may lead to the identification of subcomponents or precursors of consciousness in other species, which in turn might lead to a better understanding of the development of conscious experience in humans. —U.F.



COURTESY OF LAURENT MOTTRON

**FREEHAND DRAWING** by E.C., a male autistic savant, was made spontaneously and without any corrections. Although the perspective appears realistic, it is achieved without the “vanishing points” most artists would need. Studies by Laurent Mottron and Sylvie Belleville of the University of Montreal show that E.C.’s ability to integrate parts of visual patterns is impaired; he is unable to reproduce anything resembling a human face but has exceptional ability to remember and draw individual objects and geometric shapes.





ABRAHAM MENASHE

**SELF-ABSORPTION** displayed by this autistic girl is a common feature of the disorder. In the motion picture *Rain Man*, self-absorption was the key trait of the central character, an autistic adult portrayed by actor Dustin Hoffman.

the existence of special assets and abilities that are independent of the innate mechanism my colleagues and I see as defective. Thus it is that autistic individuals can achieve social skills that do not involve an exchange between two minds. They can learn many useful social routines, even to the extent of sometimes camouflaging their problems. The cognitive deficit we hypothesize is also specific enough not to preclude high achievement by autistic people in such diverse activities as musical performance, artistic drawing, mathematics and memorization of facts.

It remains to be seen how best to explain the coexistence of excellent and abysmal performance by autistic people in abilities that are normally expected to go together. It is still uncertain whether there may be additional damage to emotions that prevents some autistic children from being interested in social stimuli. We have as yet little idea what to make of the single-minded, often obsessive, pursuit of certain activities. With

the autistic person, it is as if a powerful integrating force—the effort to seek meaning—were missing.

### Helping the Handicapped

**T**he old image of the child in the glass shell is misleading in more ways than one. It is incorrect to think that inside the glass shell is a normal individual waiting to emerge, nor is it true that autism is a disorder of childhood only. The motion picture *Rain Man* came at the right time to suggest a new image to a receptive public. Here we see Raymond, a middle-aged man who is unworldly, egocentric in the extreme and all too amenable to manipulation by others. He is incapable of understanding his brother's double-dealing pursuits, transparently obvious though they are to the cinema audience. Through various experiences it becomes possible for the brother to learn from Raymond and to forge an emotional bond with him. This is not a farfetched story. We

can learn a great deal about ourselves through the phenomenon of autism.

Yet the illness should not be romanticized. We must see autism as a devastating handicap without a cure. The autistic child has a mind that is unlikely to develop self-consciousness. But we can now begin to identify the particular types of social behavior and emotional responsiveness of which autistic individuals are capable. Autistic people can learn to express their needs and to anticipate the behavior of others when it is regulated by external, observable factors rather than by mental states. They can form emotional attachments to others. They often strive to please and earnestly wish to be instructed in the rules of person-to-person contact. There is no doubt that within the stark limitations a degree of satisfying sociability can be achieved.

Autistic aloneness does not have to mean loneliness. The chilling aloofness experienced by many parents is not a permanent feature of their growing autistic child. In fact, it often gives way to a preference for company. Just as it is possible to engineer the environment toward a blind person's needs or toward people with other special needs, so the environment can be adapted to an autistic person's needs.

On the other hand, one must be realistic about the degree of adaptation that can be made by the limited person. We can hope for some measure of compensation and a modest ability to cope with adversity. We cannot expect autistic individuals to grow out of the unreflecting mind they did not choose to be born with. Autistic people in turn can look for us to be more sympathetic to their plight as we better understand how their minds are different from ours. SA

### Further Reading

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