Development Through Life

A HANDBOOK FOR CLINICIANS

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13: Development of a Theory of Mind: Where would we be without the Intentional Stance?

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INTRODUCTION

This chapter focuses on one topic within social cognition: 'theory of mind'. This term (coined by Premack & Woodruff, 1978) refers to the conceptual knowledge children and adults possess about the mind (its function and its contents: mental states such as beliefs, desires, intentions, etc.), and the use to which they put this knowledge in making sense of the social world. Hence its place within the larger domain of social cognition. Social cognition encompasses the full range of cognitive processes and mechanisms involved in understanding the social world (Sherrod & Lamb, 1981): person perception, perspective taking, the self-concept, imitation, moral reasoning, emotion comprehension, even communication development. In focusing this chapter on the development of a theory of mind, these other topics will not be covered here. Many of them are covered elsewhere in this volume (see Chapters 14, 17 and 19), and in addition, good reviews of the broader field of social cognition also exist (Shantz, 1983; Cicchetti & Beeghly, 1990). Before turning to the question of why the development of a theory of mind is of special interest, let us briefly consider the basic question of the nature of social cognition.

THE NATURE OF SOCIAL COGNITION

Why is it useful to separate social from non-social cognition? Why separate perception and knowledge about people from perception and knowledge about objects in general? One reason is that the stimuli to be processed are qualitatively different in the social and non-social worlds. People are self-propelling, they respond to non-physical causal events (such as beliefs), and they can reciprocate. In contrast, inanimate objects only move when acted upon by physical-causal events (Gelman & Spelke, 1981). One reason, then, for isolating social cognition as a separate domain of study, is to investigate if the cognitive system uses qualitatively different information-processing mechanisms for understanding social and non-social stimuli.

A second, related reason for studying social cognition in its own right is to investigate how social cognition has evolved independently of non-social cognition. That these two forms of cognition are dissociable is not contentious. For example, a homing pigeon's ability to navigate its way across enormous distances in the physical world matches (or even outstrips) the equivalent ability in a human adult. However, the homing pigeon's ability to recognize simple deception in the social world appears even less developed than that of a human child. Explaining the evolution of social cognition is a major task that has hardly begun (Jolly, 1966; Humphrey, 1984; Byrne & Whiten, 1988).

A third, related reason for studying social cognition comes from the finding that some fundamental cognitive processes that operate in both social and non-social cognition sometimes operate with less effort in the social than the non-social domain, perhaps reflecting the types of problems they were first evolved to solve. Thus, Cheney and Seyfarth (1990) argue that monkeys solve transitive inference problems (e.g. If $A > B$, and $B > C$, then what is A to C?) whenever they understand social dominance relationships (which they do all the time); yet they have considerable difficulty in solving these logical tasks in the non-social domain. Cosmides (1989) also demonstrated that for adult humans, logical reasoning (e.g. on the Wason selection task; Wason, 1983) is more accurate in the

social than in the non-social domain (but see also Chapter 10).

It is clear, then, that social and non-social cognition can function independently, yet may interact in important ways. They may have their own domain-specific, purpose-built information-processing mechanisms, and also use some general processing mechanisms. With these broader issues in mind, let us turn to the question of why theory of mind is of special interest.

Why focus on theory of mind?

A number of reasons guided the selection of this topic. First, it is one of the most exciting growth areas in the field of social cognition, as the number of new books and dedicated conference symposia in recent years testifies (Astington *et al.*, 1988; Harris, 1989; Wellman, 1990; Butterworth *et al.*, 1991; Frye & Moore, 1991; Perner, 1991; Whiten, 1991; Baron-Cohen *et al.*, 1993b; Davies & Stone, 1994; Mitchell & Lewis, 1994).

Second, theory of mind is not just another aspect of development to document. Rather, it seems to be a central mechanism that underlies many other domains of development, such as social development, communication, symbolic development and self-reflection (Baron-Cohen, 1988).

Third, theory of mind seems to be one of the major explanatory theories children (and adults) use in making sense of the world. The other important one, of course, is a theory of physical causality, but it is clear that young children use their theory of mind not only to make sense of the behaviour of people (e.g. 'Mummy is looking under the bed because she *thinks* I'm hiding there; she doesn't *know* I'm in the wardrobe!'), but also of animals (e.g. 'The cat *wants* to chase the mouse, but the mouse *wants* to escape'). They even use it to make sense of the behaviour of inanimate systems, when they have no other way of understanding them (Inagaki & Hatano, 1991). For example, children might reason: 'The clouds have gone dark because they *want* to *pretend* it's night'.

Finally, recent evidence suggests that theory of mind, like other cognitive abilities such as language and memory, is vulnerable to impairment. The major clinical syndromes relevant to impairment in theory of mind are autism, schizophrenia, personality disorder and conduct disorder. Such cases of psychopathology may shed light on what happens to children and adults when the normal facility to employ a theory of mind is lost, in different ways. However, before considering the pathological, let us start by mapping out the normal development of this ability.*

DEVELOPING A THEORY OF MIND: A REVIEW OF THE CHANGES IN CHILDHOOD

One starting point has been to ask if infants understand that actions are caused by mental states. Whilst infants can distinguish animate movement from inanimate movement (Gelman & Spelke, 1981) — they are sensitive to the difference between internal and external causation of movement — it is still unresolved whether they recognize the internal causes of animate movement as mental states (Premack, 1990; Wellman, 1990). By the time toddlers start to talk, however, it is clear that they talk about actions in terms of mental states. From as early as 18–30 months, normal children refer to a range of mental states: desires, beliefs, thoughts, dreams, pretence, etc. (Shatz *et al.*, 1983; Wellman, 1990). This suggests that at the very least they have what Bretherton *et al.* (1981) call an 'implicit' theory of mind. Other evidence for an implicit theory of mind can be seen in the changes Kagan (1982) described in the second year of life: appreciation of other people's expectations and standards. Studies with slightly older children have focused on obtaining evidence for an explicit theory of mind. This is reviewed next.

* A note on terminology: in this chapter, the term 'theory of mind' will be used, since it has now acquired considerable short-hand value within developmental psychology. Later in the chapter the question of whether it is appropriate or misleading to think of this ability as a *theory* the child possesses will be discussed. The reader should be aware that a range of other terms are also used in the literature to refer to the same cognitive function. These include: mentalizing (Morton, 1989), folk psychology (Dennett, 1978b), mind-reading (Whiten, 1991) and role-taking (Flavell *et al.*, 1978). For present purposes, these should be taken as coterminous with the phrase 'theory of mind'.

Understanding beliefs

Perhaps the first study of an explicit theory of mind was by Premack and Woodruff (1978), who investigated if a chimpanzee could understand another's mental states. Their tests included, for example, showing the subject a short film, and then freezing the film at a crucial point in the action sequence, and inviting the subject to choose between several outcomes in still photographs. In the discussion that followed their article, several commentators raised the criticism that such tasks need not necessarily require any reasoning about mental states for their solution (Dennett, 1978a). Instead, they proposed that the 'acid test' of when an organism was judging another's mental state arose in situations of false belief, in which the subject is exposed to current reality but another person is only exposed to partial (or wrong) information about reality. Under such conditions it is possible to separate unambiguously the subjects' judgements about their own mental state (their true belief) from ones based on their awareness of another person's different mental state (a false belief). Thus, if the subject knows the money is in the old china vase, but that Burglar Bill thinks it's in the desk drawer, if asked where Burglar Bill will look for the money, the subject should judge that he will look in the wrong place — the desk drawer.

Within developmental psychology* Wimmer and Perner (1983) employed a false belief test, and showed that not until around 4 years of age do children pass such a test. An adaptation of their test (Baron-Cohen *et al.*, 1985) is illustrated in Fig. 13.1. As can be seen, the test involves appreciating that, since Sally was absent when her marble was moved from its original location, she won't know it was moved, and therefore must still believe it is in its original location. On the belief question ('Where will Sally look for her marble?') 85% of 4-year-old children passed. Since in this and in the Wimmer and Perner study all subjects passed a memory control question ('Where was the marble in the beginning?') and a reality control question ('Where is the marble really?'), as well as a naming question ('Which doll is Sally?'), failure on the belief question by young 3 year olds was unlikely to have been due to such factors as inattention, memory or language overload, or lack of motivation. The large numbers of replications of Wimmer and Perner's (1983) result have essentially confirmed the finding that false beliefs are not well understood until 4 years of age (Perner *et al.*, 1987; Gopnik & Astington, 1988). Nevertheless, in recent years, the finding that 4 years old is a turning point in understanding false beliefs has been challenged by a number of investigators. Thus, whereas Wimmer and Perner (1983) argued that the false belief data indicated the presence of a cognitive deficit in younger children, later studies (Wellman, 1990; Freeman *et al.*, 1991; Siegal & Beattie, 1991; Zaitchik, 1991) suggest that when alternative experimental methods are employed, normal children younger than 4 years of age show evidence of understanding false belief. It still remains controversial as to when there is a genuine cognitive limitation on young children's understanding of other people's beliefs.

* Research into children's developing theory of mind has its roots in cognitive psychology (e.g. Piaget's work) and social psychology (e.g. attribution theory), as well as in philosophy of mind (see Perner & Wilde-Astington; 1991).

Understanding desires and intentions

So much for tests of understanding beliefs. What about understanding the mental state of desire? Desire is often thought to be the other key mental state, next to belief, in our folk psychology (Dennett, 1978b). With beliefs and desires, all kinds of behaviour become interpretable. For example, in watching a movie and trying to understand why the protagonist tiptoes into his empty flat, we might refer to his belief that there is someone in the flat, and his desire to get in unnoticed. Several studies show that for normal children, desire is understood earlier than belief — in fact, desire is clearly understood by normal 2 year olds (Wellman, 1990). Indeed, the 'terrible twos' have been interpreted as evidence of this age group's growing awareness of the frustrating difference between their own and their parent's desires (Wellman, 1990).

A mental state closely related to desire is intention. These are distinguishable, as Astington and Lee (1991) and Phillips (1993) make clear: it is possible to desire something and yet to have no intention of fulfilling that desire. (You might desire to go to the new play at the local theatre, but have

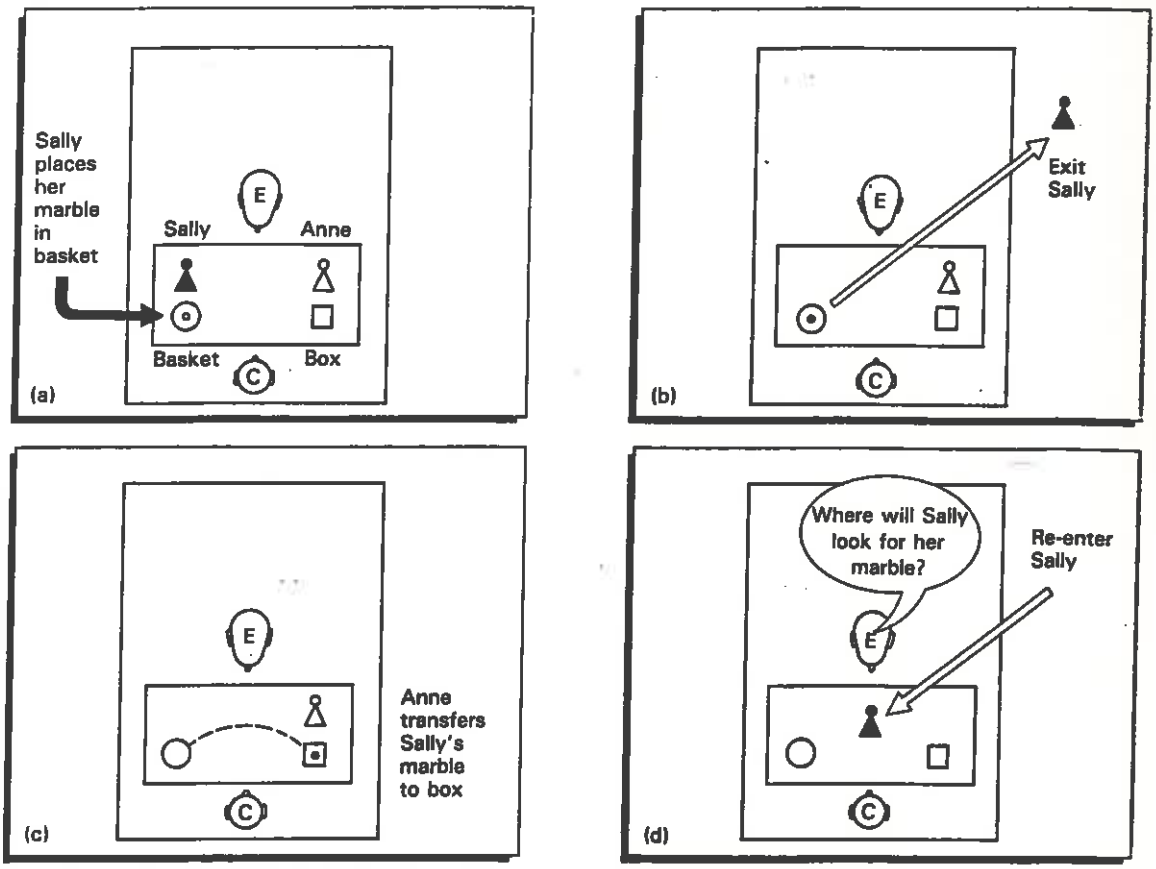

Fig. 13.1 A false belief test adapted from Baron-Cohen *et al.* (1985): (a) Sally places her marble in the basket and then (b) leaves the room. (c) Anne transfers the marble to the box. (d) When Sally comes back into the room the examiner (E) asks the child where Sally will look for the marble. See text for further details. C = child.

no intention of actually going to see it.) However, intention is related to desire in that one way of fulfilling one's desires is to formulate an intention — a plan of action — to fulfil them. Desires are of course sometimes fulfilled fortuitously (e.g. a friend might phone up unexpectedly and announce that they have tickets for you to go to the play), but the principal means for fulfilling desires is via intentional actions. When do young children grasp the concept of intention?

A large part of the literature on children's understanding of morality centres on their appreciation of the distinction between intentional and accidental acts, and children's judgements of responsibility and blame (Piaget, 1929; see also Chapter 14). However, understanding intention can and has been studied separately from moral development. Some early studies in this area, by King (1971), Berndt and Berndt (1975) and Smith (1978), found a significant change around 4 years of age in the ability to distinguish acts 'done on purpose' from accidental acts. Children younger than this were reported to err on the side of assuming that everything was intentional, and this echoes Piaget's (1929) findings.

More recent studies by Astington and Lee (1991) have extended this work by investigating young children's ability to distinguish outcomes that appear the same, but that differ in the crucial respect of the actor's intention. Thus, in one of her stories, a girl intends to feed her bread to the birds, and then she does so, whilst in another story, a girl accidently drops some breadcrumbs. The birds end up being fed just the same. In such a test, the

child is asked, 'Which girl meant to feed the birds?' These findings are broadly similar to the earlier studies, in finding chance performance before 3 years old.

Understanding pretence

Another important mental state that has been well studied is that of pretence. Children begin to produce pretend play from as early as 10–18 months of age (Bates, 1979). Experiments with verbal children also show that as soon as they can answer questions, they also seem to understand that pretence is distinct from reality (Wellman, 1990). This is clearly a complex achievement. In terms of the acquisition of different mental state concepts, understanding pretence may predate understanding desire (Baron-Cohen, 1991a; Gopnik & Slaughter, 1991), although longitudinal data on this are needed.

Pretence was for a long time studied as part of symbolic development (Piaget, 1962; McCune-Nicholich, 1981). In an important article rethinking the nature of pretence, Leslie (1987) put forward a theory that focused on children's understanding of pretence as a mental state. He argued that the logical properties of pretence (namely, suspension of normal truth conditions) resembled the logical properties of other mental states (such as belief), and on these grounds it might be that children's understanding of pretence reflected an important stage in the origins of a theory of mind.

Part of Leslie's claim also centred on the sort of cognitive architecture that would be needed to support not only comprehension of pretence, but comprehension of all mental states. His suggestion was that a capacity for metarepresentation would be minimally required. He defined this as the ability to represent an agent's mental attitude to a proposition. This capacity, he maintains, ensures that the object's pretend identity is represented separately from its real identity. (For details of the component parts of this system see Leslie, 1987, 1991; Leslie & Roth, 1993; and for counter-arguments, see Perner, 1988, 1991, 1993). The implication is that pretence might mark not only a developmental stage in the acquisition of a theory of mind, but a qualitative change in the sort of representational mechanisms available to cognition.

Understanding perception

What about children's ability to understand perception and visual perspectives? Piaget and Inhelder's (1956) 'three-mountains task' broke new ground in suggesting that children between 4 and 6 years old were unable to select a picture that showed how a view would appear to different people at different locations. Such children, Piaget and Inhelder reported, tended to attribute their own spatial perspective to other people — an error that became the hallmark of Piaget's concept of 'childhood egocentrism'.*

Flavell *et al.* (1978) challenged this view by employing far simpler experimental techniques. They distinguished between two levels of visual perspective-taking. The first they called level 1 — the ability to infer what another person can see. This appears to be present even by 2 years old (Lempers *et al.*, 1977; Flavell *et al.*, 1978, 1981). Thus, 2 year olds can put things out of or bring things into sight, when requested to do so. Level 2 visual perspective taking is the ability to infer how the object appears to another person. This seems to take longer to develop. In fact it is not until 3–4 years of age that children reliably pass level 2 tasks. For example, when shown a picture of a turtle which appears either right-side up or upside-down (depending on which side of the table it is viewed from), young 3 year olds fail to identify correctly which of these two perspectives the experimenter would have (Flavell *et al.*, 1981).

A related achievement in the development of a theory of mind is in children's understanding of the principle that 'seeing-leads-to-knowing'. Pratt and Bryant (1990) for example showed that 3 year olds are easily able to indicate which of two people will know what is in a container, if one of them has looked into the container whilst the other has simply touched it. Such an ability demonstrates that even at this young age, children are aware of the role of informational access in the formation of knowledge.

Before moving on to consider the importance of

* Light and Nix (1983) showed however that even the notion that children are biased to select their own view is not correct: rather, children are biased to select a 'good' view.

a theory of mind, it is worth noting that there has been relatively little work looking at later normal development of this ability. Perner and Wimmer (1985) studied slightly older children for the ability to attribute beliefs about beliefs to others (so-called second-order belief attribution), and found this appears for the first time at around 6 years of age. Leekam (1991) reported on related developments in the use and comprehension of figurative speech such as irony and sarcasm. Tests that tap adult levels of functioning in theory of mind are still needed. Equally, reliability and validity studies are needed in this area. Often, the tests used are 'one-shot' assessments, with no test–retest reliability, or attempt to correlate scores on tests with other aspects of the child's behaviour. The possibility of artefacts should nevertheless be considered against the impressive number of successful replications of results by independent research groups in this field.

THE IMPORTANCE OF A THEORY OF MIND: WHAT DO WE USE IT FOR?

Making sense of social behaviour

At this stage, it is worth pausing to reflect on why children are acquiring this extraordinarily rich body of knowledge: what are the benefits to the child in developing a theory of mind? Dennett (1978b) was perhaps one of the first to put forward the case for the necessary role of a theory of mind in understanding the human world. His strong thesis, entitled the intentional stance theory, claimed that attributing mental states to a complex system (such as a human) was by far the easiest way of understanding it. By understanding, he meant coming up with explanations of its behaviour, and predicting what it would do next. He called this ability adopting the intentional stance, though others after him used the term theory of mind, precisely because the child (and later, the adult), seemed to use this ability in theory-like ways: for explanation and prediction. Dennett's choice of the term intentional stance refers to our ability to attribute the full set of intentional states (beliefs, desires, intentions, imaginings, hopes, memories, fears, promises, deceptions, etc.) and not just the specific mental state of intention.

The alternatives, Dennett argued, to adopting the intentional stance, are either to attempt to understand systems in terms of their physical make-up (adopting the physical stance), or their functional design (the design stance). We adopt the physical stance to understand systems whose physical make-up we are aware of, such as the human body. For example, we might reason that the skin bleeds when it is cut because blood vessels have been severed. In this instance, the physical stance takes the form of a 'folk biology'. It is equally clear we possess a 'folk physics' to make sense of other phenomena in the physical world (see Chapter 10). Attempting to understand human behaviour in terms of physical entities is of course not possible, given the state of our knowledge: we would need to know about millions of different brain states that give rise to different behaviours in order to understand human behaviour in physical terms. A theory of mind (or the intentional stance) is an infinitely simpler and more powerful solution than the physical stance.

We adopt the design stance when we are ignorant about the physical make-up of a system (the physical stance is therefore not available to us), but wish to understand the system in terms of the functions of its observable parts. Thus, when making sense of my computer, I need know nothing about silicon chips or other physical details, to predict its behaviour. Instead, I can refer to some of its design features, such as the delete key (whose function is to rub out what I have just typed), the escape key (whose function is to clear the screen) and so on.

The design stance works well when we wish to explain a system with observable and operational parts (such as alarm clocks, televisions, thermostats, etc.), though note that a theory of mind would work just as well. Indeed, many people reason about their computer in very mentalistic ways. They might say 'My computer is displaying this command because it *thinks* I have finished', etc. However, the design stance seems just as useful in these cases, e.g. 'My computer isn't working because it is not plugged in', etc. Adopting the design stance towards understanding people would not however get one very far, since people have very few external operational parts for which one could work out a functional or design description. Furthermore, few if any of these would be at all useful in predict-

ing moment by moment changes in the person's behaviour.

Dennett (1978b) and Fodor (1987) therefore concluded that the solution evolution has come up with to enable us to understand and predict our own and other people's behaviour — or the behaviour of any complex system — is the intentional stance, or what has become better known as a theory of mind. It is a simple to use and powerful theory, which is exactly what we need when we are in the thick of a social situation. For example, imagine an insurance salesman is standing at your front door, waiting for you to sign a piece of paper. You need to reason quickly about his behaviour, and what he is likely to do next. Making inferences about his desires, intentions and motives allows you to do this. In place of this modern example can easily be substituted an equivalent example from our likely evolutionary past. Imagine you are an early hominid. Another early hominid offers to groom you and your mate. You need to reason quickly about whether you should let him approach or not. Again, making inferences about whether his motives are purely altruistic, or whether he might be deceitful, is a reasoning strategy that can be applied in time to react to possible social threat. Whilst the necessary testing remains to be done, our intuition suggests that our theory of mind reasoning is both extremely quick and automatic.

A theory of mind also goes under the name of 'folk psychology', and this may be a better term for it. This gets away from the notion that children acquire this knowledge in similar ways to how scientists develop theories. There is a case for arguing that children are theorists in much of their knowledge acquisition (Carey, 1985; Keil, 1988) and in the acquisition of their theory of mind in particular* (Wellman, 1990; Perner, 1991; Gopnik & Wellman, 1992), but the attractive benefit of talking about this ability in terms of folk psychology is that it reminds us that it is simply our everyday way of understanding people. We all use it all the time, as Dennett (1979, pp. 8–9) pointed out:

> We use folk psychology all the time, to explain and predict each other's behaviour; we attribute beliefs and desires to each other with confidence — and quite unselfconsciously — and spend a substantial portion of our waking lives formulating the world — not excluding ourselves — in these terms ... Every time we venture out on the highway, for example, we stake our lives on the reliability of our general expectations about the perceptual beliefs, normal desires and decision proclivities of the other motorists. We find ... that it is a theory of great generative power and efficiency. For instance, watching a film with a highly original and unstereotyped plot, we see the hero smile at the villain and we all swiftly and effortlessly arrive at the same complex theoretical diagnosis: 'Aha!' we conclude (but perhaps not consciously), 'He wants her to think he doesn't know she intends to defraud her brother!'

Making sense of communication

A second function of a theory of mind is to understand communication. Perhaps the clearest case for this was put by Grice (1975), a philosopher of language. He argued that aside from decoding the referent of each word (its semantics), and the syntax of speech, the key thing that we do when we search for meaning in what someone has said, is to imagine what their communicative intention might be. Thus, when the cop shouts 'Drop it!', the robber is not left in some state of acute doubt over the ambiguity of the term 'it'. Rather, the robber makes a rapid assumption that the cop intended to use the word 'it' to refer to the gun in the robber's hand, and furthermore intended the robber to recognize his intention to use the word in this way. Clearly, in decoding figurative speech (such as irony, sarcasm, metaphor or humour), a theory of mind is also essential, since in such cases the speaker does

* The reader should be alerted to a current controversy in this field over whether, in the normal case, we have to develop a theory about the mind in order to use a folk psychology, or whether we instead have privileged access to our own mental states and then, by pretending to be in the other person's situation, run a mental simulation of what we would think and feel in their place. The former theory is known as the 'theory theory', whilst the latter is known as the simulation theory. A good source for further reading about this debate is the special issue of *Mind and Language* on this topic (Vol. 7(1 + 2), 1992). As things stand at present, it can be argued that the data from developmental psychology fit both theories equally well. Critical experiments enabling these two theories to be tested against each other remain to be done.

not intend their utterance to be taken literally (Baron-Cohen, 1988; Happe, 1993).

This analysis of language in terms of complex communicative intentions makes clear that in decoding speech we are doing a lot more than simply working through the semantics of the spoken words. We are going beyond the perceptual input, to hypothesize about the speaker's mental state. Grice did not limit this analysis to speech, but argued that exactly the same process was used in non-verbal communication. Thus, when I gesture towards the doorway with an outstretched arm and with the palm of my hand open, you immediately assume that I mean (i.e. intend you to understand) that you should go through the doorway. This way of thinking about meaning can be seen in the theories developed by the Speech Act School (Austin, 1962; Searle, 1979) and in more recent work, such as relevance theory (Sperber & Wilson, 1986).

The other way in which a theory of mind is held to play an essential part in successful communication is in the speaker monitoring his or her listener's informational needs: that is, in judging what the listener already knows or does not know, and what information must still be supplied in order that the listener can understand the communicative intention. Furthermore, for communication to succeed, the speaker needs to be monitoring if their message has been understood as they intended it to be, or if rephrasing is required to clarify ambiguity. Once again, dialogue understood in this way becomes much more than simply the production of speech: it is revealed as intrinsically linked to the use of a theory of mind.

Other applications of a theory of mind

The importance of a theory of mind to social understanding and communication has been emphasized because these are arguably the most important of its functions. However, there are several other functions of this crucial ability. Let us explore just a few here.

First, there is deception. Deception, of course, is all about making someone believe that something is true when it is actually false. Clearly, this is a sophisticated use of a theory of mind, and some have argued that the benefits of being able to deceive might have been an important evolutionary pressure in the development of a theory of mind (Byrne & Whiten, 1988). This is known as the Machiavellian intelligence hypothesis. Normal children begin to engage in very convincing deception soon after they understand the notion of false belief (Sodian *et al.*, 1991), around 4 years of age. Older children, and adults, show the ability for more sophisticated deception, such as 'double-bluff' — evidence that their theory of mind continues to develop in later childhood and during the teens (Happe, 1993).

Second, there is empathy. A theory of mind naturally confers on the user an ability to infer what someone else is thinking, and how someone might be interpreting events. Empathy is often thought of in a rather restricted sense, as simply about appreciating another person's emotional state. Whilst this is part of empathy, it cannot be all of it. Appreciating a person's emotional state can to some extent be read off their facial emotional expressions, but understanding why they feel the way they do often requires appreciating what they are thinking. Harris (1989) has shown that children of 3 years of age can understand another person's emotional state as caused by external situations, but by around 5 years old they are adept at understanding a person's emotions in terms of what they thought was likely to happen (e.g. 'Jane is happy because she *thinks* she's won the race'), irrespective of whether their thought coincides with reality.

A third spin-off of a theory of mind is that it allows for self-consciousness or self-reflection. As soon as a child (or indeed any organism or system) can attribute mental states to itself, it can begin to reflect on its own mind. Thus, 4 year olds succeed at distinguishing appearance from reality and recognizing the fallibility of their beliefs ('I thought it was an x, but maybe I was wrong'; Flavell *et al.*, 1986), and about the causes of their own behaviour ('I looked for my ball under the car because I *thought* that's where it was'), as well as the source of their knowledge ('I *know* it's Kate's birthday because my mother told me'). Clearly, this transforms their thoughts from a focus on the here and now to a focus on their own subjectivity. An added advantage of this is that they can rehearse possible

solutions to problems in their own mind, before trying them out in real action ('Let's *imagine* I did x; would that work?', etc.).

A fourth application of a theory of mind is in teaching, or attempting to change a person's mind through persuasion, etc. The realization that other people's thoughts and beliefs are shaped by the information to which they are exposed allows for the possibility of informing others, in order to change what they know. Thus, there are good accounts of 4 year olds teaching their younger siblings in different ways, and older children simplifying the information in recognition of the limited knowledge of the younger child (see Chapter 11). The same phenomenon has been documented in the ways in which older children talk to younger ones (Shatz & Gelman, 1973; Sachs & Devin, 1976). In terms of the species, it is clear that human beings use their theory of mind to inform and persuade in all sorts of ways (advertising, politics, education, etc.), but finding even simple, convincing instances of teaching in other species is quite rare (Cheyney & Seyfarth, 1990). This latter point leads us next to consider a theory of mind from the vantage point of comparative psychology.

THE EVOLUTION AND ORIGINS OF A THEORY OF MIND: EVIDENCE FROM PRIMATOLOGY AND INFANCY

Because of the discovery of specific neuropsychological deficits in theory of mind (see below), it seems plausible that a theory of mind has a specific neural basis, with its own brain system. This theory of its biological basis has been one important reason leading primatologists to investigate theory of mind in non-human primates, in order to trace a possible evolutionary development of this ability. We have already mentioned the likely value a theory of mind would confer on an individual's fitness, and the Machiavellian intelligence hypothesis of how such an ability might have evolved (by natural selection) if it arose in the gene pool. Whiten's (1993) review of the evolution of a theory of mind concluded that non-human primates show little if any convincing evidence of understanding mental states like knowledge and belief, though they do understand the 'simpler' mental states of perception, and possibly desire. There thus seems to be a quantum leap between the highest ability in the apes and monkeys, and that found in 3–4-year-old humans.

The precise ontogenesis of a theory of mind in the first years of life in the human case is still controversial. One theory holds that the earliest manifestation of understanding mental states is in joint-attention behaviour (Baron-Cohen, 1989c, d, 1991c, 1993). Another theory holds that infant's sensitivity to emotional states in others is the key precursor to understanding cognitive mental states such as thoughts, beliefs, knowledge and intentions (Hobson, 1990, 1993). A final theory holds that imitation is the mechanism that allows infants to appreciate the similarity between themselves and others, and thus to extend their subjective awareness of internal states to their existence in others (Gopnik & Meltzoff, 1993). Testing these causal claims is part of the current research agenda.

ABNORMALITIES IN THE COMPREHENSION OF MENTAL STATES

Autism

There is a sizeable body of work documenting deficits in understanding mental states in children with autism (Baron-Cohen *et al.*, 1993b). For example, on tests of false belief comprehension, children with autism make more errors than both normal and mentally handicapped children of a younger mental age (Baron-Cohen *et al.*, 1985, 1986; Leslie & Frith, 1988; Baron-Cohen, 1989a, b; Perner *et al.*, 1989; Reed & Peterson, 1990; Leekam & Perner, 1991). This deficit does not seem to be due to a general difficulty in representing representations, as children with autism can understand non-mental representations (such as photographs and drawings) as representations (Leekam & Perner, 1991; Charman & Baron-Cohen, 1992; Leslie & Thaiss, 1992). The difficulty they have on false belief tests appears to relate to the symptoms these children show in social and communicative development (Baron-Cohen, 1988; Happe, 1993; Siddons *et al.*, in press).

Whilst most children with autism fail tests of

belief understanding, a minority of them do pass. This subgroup ranges from 20 to 35% in different samples. But when these subjects are given a more taxing test of belief understanding (comprising understanding second-order, nested beliefs, or beliefs about beliefs, e.g. of the form 'Anne thinks Sally thinks x') — these being well within the comprehension of normal 6–7-year-old children (Perner & Wimmer, 1985) — even these teenagers with autism fail outright (Baron-Cohen, 1989b; Ozonoff *et al.*, 1991). It appears that, whilst most children with autism do not understand beliefs even at the level of normal 3–4-year-old children, some do; but these show impaired understanding of beliefs at the level of normal 6–7-year-old children. Clearly, something is going wrong in the development of the concept of belief in children with autism. This has been discussed in terms of specific developmental deviance and delay in autism (Baron-Cohen, 1989b, 1991a, 1992a).

This inability to understand others' beliefs reveals itself most dramatically on tests of deception in autism (Sodian & Frith, 1992). As discussed earlier, since deception entails belief manipulation, this is consistent with their difficulties in belief comprehension. Thus, in the penny hiding game (Gratch, 1964), a simple test of deception, children with autism fail to hide the clues that enable the guesser to infer the whereabouts of the penny (Oswald & Ollendick, 1989; Baron-Cohen, 1992b). For example, they omit to close the empty hand, or they hide the penny in full view of the guesser, or they show the guesser where the penny is, before the guesser has guessed. In contrast, subjects with mental handicap and normal 3-year-old children make far fewer errors of this sort.

What of their understanding of other mental states? When children with autism are asked how a story character will feel when given something they either want or do not want, no impairments are found, relative to a mental-age matched control group without autism (Baron-Cohen, 1991b; Tan & Harris, 1991). Understanding desire at this simple level thus seems to be within their ability. However, in studies of pretence in autism (Ungerer & Sigman, 1981; Baron-Cohen, 1987), children with autism seem to produce significantly less spontaneous pretend play than mentally handicapped control groups. On tests of understanding. perception, children with autism have been tested at both levels of visual perspective taking (Hobson, 1984; Leslie & Frith, 1988; Baron-Cohen, 1989d, 1991a; Reed & Peterson, 1990; Tan & Harris, 1991), and appear to show no deficits.

One key set of mental states that has been a major focus of some studies (Hobson, 1993) is emotion. In his early studies, Hobson (1986a, b) found that subjects with autism performed significantly worse than control groups on emotion expression matching tasks. In later studies, these differences were not found when groups were matched on verbal mental age (Hobson *et al.*, 1988a, b, 1989; Braverman *et al.*, 1989; Tantam *et al.*, 1989; Ozonoff *et al.*, 1990; Prior *et al.*, 1990). Furthermore, since emotion recognition deficits are also found in a range of other clinical disorders, such as schizophrenia (Cutting, 1981; Novic *et al.*, 1984), mental handicap (Gray *et al.*, 1983), abused children (Camras *et al.*, 1983), deaf children (Odom *et al.*, 1973) and prosopagnosia (Kurucz *et al.*, 1979; De Kosky *et al.*, 1980), the status of this deficit as an explanation is called into question.

Some studies have focused not on emotion recognition, but emotion prediction. The aim in these studies is to establish how much children with autism understand about the causes of emotion — how a person will feel, given a set of circumstances. As mentioned earlier, Harris *et al.* (1989) showed that normal 3–4-year-old children understand that emotion can be caused by situations (e.g. nice situations make you feel happy, nasty ones make you feel sad) and desires (e.g. fulfilled desires make you feel happy, unfulfilled ones make you feel sad). They also showed that by 4–6 years old, normal children understand that beliefs can affect emotion (e.g. if you think you're getting what you want, you'll feel happy, and if you think you're not, you'll feel sad — irrespective of what you're actually getting).

Baron-Cohen (1991b) found that subjects with autism were easily able to judge a story character's emotion when this was caused by a situation, and were as good as a group with mental handicap at predicting the character's emotion given her desire. However, they were significantly worse at predicting the character's emotion given her belief, than either normal 5-year-old children or subjects with mental handicap. The implication is that

'simple' emotions may be within the understanding of people with autism, whilst 'cognitive' or belief-based emotions (Wellman, 1990) may pose considerable difficulty for them. This has also been found in a more fine-grain analysis of emotion-recognition tasks in these terms (Baron-Cohen *et al.*, 1993a).

The picture emerging from these studies is that not all mental states pose difficulties for children with autism: perception, simple emotion and desire do not, but pretence, knowledge and belief do. Explaining why this specific pattern of intact and impaired comprehension is found is currently the focus of debate (Baron-Cohen *et al.*, 1993). However, the claim that these deficits are specific to autism appears less controversial, and relies on experimental evidence from other clinical groups. Thus, other childhood clinical populations tend to pass false belief tests. These populations include children with Down's syndrome (Baron-Cohen *et al.*, 1985), Williams' syndrome (Karmiloff-Smith, 1993), mental handicap of unknown aetiology (Baron-Cohen, 1989a), language-impairment (Leslie & Frith, 1988), conduct disorder (Siddons *et al.*, in press), deafness (Sellars & Leslie, 1990), and children with callosal agenesis (Temple & Vilarroya, 1990). Further clinical populations remain to be tested, but the deficit does seem to be autism-specific. That most disorders leave the development of a theory of mind relatively intact is some confirmation for the view that a theory of mind is so important that it has been innately built in to the human mind, and is a universal. Avis and Harris (1991) provide some cross-cultural data in support of this view.

Other clinical groups

Whilst autism seems to reflect the most severe disruption to the normal acquisition of a theory of mind — these children often not even arriving at the fundamental stage of appreciating that such mental states as beliefs even exist — there are other disorders in which children do reach this basic level, but show difficulties in the accurate use of a theory of mind. Thus, in schizophrenia some have argued that symptoms of paranoia (Baron-Cohen, 1989e) are an expression of inaccurate attribution of beliefs to others (e.g. consider the paranoid delusion 'The man on the television *knows* what I am thinking', etc.). Frith and Frith (1991) have suggested that there may be a link between autism and schizophrenia in terms of the same mechanism (theory of mind) becoming impaired at very different times in development, with radically different outcomes. In autism, the abnormality would be in infancy or prenatally, whilst in schizophrenia the impairment in theory of mind may only be 'switched on' (genetically?) in adolescence or later. Such a theoretical comparison remains to be empirically tested.

Aggressive behaviour in children with conduct disorder has also been associated with inaccurate attribution of intentions to others ('You *deliberately* bumped into me', etc.; Dodge, 1980). Such distortions in accurate identification of intentions may in part be a product of the child's learning history. For example, Dodge *et al.* (1990) found that distorted perception of others' intentions was more likely in children who had experienced physical abuse, and appeared to mediate between the experience of abuse and the risk of later aggressive behaviour.

A third disorder in which it has been hypothesized that abnormal theory of mind development may occur is narcissistic personality disorder (Fonagy, 1989). In these patients, it is argued — on the basis of clinical rather than experimental studies — that the striking lack of empathy such individuals show may reflect not a lack of awareness that other people have minds, but a psychological defence against confronting the contents of other people's minds.

Finally, patients with semantic–pragmatic disorder (Bishop, 1989) are thought to have particular difficulties in accurately identifying a speaker's communicative intent, and taking into account a listener's informational needs — what they need to know for an utterance to be understood. Whilst these subjects may well overlap considerably with autism (Baron-Cohen, 1988; Lister-Brook & Bowler, 1992) it is possible that the two conditions are also distinguishable. Future work is needed to establish the extent to which they are separable disorders, and to what extent deficits in theory of mind use differ between them.

CONCLUSION

The impressive ability of even very young normal children to use a theory of mind, apparently effortlessly, and the serious consequences of its impairment in autism, suggest the existence of specialized cognitive mechanisms for understanding mental states. The studies from autism have been enriched by and in turn have challenged models of the normal development of a theory of mind (Baron-Cohen, 1990, 1991a, 1993). A theory of mind is a strong candidate for a modular mechanism in the brain (Leslie, 1991; Baron-Cohen, 1992a; Leslie & Roth, 1993). It is assumed to be biological in origin first because autism has a biological basis (Rutter, 1983), and second because it appears to be universal (Avis & Harris, 1991).

In attempting to speculate about likely developments in this field, in the next decade, four fruitful areas seem worth identifying. First, using current neuroimaging techniques, if a theory of mind does indeed depend on a localizable, discrete neural mechanism (or set of neural mechanisms), the use of theory of mind tasks as cognitive activation during brain imaging might bring us closer to an understanding of the links between brain and cognition. Second, if the traditional laboratory methods for studying infants (habituation, perceptual preference, etc.) are applied to the investigation of early theory of mind knowledge in the first year of life, we may need to revise our ideas of how a theory of mind develops, and how we should characterize the 'initial state' of the infant. Third, it will be important for progress in understanding normal processes in the development and employment of a theory of mind to continue to inform our understanding of disorders (such as autism). Finally, and related to this last point, it is both likely and desirable that such cross-fertilization between developmental psychology and psychopathology will not only lead to greater understanding of processes and mechanisms, but also to new advances in the application of such knowledge: in the fields of early diagnosis, and intervention. Such cross-fertilization is already taking place (Baron-Cohen *et al.*, 1992; Baron-Cohen & Howlin, 1993).

In closing, it is worth restating the vital role that theory of mind plays in development. It is likely that this piece of cognitive machinery has captured the centre stage of developmental psychology precisely because of its importance to human development. As mentioned earlier, Leslie (1987; Leslie & Roth, 1993) has argued that underlying a theory of mind is a mechanism for representing mental representations, and traces the importance of this through the lifespan, from its emergence in the pretend games of the toddler, through to the use of the imagination all through life. The bald implication is: no theory of mind, no art. Similarly, no theory of mind, no culture or society, at least not as we understand the term as applied to the human case. Hence Fodor's (1987, p. 133) claim that 'There is, so far as I know, no human group that doesn't explain behaviour by imputing beliefs and desires to the behaviour. (And if an anthropologist claimed to have found such a group, I wouldn't believe him.)'. In autism, one theory holds, we see the cruel consequence of a lack of theory of mind: an inability to join the group.

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