

choose interaction partners than when they are asked to report how they feel about the feedback they encounter.

The second theme concerns recent suggestions that people behave so as to re-create the conceptual equivalents of relationships experienced earlier in life. First advanced by Freud in his discussions of transference, the notion that people reenact earlier relationships has gained increasing currency within developmental psychology. Indeed, a growing body of research suggests that the relationships children form with their primary caretakers will later help them—or haunt them—as they mature. Our data suggest that people's self-concepts may be an important vehicle through which childhood relationships are carried forward through life.

Finally, in recent years, there has been much talk among psychologists about the tendency for people to "construct reality." With few exceptions, these theorists have referred to a cognitive construction process through which people actively transform sensory data into beliefs and expectations about the world. Our research suggests another sense in which people may construct their social worlds. In par-

ticular, once people form and become relatively certain of their self-conceptions, they may work to maintain them by systematically recruiting friends and intimates who will verify these conceptions. In this way, people may alter the raw materials that enter into the cognitive construction process; they may create idiosyncratically skewed versions of social reality that sustain their firmly held beliefs about themselves—even if these beliefs are negative. Such is the power of people's desire to remain in touch with social reality, however harsh that reality may seem.

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Pretense, Autism, and the Theory-of-Mind Module

Alan M. Leslie

Even mundane social life depends on the ability to comprehend other minds and their informational states. We rely heavily on commonsense folk psychology, or "theory of mind," to understand other people's behavior and to predict their reac-

tions. A critical component of this commonsense knowledge is the concept of a *propositional attitude*. We often construe behavior as mediated by an agent's holding or taking an attitude to a proposition *p* (e.g., believing, hoping, or pretend-

ing that *p*). Recent research shows that even preschool children have an impressive and spontaneous grasp of this mental source of action.

The acquisition of the knowledge and skills necessary to understand

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another person's mind has become a topic of interest to developmental psychologists.¹ One potentially important line of work in this area concerns the nature of cognitive deficits in the neurodevelopmental disorder known as childhood autism. Although early biological damage to the growing brain is likely to have a number of different consequences for cognitive development, there is increasing evidence that, in autism, one of the effects is a relatively focused and specific impairment in the capacity to reason about mental states.

EXPERIMENTAL TESTS OF THE CHILD'S THEORY OF MIND

Folk psychology arises naturally during the preschool years. One of the most striking demonstrations of this development comes from the study of attribution of false beliefs. Imagine the following scene in which Sally is tricked by Anne. Sally puts her candy in a cupboard and goes out to play. Naughty Anne comes in, finds the candy, and moves it to a nearby drawer. Now Sally comes back for her candy. Where does Sally think her candy is? Where will she look for it? Working at the Universities of Salzburg and Sussex, respectively, Wimmer and Perner² used scenarios such as this one to show that 4-year-old children could figure out what Sally wrongly thinks. The children were able to attribute a false belief to Sally and thus to predict her erroneous behavior. Children younger than 4, however, would predict Sally's behavior based on the candy's current position, as if Sally would know this.

In a further study, Perner, Leekam, and Wimmer³ developed the "Smarties" task, which also tests for understanding false belief. (Smarties are a type of candy known

and loved by European children.) The child is shown a Smarties box and asked what it contains. "Smarties" is the invariable reply. The child is then shown that, actually, the box contains only a pencil. The pencil is placed back in the box, and the lid is closed again. The child is reminded that his or her friend is outside waiting to come in. Then the test question is asked: "What will your friend say [think] is in the box when we first show it to him?" Again, most 4-year-olds correctly predict "Smarties," whereas most 3-year-olds expect the friend to say, "pencil."

The study of false belief has come to dominate much of the effort in this area since these findings. Interest in false belief arose initially out of Premack and Woodruff's⁴ article on the question of whether or not chimpanzees have a theory of mind. In a commentary on that article, Dennett⁵ suggested that a crucial test of animals' understanding would involve not just belief but *false* belief. In understanding false belief, animals must understand a belief that is not their own and therefore does not reflect reality as they construe it. Wimmer and Perner took up this idea and developed the above scenarios, testing not chimpanzees but human children instead.

Other, simplified, versions of false belief tasks have been developed. For example, Wellman and Bartsch⁶ found that 3-year-olds can pass a version of the Sally-and-Anne task in which the position of the target object is not known but guessed. Whatever the child guesses, the experimenter says that Sally thinks it is some other place. When asked to predict Sally's search behavior, then, the child has to predict on the basis of Sally's different belief. Under these circumstances, most 3-year-olds succeed. Apparently, their efforts to represent Sally's belief are not swamped by current reality, if reality is only guessed at and not known for sure.

SHARED PRETENSE: AN EARLY INDICATOR OF MENTALISM

The preschool child makes relatively slow progress in understanding situations in which people act on false beliefs. Two-year-olds, however, understand at least one kind of situation in which people act in response to imagined circumstances: shared pretense. In shared pretense, one person's behavior communicates an imaginary situation to the other person. I analyzed this ability, which first emerges between 18 and 24 months, by means of a cognitive model that identified the main properties of the internal representations required.⁷ These representations turned out to express the key information contained in propositional attitudes, leading me to suggest that these same representational mechanisms probably underlie the child's capacity to acquire and elaborate different theories of mind. In the preschooler's "concept" of pretense, we glimpse the specific innate basis of our capacity spontaneously to acquire a "theory of mind."

Pretending, in the sense I was interested in, is a playful activity and does not have an ulterior motive, such as to deceive. It should also be distinguished from being confused: If I pretend that a banana is a telephone, I know perfectly well what the banana really is. To engage in shared pretense, I have to understand that someone else can have a pretend-type attitude to the imaginary situation of the banana being a telephone. Just such an ability is found in 2-year-olds. Their ability to represent a propositional attitude is an index of their capacity to acquire a theory of mind—including, for example, an ability to employ a concept of belief.

Perhaps the easiest way to see the connection between understanding pretense in others and theory of mind is to consider the following.

Suppose you are faced with trying to understand why some particular physical event has happened (e.g., why your automobile's engine keeps cutting out). You will consider only explanations based on actual circumstances, dismissing explanations based on imagined circumstances as irrelevant. When it comes to understanding the behavior of people, however, things are different. In such cases, we often consider imaginary circumstances because we know that people sometimes behave in relation to circumstances that are not real. A metal button can be attracted only by a magnet that is really there, but a deluded Sally can be "attracted" to an empty box by a piece of chocolate that is no longer there. Or perhaps there never was a piece of chocolate—perhaps Sally is just pretending there is something in the box. In either case, Sally is behaving with respect to a situation that is only imaginary.

AUTISM: EVIDENCE FOR MODULARITY?

The single capacity to pretend and to understand pretense in others has important implications. It implies the existence of a domain-specific processing mechanism whose task is to understand behavior in relation to mental states. This mechanism is essentially innate and, in some sense, a specific part of the brain. If all this were true, then we might find an organic brain disorder that detrimentally affects this mechanism while leaving many other capacities relatively intact. There should be individuals whose capacity to pretend and to understand pretense in others is impaired. Individuals with this sort of organic damage should also have problems with intentional communication⁸ and specific difficulties in acquiring and elaborating a theory of mind. Finally, such developmental difficul-

ties should give rise to a peculiarly limited social life. Together with my colleagues in London, Simon Baron-Cohen and Uta Frith, I began working on these conjectures when it seemed to us that childhood autism might fit this profile.⁹

What was already known about autism was that pretense and imaginative abilities, intentional communication, and social competence are all impaired. Indeed, these three features are central to the behavioral diagnosis of autism. There were good reasons for thinking that autism has a biological origin, and the pioneering work of Hermelin and O'Connor¹⁰ showed that autism involves cognitive deficits. What we needed to discover was whether autistic children also show any inordinate difficulty with theory-of-mind concepts. We started with false belief.

We presented three groups of children with a task adapted from Wimmer and Perner²—essentially the Sally-and-Anne scenario outlined earlier. One of these groups consisted of normal 4-year-olds, the other two of Down syndrome and autistic children. We deliberately arranged that the autistic group had a mental and chronological age considerably higher than that of the other groups. In fact, their IQs were in the borderline to normal range (mean = 82), whereas the children with Down syndrome averaged an IQ of 64. We went to these lengths to ensure that any difficulty the autistic children might have with this task would not be due to general intellectual level. This point was important because our hypothesis was that autism involves a specific brain mechanism. The results of this study were clear. Although around 85% of both the normal and Down's groups correctly predicted Sally's false belief, only 20% of the autistic group did so, despite their intellectual and age advantage.

Autistic children may lack understanding of mental states, but do they lack *only* an understanding of

mental states? In a follow-up study, we used a picture-sequencing task to compare, across these same three groups, the children's ability to understand mental and physical events. Some sequences depicted physical-causal events, and some sequences depicted events that, it seemed to us, could be appreciated only if one took into account the mental states of the protagonists. The results were again striking. The autistic children showed a specific difficulty. They performed well on the physical-causal events but slumped to chance performance on the mental state stories. The younger normal children were near ceiling on the latter stories, and even the more retarded Down's group outperformed the autistic group. Finally, our analysis of the children's verbal descriptions of the stories showed that the autistic children produced much more physical-causal language but much less mental state language than the other two groups. In sum, the autistic children appeared to be disadvantaged when it came to understanding events that required a "theory of mind." Incidentally, we also included sequences depicting social interactions that we thought could be understood without reference to mental states. On these sequences, the autistic children did as well as the normal children and better than the Down's children.

The findings of these initial studies have subsequently been confirmed and extended in a number of ways.¹¹ For example, Baron-Cohen showed that even those autistic children who pass a basic false belief task fail a more complex ("second order") version that Down's children often pass. Frith and I demonstrated that high-ability autistic children have difficulty with true belief as well as false belief. Perner, Frith, Leekam, and I showed that most autistic children fail the Smarties task and do not take into account what another person knows while com-

municating with that person. These basic findings have received support from studies by other workers.¹²

The classical view of autism, originated by Kanner¹³ and currently championed by Hobson,¹⁴ is that it is primarily an affective disorder, but the specific pattern of spared and impaired abilities seems hard to explain in terms of a general affective disorder. Instead, Frith and I¹⁵ have argued that autism involves a cognitive impairment specifically affecting *metarepresentational* capacity. Frith¹⁶ provided the first detailed consideration of the connection between theory-of-mind deficits and the clinical picture of autism. Baron-Cohen¹⁷ showed that not all "theoretical" concepts in autistic children are impaired. Roth and I¹⁸ found that although normal 3-year-old children failed standard false belief tasks, they could attribute propositional attitudes to participants in a conversation. Our autistic subjects, however, failed to perform even at this 3-year-old level.

Further evidence that autistic children are not simply "delayed 3-year-olds" comes from recent work¹⁹ that extended Zaitchik's²⁰ elegant "false photographs" tasks to show that autistic children perform well (better than normal 4-year-olds) on a task that is structurally similar to a false belief task. This task involves not beliefs but photographs that become false by going out-of-date. This superior performance extends to understanding a false map, leading to the conclusion that autistic children are not impaired *generally* in problem solving that, like "theory of mind," requires executive functioning or counterfactual reasoning. These results support the idea that autism involves a damaged theory-of-mind module.

THE THEORY-OF-MIND MODULE

I have argued that the normal and rapid development of theory-of-mind knowledge depends on a specialized mechanism that allows the brain to attend to invisible mental states.²¹ Very early biological damage may prevent the normal expression of this theory-of-mind module in the developing brain, resulting in the core symptoms of autism.²²

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