Children's Early Understanding of Mind

C Lewis + P Mitchell (eds)

Lawrence Earlbaum Assoc '94

3 Grades of Mindreading

Andrew Whiten
University of St. Andrews, UK

INTRODUCTION

The origins of an understanding of mind can be sought on several different timescales. One scale is that of human development, perhaps the most accessible to empirical investigation and certainly the area of most vigorous research in recent years, as demonstrated by this volume and its ancestors (Astington, Harris, & Olson, 1988; Butterworth, Harris, Leslie, & Wellman, 1991; Frye & Moore, 1991; Whiten, 1991). At the other extreme is the evolutionary timescale. The ability to understand mind, which develops in our species, did not spring out of nowhere: it must have had more primitive evolutionary beginnings. Although many details of these origins may be lost to empirical study, comparative research, particularly on our closest primate relatives, is beginning to shed light on the roots of mindreading (Whiten, 1993). So we should be thinking about origins on at least these two very different timescales. In addition, we should remember that the two are not separate, but interactive processes. Evolutionary change is moulded through successive developmental cycles and therefore influenced by the processes and products of ontogeny (Baldwin, 1902): Conversely, developmental processes are themselves the products of evolution and their nature may therefore often be understood in functional terms—as taking the particular ontogenetic course they do for adaptive reasons. For example, it may be beneficial for the human infant initially to be focused on the reading of certain mental states, rather than others, in its caretakers (see Mitchell, this volume; Dunn, this volume).

Between these two timescales, there is the historical one. We shall be less concerned with it here, but its existence should be remembered. The "folk psychology" or "folk theory of mind" (Heider, 1958; Wundt, 1916) that children appear to acquire itself has origins in historical and cultural processes. These have shaped the language in which we talk about states of mind and, presumably, unlike the processes we may distinguish as evolutionary, have led to divergent understandings of mind in different cultures (Heelas & Lock, 1981). These understandings can hardly fail to influence what the children of each culture learn; but in turn we must acknowledge that the cultural processes must have built on and interacted with social cognitive abilities that evolution bequeathed our species. I suggest, therefore, that the origins of understanding of mind lie in a complex web of ontogenetic, historical, and evolutionary factors. We cannot understand the first of these adequately if we neglect the other two.

We should also recognise diversity—the main theme of this paper (and arguably, of this book)—when we consider what counts as an "understanding of mind." The answer depends, of course, on what we mean by "understanding" and by "mind" (Whiten & Perner, 1991). Neither of these are neatly circumscribed concepts: But this is for good reason, and I am going to advocate that we acknowledge and indeed exploit the fact that grades of both can be discriminated, which is of obvious relevance when we are interested in processes of developmental or evolutionary elaboration. If we seek the origins of an understanding of mind, we shall need to examine a range of phenomena, from potential precursors, through marginal and superficial cases of mindreading, to the deep and sophisticated diagnoses of others' mental lives, which may eventually be built on such foundations.

My aim in this chapter is to map the scope of what needs to go into the melting pot if we seek to understand the origins of people's everyday "understanding of mind." What different ideas, concepts, types of experiment and observations, species of animals, and ages of children do we need to entertain? I shall start by sketching what I see as some of the extremes in analyses of the nature of mindreading, to emphasise the potentially enormous—not to mention fascinating—breadth of our subject matter.

MINDREADING, INTERSUBJECTIVITY, THEORY OF MIND—DIFFERENT APPROACHES TO A COMMON THEME

One way to begin to appreciate this breadth is to list some of the many terms and concepts—variations on the theme of mindreading—that have proliferated in the literature (Table 3.1). Some of these are sufficiently similar in meaning to be used interchangeably, as synonyms. Others appear to express very different ideas of what shall count as reading the mind.

TABLE 3.1
Alternative Labels for, and Concepts about, Mindreading (a Partial List)

FOLK PSYCHOLOGY (Wundt, 1916)
CONSCIOUSNESS OF THE FEELING OF THEIR FELLOWS (Thorndike, 1911)
IMPUTATION TO OTHERS OF FIRST-HAND EXPERIENCE (Lloyd Morgan, 1930)
NAIVE PSYCHOLOGY (Heider, 1958)
SECOND-ORDER INTENTIONALITY (Dennett, 1971)
INTERSUBJECTIVITY (Trevarthen, 1977)
THEORY OF MIND (Premack & Woodruff, 1978)
METAREPRESENTATION (Pylyshyn, 1978)
BELIEF-DESIRE REASONING (Davidson, 1980)
NATURAL PSYCHOLOGY (Humphrey, 1980)
SOCIAL REFERENCING (Feinman, 1982)
MINDREADING (Krebs & Dawkins, 1984)
MENTAL SIMULATION (Gordon, 1986)
MENTALISING (Morton, 1989)
PERCEPTION OF INTENTIONALITY (Dasser et al., 1989)
(MENTAL) ATTRIBUTION (Cheney & Seyfarth, 1990)
MENTALISTIC THEORY OF BEHAVIOUR (Perner, 1991)
REPRESENTATIONAL THEORY OF MIND (Perner, 1991)

Theory of Mind

The most familiar expression to students of developmental psychology will be "theory of mind," as used by Premack and Woodruff (1978, p. 515), who first asked "Does the chimpanzee have a theory of mind?": "In saying that an individual has a theory of mind, we mean that the individual imputes mental states to himself and to others... A system of inferences of this kind is properly viewed as a theory, first, because such states are not directly observable, and second, because the system can be used to make predictions, specifically about the behaviour of other organisms."

The expression "theory of mind" has been adopted enthusiastically by a network of researchers in child development (e.g. Butterworth et al., 1991). On the basis of Premack and Woodruff's paper and suggestions made by the philosophers Bennett, Dennett, and Harman in the peer commentary on the paper, Wimmer and Perner (1983) designed tests for children's ability to

ascribe one particular mental state—(false) belief—which has come to assume special significance in this research area (see Mitchell & Lewis, this volume). This is because a child's recognition that others may hold beliefs that are false (about states of the world that the child knows to be true) entails an appreciation that others may represent the state of the world in a way different to that used by the child itself. Perner (1991) thus refers to such a child as achieving a "representational theory of mind," and it can be argued that such a representational theory expresses a deep grasp of the nature of mind. In the classic test of false belief attribution (what Mitchell & Lewis, this volume, distinguish as the "unexpected transfer test"), the child-mentalist will recognise that, even though she herself believes an object is in locus A, another person may represent reality differently, believing the object is in locus B because, unlike the child, he did not witness the shift from B to A (Wimmer & Perner, 1983).

Tests of such false-belief attribution have been used to legislate on whether the child "has a theory of mind." For example, failure on such tests was the basis for a negative answer to the question "Does the autistic child have a theory of mind?" (Baron-Cohen, Leslie, & Frith, 1985), and to many researchers it is the ability to attribute false belief that marks the average four-year-old's acquisition of an explicit theory of mind (Light, 1993; and see Mitchell & Lewis, this volume).

There are grades of complexity within this idea of a "Theory of Mind" (T-o-M), which will beg closer scrutiny later. At this point, however, I want to contrast the concept of T-o-M with other concepts which, although sharing the central focus of interest, are nevertheless drastically different. For these comparative purposes it is sufficient to emphasise two things in the story so far. First, the basic ability is seen as recognising states of mind (or mental states). This is taken to be inherent in the everyday folk psychology utilised by adults, the function of which appears to lie in the provision of a scheme that facilitates powerful prediction and explanation of others' actions. Second, the ability has been argued by many to be a quite sophisticated cognitive achievement, emerging clearly only in four-year-old children. No nonhuman primate has yet passed a test for the attribution of false belief (Premack, 1988; Whiten, 1993). Compare, then, two further concepts that emerged in ethology between the time of the Premack and Woodruff paper and the beginnings of the present explosion of research in child development.

Natural Psychology and Mindreading

For ethologists, the starting point of any journey of scientific discovery must be the natural behaviour of the organisms concerned, and this is no less true in the present case. Humphrey (1976) sought an answer to the question of

why monkeys and apes are so intelligent in the problems they had to deal with in their everyday lives. His observations led him to the hypothesis that the answer lay not in the complexity of their physical ecology, such as the nature and distribution of their food sources, but rather in their social complexity. Subsequent research has dissected this social complexity and revealed anthropoid primates to be skilled social operators (Byrne & Whiten, 1988), using tactics ranging from deception (Whiten & Byrne, 1988a), to alliances with powerful others (Harcourt & de Waal, 1992), which manipulate the social environment to their advantage. Of course each individual is playing out such tactics in a social environment made up of skilled, like-minded others, so that we must envisage these social interactions as an escalating "game." As in many formalised human games, from chess to basketball, the optimal tactics will vary according to the intentions, knowledge, and motivations of one's opponents: in a word, their states of mind. We might therefore expect these societies to be evolutionary hotbeds selecting for the cognitive abilities that would allow the recognition of such states, as suggested by Humphrey (1980; 1986). A primate who, in Humphrey's expression, could act as one of "nature's psychologists," reading the true intentions of others before they acted, might get one step ahead in the game (see Mitchell, this volume, for further discussion of the utility of mentalism).

Humphrey's speculations were grounded in the everyday lives of anthropoid primates and other socially complex mammals like wolves and elephants. Dawkins and Krebs' (1978) analyses were set in a yet wider ethological perspective. The first step in their analysis involved pointing out that the classic assumption about the nature of animal communication signals, that their function has evolved to facilitate the transfer of information about the animal's motivational state (e.g. its intentions), is not so consistent with evolutionary theory as was first thought. Instead, we should expect natural selection to have favoured information transmission that manipulates others to the (reproductive, or genetic) benefit of the self. Although in some, or many, cases this can be achieved by co-operative and honest communication, the fact that the "bottom line" is manipulation of others to the self's benefit means that, wherever it pays, communication will be selected not to correspond with the true internal state. The relevance to the subject matter of this paper is clear: Once this lack of correspondence emerges, a selection pressure will exist for animals to avoid such manipulation by attempting to discern the true internal state—the true state of mind—of the protagonist. Krebs and Dawkins (1984) and Dawkins (1992) thus present a very general argument for natural selection to favour the emergence of an ability for what they called "mindreading." The argument would appear to apply in principle to all animals who communicate with their conspecifics: to all those

vertebrates and invertebrates, who, for example, either threaten or court other animals.

We thus appear to have a vast difference amongst concepts of what might be involved in taking account of states of mind in others, and which organisms might have such capacities. At one extreme, amongst some researchers there is debate about whether a true "theory of mind" is the province of any children less than four years of age (e.g. Chandler, Fritz, & Hala, 1989), or whether it can be ascribed to such an intelligent animal as our closest living relative, the chimpanzee (Whiten, 1993). At the other extreme, in the ethologists' theorising just reviewed, we appear to have a general argument for the reasons that the recognition of mental states should be widespread in nature (Krebs & Dawkins, 1984; Dawkins, 1992 are coy of being too specific about just which animals might deserve the label "mindreader").

There could be several reasons for this apparent gulf. One is that, theoretical arguments notwithstanding, nonhuman animals and very young humans are not, in fact, mindreaders. That might be (for example) because mindreading requires cognitive processes unique to the size and/or organisation of the human brain in middle childhood. Another possibility is that people are really talking about different things: That it is misleading to think of all the expressions in Table 3.1 as anything like close synonyms. I think that there is some truth in each of these answers. There are important differences between some of the concepts labelled in Table 3.1, although these have yet to be made explicit: When they are, we may well find ontogenetic and phylogenetic differences in their expression. However, equally important is that the concepts share sufficient meaning such that all of them are of potential relevance to understanding developmental and evolutionary transitions. If the ethologists' term "mindreading" is justified at all, it must in some sense involve taking into account "states of mind!"

We shall therefore scrutinise the meaning and significance of these concepts further in the following paragraphs. In particular, we need to examine more closely just what is the difference between what is implied by the expressions in Table 3.1 and the most obvious alternative to them: In the absence of mindreading, it is "just behaviour" that is read. "Mentalism" is the term in Table 3.1 which most precisely expresses this contrast with "behaviourism." However, the distinction is not so straightforward as it looks on first sight (Whiten, 1993). Whenever I say that I can read the mind of my daughter, I am not claiming telepathy: However well I do it, the achievement has to be based on direct observations of behaviour (the actions of my daughter and perhaps others) and its context (the world within which she perceives and acts). We therefore need to consider rather carefully just where the analysis of states of behaviour/world becomes the analysis of states of mind. Before doing that, however, there are still other

major frontiers in the landscape of mindreading which should be mentioned at the outset.

Intersubjectivity

Some who have studied the micro-structure of social interactions in human infancy carefully—the vocalisations, gestures, and facial expressions that occur when babies and their parents "talk" to each other—have concluded that these scenes are best described as a meeting of minds. Intersubjectivity literally means the sharing of subjective states: It is a term borrowed from philosophy of mind and, applied to parent–infant interactions, it has been defined (Trevarthen, 1977) as "the mutual adjustments of conscious voluntary agents (subjects) to one another's mental states." Primary intersubjectivity refers to an early and "purely social" mental meshing of the infant directly with the parent: Secondary intersubjectivity is distinguished when infant and parent are able to incorporate objects into this sensitivity, as in the case of achieving joint attention on some locus in their environment (Trevarthen & Hubley, 1978).

The reference to mental states in the definition of intersubjectivity implies that it is within our remit: It is some grade of mindreading—but what? Attempts to relate the work in this area to the new T-o-M literature are so far few, tentative, and controversial (Karmiloff-Smith, 1993; Leekam, 1991; 1993; Perner, 1991; Reddy, 1991). You will not even find "intersubjectivity" in the index of principal T-o-M monographs (Harris, 1989; Perner, 1991; Wellman, 1990). In the present volume, however, see especially Butterworth, and Baldwin and Moses, on the related concept of "social referencing."

Perception of Intentionality

Many years ago, Michotte showed that our recognition of physical causality could be manipulated by small changes in visual displays: For example, the tendency to see the movement of an object A as being caused by object B can be reduced or eliminated by delays between impact and movement, and by physical separation (Michotte, 1963), and such phenomena have been investigated in human infants (Leslie, 1982). Heider and Simmel (1944) and, more recently, Dasser, Ulbaek, and Premack (1989) showed that similar effects can be obtained for the perception of intentional states, or "psychological causality." Abstract objects enacted what could be seen as a narrative sequence. In one example from Dasser et al., a ball fell down a small incline, and was "helped" up again by another ball. Young children were shown to attend differentially to such patterns, versus control patterns in which the movement of the balls were the same, but displayed in a different order such that intentions (helping, in the example above) would not be apparent. Such results raise similar questions to those provoked by some other concepts in Table 3.1. They seem to imply some form of

mentalism, which in this case involves imputing automatically certain intentional states, normally associated only with living beings, to abstract shapes that move in the right way.

WHEN DOES READING BEHAVIOUR BECOME READING MIND?

The question of whether a child or a nonhuman animal has reached the stage of truly recognising states of mind is typically contrasted with the likelihood that the organism concerned is instead merely reacting to the behaviour of others. Cheney and Seyfarth (1990a; 1990b), for example, conclude from negative results of tests for knowledge attribution in macaques that these monkeys are poor psychologists, even though excellent ethologists: They are very good at making fine distinctions only at the level of the behaviour of their companions. Likewise, Perner (1991, p. 128) suggests that human infants, in allowing their mother's expression of fear to influence their decision about crossing a potentially dangerous ledge (Sorce, Emde, Campos, & Klinnert, 1985), are not applying an implicit theory of mind in which fear is recognised as a mental state: rather, they may be following a behavioural rule that "when you see something dubious and your mother is watching you and shows a fearful face, then avoid that object or area."

However, we noted earlier that mindreading is not telepathy: The minds of others have to be read in observables, which inevitably brings us back to behaviour. Indeed, Krebs and Dawkins (1984, p. 386) make quite explicit reference to the way in which the predictive function of mindreading, as they conceive of it, must be based on behavioural analysis:

> Animals can, in principle, forecast the behaviour of other animals, because sequences of animal behaviour follow statistical rules. Ethologists discover the rules systematically by recording long sequences of behaviour and analysing them statistically, for example by transition matrices, and in the same way an animal can behave as if it is predicting another individual's future behaviour ... we may use the term mindreading as a catch-word to describe what we are doing when we use statistical laws to predict what an animal will do next. [Or, presumably, when any organism makes these predictions.]

In one sense, I must agree with this analysis. The possibility of reading others' mental states must be based on certain statistical patterns in what is directly observable in the world (behaviour and environmental context): These would seem to offer the only data available. However, if the trick of prediction were to lie only in analysing linear sequences—"fear-expression predicts withdrawal behaviour," for example—then behaviour-reading would be as apt a description as mindreading. In other words, the pattern

of observations that underlies the recognition of mental states has to be of a certain special character. I have suggested elsewhere (Whiten, 1993) that the key pattern must be akin to that which begged the recognition of "intervening variables" in an earlier phase in the development of the science of psychology.

Mental States as Intervening Variables

A well-known example of the original rationale for recognising intervening variables is shown in Fig. 3.1. The first diagram represents the fact that it is possible to show that any of a rat's behavioural tendencies listed on the right can be predicted from the conditions listed on the left: Thus, nine stimulus-response links need to be represented, as indicated by the arrows. In the second diagram, a more economical representation of this knowledge is offered by replacing the nine links with only six, together with an intervening variable interposed as shown. The value of the posited intervening variable is influenced by changes in the states of the variables on the left, and in turn influences those on the right. We can think of this intervening variable as a state the animal can be in, which can take different values. In this case an apt label for the variable is "thirst."

My suggestion is that the recognition of a mental state—whether this is achieved by a human adult, an infant, or a monkey—shares key similarities with the recognition of such intervening variables by behavioural scientists. In particular, the important difference between a mental state (e.g. fear) and a behavioural one (e.g. looking scared, fleeing) is similar to that between an intervening variable like thirst in Fig. 3.1b, and any one of the variables on the left or right: The mental state must lie at the centre of some web of observed conditions and predicted outcomes. Precisely because it stands here at the centre, it provides an *economical* representation of the state of the observed organism. This economy seems one likely reason why everyday psychology is mentalist rather than behavioural. However, this eminently plausible proposition presents a paradox. If mental states are the most economical units in which to code the action pattern of others, shouldn't this be the primitive way of operating, observable in animals and infants? After all, millions of years of hominid evolution and thousands of years of human history passed before "behaviourism" got invented. The answer to this conundrum may lie in distinguishing two aspects of cognitive mechanisms underlying mindreading. The ability to detect state patterns (fear, knowledge, and so on) in the first place may require extensive cognitive resources. By contrast, the routine classification of further events into such a framework may be efficient of cognitive resources. In addition, mental states as intervening variables are potentially powerful, productive representations. If all predictions were done on the basis of recognising

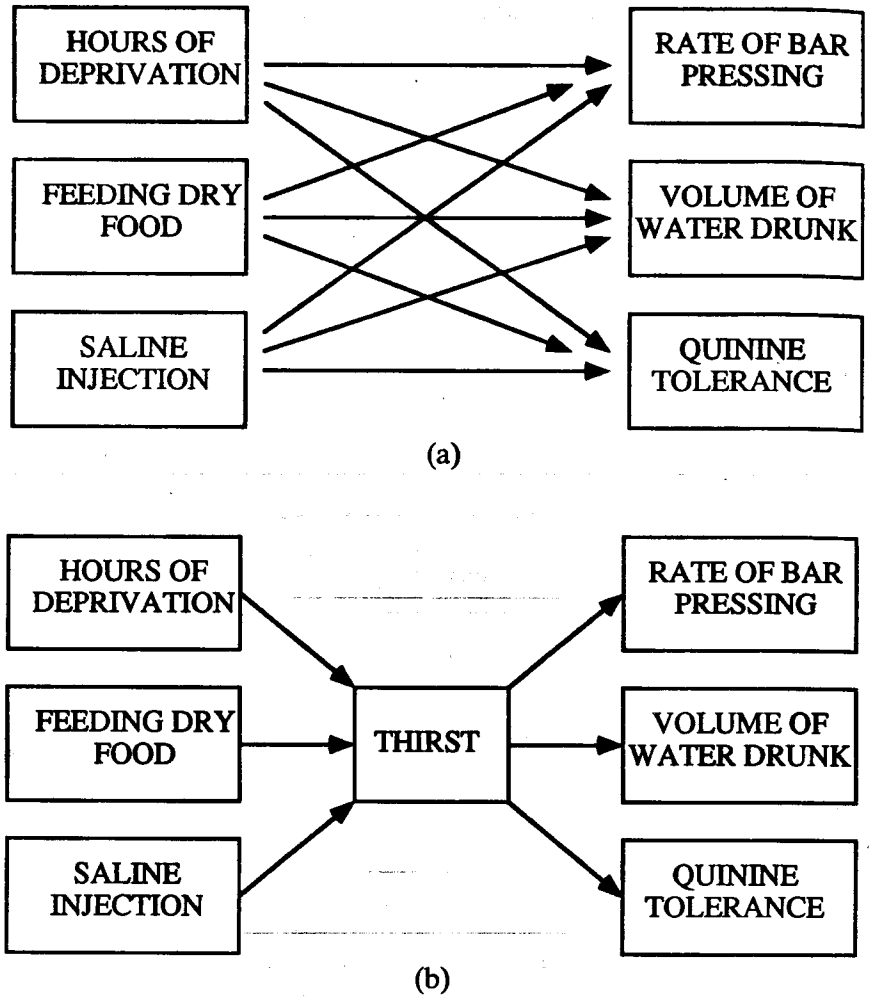

FIG. 3.1 (a) shows relationships between three independent and three dependent variables relating to rats' drinking behaviour; (b) shows a more economical representation incorporating an intervening variable, here labelled "thirst" (after Miller, 1959; Hinde, 1970).

individual S–R links, as in Fig. 3.1a, then only those specific contingencies can be handled. By contrast, once an intervening state like thirst is posited, novel predictions can be generated. For example, a new input condition, observed to be correlated with only some of the outcomes on the right, leads us to predict that the new input condition will also affect other output conditions not yet observed to be linked with this input.

Figure 3.2 shows a hypothetical example for a mental state of wanting: A baboon Y codes various different specific observations of baboon X (on the left) in the same way: The equivalence class is "X wants the meat." Irrespective of the basis on which this state of meat-wanting is recognised, it then predicts various consequences (on the right) that Y can utilise in making adaptive decisions about how to behave, according to the local circumstances (e.g. Y might be in naked competition with X, or alternatively may be seeking to befriend X: in each case the coding of X as wanting the meat can be put to appropriate, but different, effect). It follows that mindreading, as defined in this way, will only be of use (i.e. it would be

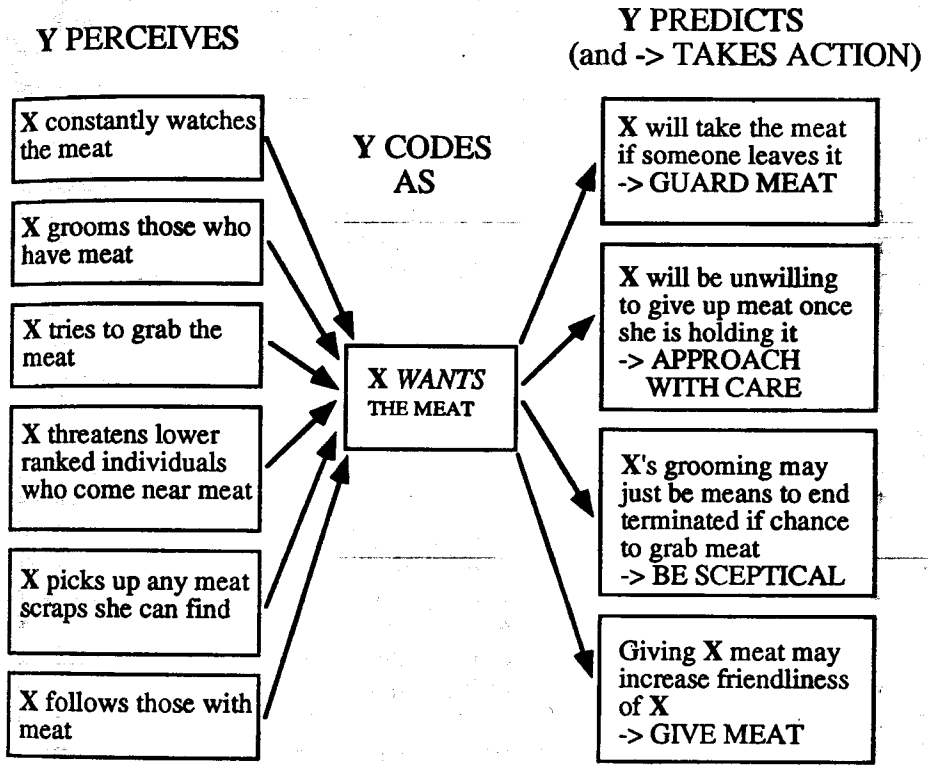

FIG. 3.2 A hypothetical example of mindreading as the recognition of an intervening variable in the course of repeated and varied interactions of two baboons, X and Y, over a meat carcase, which is generally a source of significant competition. In this example a mental state of *wanting* is recognised in X by a mindreader Y, permitting various predictions about X and appropriate courses of action on Y's part. Here *wanting* has the status of an intervening variable that economically represents the relationships between observations of X listed on the left, and outcomes for X listed on the right.

expected to develop/evolve) in a creature with a certain degree of intelligence and potential for flexibility of action: Otherwise, prediction of others' further actions and generation of appropriate responses can be handled by a small set of linear sequences.

This analysis of what mental states "are" to the mindreader suggests that any attempt simply to dichotomise mentalism and behaviourism is likely to dissolve into gradations. If mentalism can be boiled down to a kind of complex behaviour/context pattern recognition, the process of recognising a mental state can, in principle, always be described alternatively in terms of the pattern of behaviour/context on which it rests: It is just that as the pattern becomes more complex, it becomes uneconomic to do so. Simple mentalism would thus appear to grade into complex behaviourism.

Origins of Mental State Recognition

We might describe the transition from the representation in Fig. 3.1a to Fig. 3.1b as demonstrating an *insight* into the overall pattern exhibited by the relationship of the input and output variables. Likewise, then, the recognition of mental states as intervening variables that make sense of patterns of correlations like those in Fig. 3.2 might be achieved as an insight into the actions of others on the part of the mindreader. In other words, an individual who started by being quite behaviourist, having observed many of the specific contingencies between the conditions on the left of Fig. 3.2 and those consequences on the right, would be in a position to unite all these separate observations under a single description (Bennett, 1991): That all the conditions can be coded in the common form of X wanting a thing, and that this state of X affords not just a single outcome but instead a whole range of potential consequences.

In first developing this notion of T-o-M development as a hierarchical series of insights, I made comparison with insight models of language acquisition (McShane, 1980). What is the alternative to this notion of cognitive development? The only drastic alternative to achieving an insight would seem to be a capacity to code these patterns in the way I have outlined without having to learn to do so. This seems difficult to envisage. Although it may well be that certain species—most obviously our own—have a readiness to learn the significance of these patterns, the exemplars of conditions and consequences (as in Fig. 3.2) are so local and concrete that their recognition would probably be achieved through active information processing, rather than be given. This is supported by the circumstantial evidence that mental state attribution is accelerated in children's development in richer social contexts (Dunn, Brown, & Beardsall, 1991a; Dunn et al., 1991; Perner, Ruffman, & Leekam, in press).

However, in the case of the language-acquiring human child, the situation is of course different to that for preverbal infants or nonverbal animals. The child appears to acquire a folk psychology, which is richly described in the terms of everyday language—Johnson-Laird and Oatley (1989) list 590 English terms that describe emotions alone—and the child develops her ability to mentalise in the context of such talk. To whatever extent the recognition of mental states depends on the achievement of insights into the causal structure of human action, the language of mental states has the capacity to point the child towards selection of the most productive intervening variables. Andrew Lock (1980) aptly titled a treatise on language acquisition "The guided reinvention of language": Most children probably exemplify "the guided reinvention of mentalism." Any non-human primate who discriminates a mental state must, by contrast, achieve this without any such cultural, linguistic guide. That this is not necessarily a very radical possibility, is suggested by the likelihood that in the course of human history/evolution, the naming of these states postdated the initial recognition of them, which would therefore have been preverbal by definition (Whiten, 1993).

Implications for the Identification of Mentalism

The logic of the intervening variables account of mental states is that the identification of mindreading is unlikely to lie in the one-shot experiment (Heyes, 1993). Even a classic false belief test can be solved by the use of a behavioural rule—"people tend to search for an object in the place they last saw it hidden." That the subject is discriminating a mental state as an intervening variable can really only be established in a variety of contexts, which yield convergent evidence. Ideally, the mental state should be created in a number of ways, and evidence sought that the candidate mindreader can discriminate this state as a means to achieving different ends. An example of the first of these requirements comes from a study by Povinelli, Nelson, and Boysen (1990) on chimpanzees' ability to discriminate between potential helpers who are either knowledgeable or ignorant of the location of a reward. In a first series of tests, ignorance was created by absence from the scene, but a critical transfer test created the ignorant state in a different way, by covering the eyes. An example of the second requirement, applying the hypothesised attribution to different contexts for which that mental state is appropriate, comes from Wimmer and Perner's (1983) original experiments on false belief attribution, where the child was tested for appropriate application of false belief recognition to very different contexts of competition versus co-operation with others.

All too few experiments have manipulated variations of both ends of the web in the centre of which mental states sit logically. However, even though

this may not be done in the case of individual studies, convergence of evidence has occurred in a more general way, so that particular mindreading competence is becoming pinpointed for children at a certain age (or, in Heyes' [in press] terms, "triangulated"); the "unexpected transfer" and "deceptive box" tests representing two alternative contexts for revealing the attribution of false belief (see Mitchell & Lewis, this volume).

IMPLICIT VERSUS EXPLICIT MINDREADING

It is sometimes suggested that a distinction can be made between an advanced grade of mindreading that is *explicit*, and an *implicit* grade that precedes and perhaps gives rise to it: In other words, what is initially implicit may become explicit, either in development (e.g. Bretherton, McNew, & Beeghly-Smith, 1981) or in evolution (e.g. Gomez, 1991). However, I suspect that two different types of distinction are at stake here, in what is meant by implicit versus explicit. I shall consider each in turn.

What is Read–Implicit Mind or Explicit Mind?

Gomez (1991) has described the development of a young gorilla's techniques for getting a human to unlatch a door. In the earliest phase the gorilla treated the human like an object, merely attempting to drag them to the door and even climbing on them to release the latch. However, with time, the youngster developed communication strategies, during which she would more gently guide the human towards the door, alternating her gaze at the latch and at the humans' eyes. As Gomez says (1991, p. 201): "she seemed to use eye contact to monitor if the human was *attending* to her request that he act. Thus, she seemed to understand that in subjects perceiving is causally related to acting. And here is where the mind appears, since the co-ordination between perceptions and actions is carried out by the mind." Gomez compares this to the stage of secondary intersubjectivity in human infancy, because (1991, p. 202) it is: "based on an understanding of people as subjective entities, whose autonomous behaviour can be influenced through a special kind of causal contact: mutual attention. This development seems to coincide with that of preverbal human infants at around 12 months, when they begin to communicate with adults about external objects."

Gomez is making an important point with respect to the origins of an understanding of mind. Even though what the gorilla (or human infant) is recognising can be described in fairly straightforward external terms, such as direction of eye gaze and unlatching actions, her recognition of the significance of the integrated pattern of these means that she is attending to crucial perceptual foundations of a more advanced model of mind.

However, the difficulty in calling this an implicit theory of mind (or in another of Gomez's expressions, a "latent hypothesis of mind") lies in the very ease of redescription in simple behavioural terms: We are brought back to our discussion of mentalism versus behaviourism. "Mindreading," as defined by Krebs and Dawkins and discussed at the start of this paper, seems to suffer the same difficulty, insofar as it reflects merely the ability of organism A to predict what B will do next on the basis of a previously observed sequence of behaviour. One can object that, in the end, not only known sequences but *all* sequences of behaviour are organised by a mind, so that to read behaviour is always implicitly to read mind! This, of course, makes a mockery of any attempt to make an interesting distinction between behaviourism and mentalism. What is special about cases such as that described by Gomez is that the observables the animal is attending to constitute a pattern that incorporates causally connected evidence of perceptions and actions.

Still, the Gomez gorilla example fits the Krebs and Dawkins formulation of mindreading, in that what was described appeared to be a specific technique for getting a particular job done—opening the latch. If such an animal were to go further and utilise attention to others' gaze patterns for other purposes, then one would be more justified in talking of the ape recognising attention as a mental state; and if the candidate mindreader also utilised other evidence of attention, such as pointing or talking, to similar ends, then one would be more justified still (I suspect that this appeal to convergent evidence is what we do when, in everyday life and without any experiments, we confidently talk of a child having come to distinguish when others are attending to things). What this amounts to is that the organism is classifying a mental state (in this case, attention) as unifying a web of input conditions and outcomes in the manner of an intervening variable, as described in an earlier section of this chapter. And once this happens, it becomes appropriate to talk of a state of mind being read not only as implicit in behaviour, but as explicitly recognised, coded as a unique state in the mindreaders' brain. So that is one sense in which a distinction between implicit and explicit mindreading should be made. *Explicit* means there is a mental coding in the mindreader that, uniquely, picks out the mental state as the unifying factor in very diverse observations. *Implicit* means that the only mind being read is implicit in others' actions and it is only the latter that the observer is mentally coding: So, given the extent to which mind is always implicit in animals' behaviour, other criteria need to be applied to justify why some mindreading in this category is of interest. One such case is where what is discriminated is a perception-action cluster, like that described earlier for Gomez's gorilla.

Is Mindreading Implicated or Explicated?

The second dichotomy that can be labelled implicit/explicit hinges on the more advanced, explicit grade being distinguished by the individual's ability to represent the underlying mindreading rule independently. In operational terms, this translates into whether they can verbally explain an understanding underlying their actions. An example comes from the work of Povinelli and deBlois (1991), who repeated the tests described earlier for chimpanzees, with children. In these tests, success depended on an ability to discriminate knowledgeable helpers from ignorant ones who could only guess about the location of a hidden reward. Four-year-old children usually succeeded where three-year-olds failed, and the successful children were able to offer verbal explanations for their choice; these exemplified explicit mentalism. In this experiment, there was no obvious case of implicit mentalism—those who succeeded could give explanations, whereas those who failed tended not to be able to do so. In other experiments, however, children have been found to be capable of taking the right course of nonverbal action according to the belief state of another individual, and yet to fail in verbal responses (Freeman, Lewis, & Doherty, 1991). The verbalisations in this case were not explanations as such, but the results suggest that there may be cases where children can take a course of action that proves they recognise a certain mental state, yet cannot explain how they do so: their mentalism would then be implicit in the sense I am discussing it here. In the case of the chimpanzees tested by Povinelli et al., their lack of language means we cannot decide the issue either way. For these animals, the implicit/explicit distinction discussed in the previous section is the one that can be pursued empirically.

GRADES OF MENTAL STATE THAT CAN BE READ

There are theoretical reasons why certain mental states would be expected to be more difficult to diagnose, and results of a now extensive catalogue of experiments and observations on children and nonhuman animals appear to fit with theory—although, compared to the number of mental states folk psychology covers (e.g. D'Andrade, 1987), the list of those whose ascription has been investigated is small. The special significance of false belief recognition was outlined early in this chapter. Accordingly, it has been the most studied attribution. Many studies have concurred in the conclusion that this is difficult to demonstrate in children younger than about four years of age (Astington & Gopnik, 1991; Leekam, 1993 for reviews; Perner, 1991), although a growing literature documents controversies and conditions that appear to facilitate expression at earlier ages (Chandler et al., 1989; Dunn, 1991; Freeman et al., 1991; McGregor & Whiten, 1993; and see Mitchell & Lewis, this volume).

Children can recognise other mental states at earlier ages, however, and there is convergent evidence that autistic children who fail to attribute false belief can succeed with some of those states. Such states include other epistemic categories like knowledge (versus ignorance) (Leslie & Frith, 1988; Pratt & Bryant, 1990); intention (Astington & Gopnik, 1991; Shultz & Shamash, 1981; wanting (Wellman, 1991) emotions like happy and sad (Harris, 1989; 1991); and seeing (Baron-Cohen, 1991; Flavell, Everett, Croft, & Flavell, 1981). There appear to be parallels here with evidence for mindreading in primates, as reviewed by Whiten (1991b; 1993). Thus, experiments (Premack, 1988) and observations of tactical deception in chimpanzees (Whiten & Byrne, 1988a; 1988b; Byrne & Whiten, 1992) have failed to provide convincing evidence of the attribution or intentional creation of false beliefs in others: However, there is evidence from these same sources for the recognition of wanting/intention (see also Premack & Woodruff, 1978) and the seeing–knowing complex (see also Povinelli et al., 1990; Whiten, 1993). Monkeys, much more distantly related to us than are chimpanzees, have yielded only negative evidence on these counts (Cheney & Seyfarth, 1990a; 1990b; Povinelli, Parks, & Novak, 1992), although records of deception provide tentative support for their ability to compute the visual perspective of others (to recognise that sometimes others cannot see what they themselves can see)—what Flavell et al. (1981) labelled Level-1 understanding of seeing.

Thus, amongst these folk psychology states of mind, there appear to be grades of cognitive difficulty when it comes to reading them. Very crudely, one might say this gradation corresponds to the depth of penetration that the mindreader makes into the mind of the other: Level-1 seeing is very much on the behavioural surface, wanting and intention less clearly so, and false belief much less so—the conditions for this last state not even requiring the person acquiring the belief to twitch a muscle.

Perner (1991), arguing that it is only at the level of false belief ascription that children achieve a truly "representational theory of mind," has classed the earlier achievements as those of a "mentalistic theory of behaviour." In the terms I used earlier in this paper, this idea of a mentalistic theory of behaviour translates into the gaining of an insight into states of mind acting as intervening variables. The achievement of the higher grade of mindreading, in which the nature of representation is appreciated, could represent a further insight that older children, and perhaps not other animals, achieve (see Robinson, this volume).

READING ONE'S OWN MIND VERSUS OTHERS'

I have couched much of the foregoing discussion as if the only minds a mindreader reads are those of other individuals. However, the ethologist

Humphrey (1980) suggested that individuals might be able to use their own privileged access to their mental states to model the way the mind works in a way useful to the trick of reading the apparently less accessible minds of others. This idea was developed by philosophers (e.g. Gordon, 1986) and psychologists (Harris, 1991) and, now dubbed the "simulation theory" of mind, has been contrasted with the "theory theory" of mind in vigorous theoretical and empirical debates (see the journal *Mind and Language, Volume 7*). The theory theory suggests that, rather than use her own mind to simulate others', the mindreader employs mental states as theoretical constructs that predict and explain others' actions. I will not dwell on this controversy because it is dealt with in other chapters (Freeman, Harris, this volume). However, it demands mention here because of the implication that, if the simulation theory is right, reading one's own mind is a different grade of mindreading to that of reading others': It should be easier, and one apparent prediction is that specific mental states, such as ignorance, would be recognised in self before others. However, this is disputed (Gopnik, 1993).

COUSINS OF MINDREADING

Two phenomena that have been discussed recently in the theory of mind literature are pretence and imitation. These are marginal instances of mindreading per se, insofar as folk psychology does not tend to talk about a child indulging in pretend play by itself, or imitating another, in terms of their attributing any mental states to either self or other. However, psychologists have suggested that links exist in both cases.

In the case of pretence, Leslie (1987) argued that, as in T-o-M, metarepresentation is implicated: The child engaged in pretend play must hold in mind both the primary representation of the reality before it, and the pretend representation derived from the primary one. Perner (1991) has argued against this, that a distinction should be made between what is achieved in pretence, which as Leslie noted occurs in two-year-olds, and the achievement in four-year-olds of a representational theory of mind. In the latter, the nature of representation is grasped by the child in a way that Perner proposes is unnecessary for explaining pretence. Instead, Perner proposes that, in the prior stage of the child's mentalistic theory of behaviour, the level of representation achieved is best thought of as secondary representation rather than metarepresentation in the strong sense. Secondary representations are about hypothetical situations (the child is a "situation theorist") rather than about the representational power of certain mental states.

I find Perner's dissection of representational development into these three levels—primary, secondary, and meta—compelling. Whereas previous

papers (Whiten, 1988; Whiten & Byrne, 1991) followed up Leslie's insight by arguing that certain records of elaborate pretend play documented in chimpanzees are consistent with their mindreading because metarepresentation is implicated, Perner's analysis leads me to the more modest interpretation that the chimps' pretence and mindreading are at the secondary level, which would be consistent with the pretence and mindreading of two- to three-year-old children.

Whiten and Byrne (1991), having noted the pretence-mindreading linkage in both nonhuman primates and children (and the linked deficit/delay in both and in autistic children), went on to observe that, amongst nonhuman primates, the pattern appears to extend to imitation, in which chimpanzees again outperform monkeys (Whiten & Ham, 1992). It is therefore of interest that a recent review showed that accumulating evidence in autistic children suggests difficulties in imitation, which includes the copying of acts that should not be difficult just because they have an intentional or pretence component (Rogers & Pennington, 1991).

Whiten (1992) suggested two alternative explanations for why imitation might be linked to mindreading abilities: One is that imitation requires a transposition of visual perspective in translating the acts of the model into those of the imitator; the other is that it depends, in many cases, on some understanding of what the model's intentions are.

According to these analyses, one could argue that imitation is a grade of mindreading in its own right. In addition, because both pretence and imitation can vary from simple acts to very complex ones, grades of difficulty are to be expected in their performance, and thus in their mastery by different species and children of different ages.

GRADES OF INTEGRATION

Although the question of whether a child "has a theory of mind" has often been diagnosed through one-shot tests, particularly for the recognition of false belief, it seems over-grand to equate the attribution of any one mental state with a "theory of mind." A distinctive feature of mind as seen by folk psychology lies in the way it integrates a number of mental states, and only through this integration does a theory of mind become useful in explanation and prediction. The integration between two states in particular have been emphasised by philosophers (Bennett, 1991; Davidson, 1980; and investigated by psychologists (Wellman, 1990; 1991). These states are beliefs and desires, and in combination they are used to explain and/or predict much rational action. However, young children integrate other states. Two-year-olds, for example, can predict emotional reactions to the fulfilment or frustration of desires (Wellman, 1991). I suggest that only when children use their ascriptions of mental states in some combinatorial

fashion could we reasonably say they have a theory of mind rather than just an ability to recognise one or more mental states. When they first combine two simple states they have a primitive theory, we might say, and when they combine several, including complex states like belief, they have a more sophisticated theory. There are obviously many grades of integration between (see Lewis, this volume).

GRADES OF EMBEDDING

Five-year-olds can usually attribute false beliefs, but only older children can successfully take account of another individual's beliefs about someone else's beliefs. It is one of the logical features of mental states that they can embed in this way indefinitely, but as Dennett (1983, p. 345) so nicely put it: "I suspect that you wonder whether I realise how hard it is for you to be sure that you understand whether I mean to be saying that you can recognise that I can believe you to want me to explain that most of us can keep track of only about five or six orders, under the best of circumstances." Nevertheless, the ability to handle embeddings is plausibly the basis of sophisticated social manoeuvring, as, for example, in deception and escalating counter-deception (Whiten & Byrne, 1988b; see also Mitchell, this volume), and distinguishing jokes and lies (Leekam, 1991). There are thus important developmental questions about the number of embeddings a child can handle (although care has to be taken in the counting procedure: Whiten & Perner, 1991), and what permits developmental progress to higher grades.

GRADES OF MINDREADING AND GRADES OF MIND

Finally, we should remember that one factor contributing to the grading of mindreading is the grade of mind that is being read. Chimpanzees may have at best a primitive capacity for mindreading, but then they have not such complex minds to read as we do.

There are many grades of interplay between the mindreader and the mind being read. In the case of social competition, we may have deceptive minds trying not to be read: Conversely, in the case of parental scaffolding behaviour we may have a parent offering their mind to be read. A different type of interplay arises when the minds are very different, as in the case of parent and infant, or scientist and chimpanzee.

Of course, the most challenging of these combinations comes in the scientific efforts of the psychologist to read the mind of the mindreader reading minds commonsensically.

ACKNOWLEDGEMENTS

I am grateful to P. Mitchell and C. Lewis for their comments on an earlier draft: Also, to the organisers and participants for their support and criticism in two meetings where some of the issues in this paper were discussed: New College Interdisciplinary Symposium on Mindreading, Oxford, 1992; Symposium on the Mental Life of Animals, Georgia State University, 1993.

REFERENCES

Astington, J.W., & Gopnik, A. (1991). Developing understanding of desire and intention. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Astington, J.W., Harris, P.L., & Olson, D.R. (Eds.) (1988). *Developing theories of mind*. Cambridge: Cambridge University Press.

Baldwin, J.M. (1902). *Development and evolution*. New York: Macmillan.

Baron-Cohen, S. (1991). Precursors to a theory of mind: Understanding attention in others. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Baron-Cohen, S., Leslie, A.M., & Frith, U. (1985). Does the autistic child have a "theory of mind?" *Cognition, 21*, 37–46.

Bennett, J. (1991). How to read minds in behaviour: A suggestion from a philosopher. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Bretherton, I., McNew, S., & Beeghly-Smith, M. (1981). Early person knowledge as expressed in gestural and verbal communication: When do infants acquire a "theory of mind?" In M.E. Lamb & L.R. Sherrod (Eds.), *Infant social cognition*. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Butterworth, G., Harris, P.L., Leslie, A.M., & Wellman, H.M. (Eds.) (1991). *Perspectives on the child's theory of mind*. Oxford: BPS and Oxford University Press.

Byrne, R.W., & Whiten, A. (1988). *Machiavellian intelligence: Social expertise and the evolution of intellect in monkeys, apes and humans*. Oxford: Oxford University Press.

Byrne, R.W., & Whiten, A. (1991). Computation and mindreading in primate tactical deception. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Byrne, R.W., & Whiten, A. (1992). Cognitive evolution in primates: Evidence from tactical deception. *Man, 27*, 609–627.

Chandler, M., Fritz, A.S., & Hala, S. (1989). Small-scale deceit: Deception as a marker of two-, three- and four-year-olds' early theories of mind. *Child Development, 60*, 1263–1277.

Cheney, D.L., & Seyfarth, R.M. (1990a). Attending to behaviour versus attending to knowledge: Examining monkey's attribution of mental states. *Animal Behaviour, 40*, 742–753.

Cheney, D.L., & Seyfarth, R.M. (1990b). *How monkeys see the world*. Chicago: Chicago University Press.

D'Andrade, R.G. (1987). A folk model of the mind. In D. Holland & N. Quinn (Eds.), *Cultural models in language and thought*. Cambridge: Cambridge University Press.

Davidson, D. (1980). Psychology as philosophy. In D. Davidson (Ed.), *Essays on actions and events*. Oxford: Oxford University Press.

Dasser, V., Ulbaek, I., & Premack, D. (1989). The perception of intention. *Science, 243*, 365–367.

Dawkins, R. (1992). *The theories of mind used by animals and children.* Paper read at New College Interdisciplinary Symposium on Mindreading, Oxford.

Dawkins, R., & Krebs, J.R. (1978). Animal signals: Information or manipulation? In J.R. Krebs & N.B. Davies (Eds.), *Behavioural ecology: An evolutionary approach.* Oxford: Blackwell.

Dennett, D.C. (1971). Intentional systems. *Journal of Philosophy, 8,* 87–106.

Dennett, D.C. (1983). Intentional systems in cognitive ethology: The "Panglossian paradigm" defended. *Behavioral and Brain Sciences, 6,* 343–390.

Dunn, J. (1991). Understanding others: Evidence from naturalistic studies of children. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading.* Oxford: Basil Blackwell.

Dunn, J., Brown, J., & Beardsall, L. (1991a). Family talk about emotions, and children's later understanding of others' emotions. *Developmental Psychology, 27,* 448–455.

Dunn, J., Brown, J., Slomowski, C., Tesla, C., & Youngblade, L. (1991b). Young children's understanding of other people's feelings and beliefs. *Child Development, 91* (62), 1352–1366.

Feinman, S. (1982). Social referencing in infancy. *Merrill-Palmer Quarterly, 28,* 445–470.

Flavell, J.H., Everett, B.A., Croft, K., & Flavell, E.R. (1981). Young children's knowledge about visual perception: Further evidence for the Level 1–Level 2 distinction. *Developmental Psychology, 17,* 99–103.

Freeman, N.H., Lewis, C., & Doherty, M.J. (1991). Preschoolers' grasp of a desire for knowledge in false belief prediction: Practical intelligence and verbal report. *British Journal of Developmental Psychology, 9,* 139–157.

Frye, D., & Moore, C. (Eds.) (1991). *Children's theories of mind: Mental states and social understanding.* Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Gomez, J.C. (1991). Visual behaviour as a window for reading the mind of others in primates. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading.* Oxford: Basil Blackwell.

Gopnik, A. (1993). How we know our minds: The illusion of first-person knowledge of intentionality. *Behavioural and Brain Sciences, 16,* 1–14.

Gordon, R.M. (1986). Folk psychology as simulation. *Mind and Language, 1,* 158–171.

Harcourt, A.H., & de Waal, F.B.M. (1992). *Coalitions and alliances in humans and other animals.* Oxford: Oxford University Press.

Harris, P.L. (1989). *Children and emotion: The development of psychological understanding.* Oxford: Basil Blackwell.

Harris, P.L. (1991). The work of the imagination. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading.* Oxford: Basil Blackwell.

Heelas, P., & Lock, A. (Eds.) (1981). *Indigenous psychologies.* London: Academic Press.

Heider, F. (1958). *The psychology of interpersonal relations.* New York: Wiley.

Heider, F., & Simmel, M. (1944). An experimental study of apparent behaviour. *American Journal of Psychology, 57,* 243–259.

Heyes, C.M. (1993). Anecdotes, training, trapping, and triangulating: Do animals attribute mental states? *Animal Behaviour, 46,* 177–188.

Hinde, R.A. (1970). *Animal behaviour: A synthesis of ethology and comparative psychology* (2nd edn.). London: McGraw-Hill.

Humphrey, N. (1976). The social function of intellect. In P.P.G. Bateson & R.A. Hinde (Eds.), *Growing points in ethology.* Cambridge: Cambridge University Press.

Humphrey, N.K. (1980). Nature's psychologists. In B. Josephson & V. Ramachandran (Eds.), *Consciousness and the physical world.* London: Pergamon Press.

Humphrey, N.K. (1983). *Consciousness regained.* Oxford: Oxford University Press.

Humphrey, N.K. (1986). *The inner eye.* London: Faber & Faber.

Johnson-Laird, P.N., & Oatley, K. (1989). The meaning of emotions: Analysis of a semantic field. *Cognition and Emotion, 3,* 81–123.

Karmiloff-Smith, A. (1993). *Beyond modularity: A developmental perspective on cognitive science.* Cambridge, Mass.: Bradford/MIT.

Krebs, J.R., & Dawkins, R. (1984). Animal signals: Mind reading and manipulation. In J.R. Krebs & N.B. Davies (Eds.), *Behavioural ecology: An evolutionary approach.* Oxford: Blackwell

Leekam, S.R. (1991). Jokes and lies: Children's understanding of intentional falsehood. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading.* Oxford: Basil Blackwell.

Leekam, S.R. (1993). Children's understanding of mind. In M. Bennet (Ed.), *The child as psychologist: An introduction to the development of social cognition.* London: Harvester Wheatsheaf.

Leslie, A.M. (1982). The perception of causality in infants. *Perception, 11,* 173–186.

Leslie, A.M. (1987). Pretence and representation in infancy: The origins of "theory of mind." *Psychological Review, 94,* 84–106.

Leslie, A.M., & Firth, U. (1988). Autistic children's understanding of seeing, knowing and believing. *British Journal of Developmental Psychology, 6,* 315–324.

Light, P. (1993). Developing psychologies. In M. Bennett (Ed.), *The child as psychologist: An introduction to the development of social cognition.* London: Harvester Wheatsheaf.

Lloyd Morgan, C. (1930). *The animal mind.* London: Edward Arnold.

Lock, A. (1980). *The guided reinvention of language.* New York: Academic Press.

McGregor, E., & Whiten, A. (1993). *Factors affecting young children's recognition of others' false beliefs: Do actions speak louder than words?* Unpublished manuscript, University of St. Andrews.

McShane, J. (1980). *Learning to talk.* Cambridge: Cambridge University Press.

Michotte, A. (1963). *The perception of causality.* London: Methuen.

Miller, N.E. (1959). Liberalisation of basic S-R concepts. In S. Koch (Ed.), *Psychology: A study of a science.* New York: McGraw-Hill.

Morton, J. (1989). The origins of autism. *New Scientist,* 1964, 44–7.

Perner, J. (1991). *Understanding the representational mind.* Cambridge, Mass.: Bradford/MIT.

Perner, J., Ruffman, T., & Leekam, S.R. (in press). *Theory of mind is contagious: You catch it from your sibs. Child Development.*

Povinelli, D.J., & deBlois, S. (1991). Young children's (*Homo sapiens*) understanding of knowledge formation in themselves and others. *Journal of Comparative Psychology, 106,* 228–238.

Povinelli, D.J., Nelson, K.E., & Boysen, S.T. (1990). Inferences about guessing and knowing by chimpanzees (*Pan troglodytes*). *Journal of Comparative Psychology, 104,* 203–210.

Povinelli, D.J., Parks, K.A., & Novak, M.A. (1992). Do rhesus monkeys (*Macaca mulatta*) attribute knowledge and ignorance to others? *Journal of Comparative Psychology, 105,* 318–325.

Pratt, C., & Bryant, P.E. (1990). Young children understand that looking leads to knowing (so long as they are looking into a single barrel). *Child Development, 61,* 973–982.

Premack, D. (1988). "Does the chimpanzee have a theory of mind?" revisited. In R.W. Byrne & A. Whiten (Eds.), *Machiavellian intelligence: Social expertise and the evolution of intellect in monkeys, apes and humans.* Oxford: Oxford University Press.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *The Behavioural and Brain Sciences, 1,* 515–526.

Pylyshyn, Z.W. (1978). When is attribution of belief justified? *Behavioral and Brain Sciences, 1,* 592–593.

Reddy, V. (1991). Playing with other's expectations: Teasing and mucking about in the first year. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading.* Oxford: Basil Blackwell.

Rogers, S.J., & Pennington, B.F. (1991). A theoretical approach to the deficits in infantile autism. *Development and Psychopathology, 3,* 137–162.

Shultz, T.R., & Shamash, F. (1981). The child's conception of intending act and consequence. *Canadian Journal of Behavioural Science, 13*, 368–372.

Sorce, J.F., Emde, R.N., Campos, J., & Klinnert, M.D. (1985). Maternal emotional signalling: Its effect on the visual cliff behaviour of infants and young children. *Journal of Experimental Child Psychology, 35*, 369–390.

Thorndike, E.L. (1911). *Animal intelligence*. New York: MacMillan.

Trevarthen, C. (1977). Descriptive analyses of infant communicative behaviour. In H.R. Schaffer (Ed.), *Studies in mother–infant interaction*. London: Academic Press.

Trevarthen, C., & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiders and acts of meaning in the first year. In A. Lock (Ed.), *Action, gesture and symbol*. New York: Academic Press.

Wellman, H.M. (1990). *Children's theories of mind*. Cambridge, Mass.: Bradford/MIT Press.

Wellman, H.M. (1991). From desires to beliefs: Acquisition of a theory of mind. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Whiten, A. (1988). *From literal to non-literal social knowledge in human ontogeny and primate phylogeny*. [Abstracted in *Primate Eye 37, 11* (1989).] Paper presented at Primate Society of Great Britain meeting on Social Knowledge in Primates, London.

Whiten, A. (Ed.) (1991a). *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Whiten, A. (1991b). The emergence of mindreading: Steps towards an interdisciplinary enterprise. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Whiten, A. (1992). Mindreading, pretence, and imitation in monkeys and apes. *The Behavioral and Brain Sciences, 15*, 170–171.

Whiten, A. (1993). Evolving a theory of mind: The nature of nonverbal mentalism in other primates. In S. Baron-Cohen, H. Tager-Flusberg, & D.J. Cohen (Eds.), *Understanding other minds*. Oxford: Oxford University Press.

Whiten, A., & Byrne, R.W. (1988a). Tactical deception in primates. *Behavioral and Brain Sciences, 11*, 233–273.

Whiten, A., & Byrne, R.W. (1988b). Taking (Machiavellian) intelligence apart. In R.W. Byrne & A. Whiten (Eds.), *Machiavellian intelligence: Social expertise and the evolution of intellect in monkeys, apes and humans*. Oxford: Oxford University Press.

Whiten, A., & Byrne, R.W. (1991). The emergence of metarepresentation in human ontogeny and primate phylogeny. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Whiten, A., & Ham, R. (1992). On the nature and evolution of imitation in the animal kingdom: Reappraisal of a century of research. In P.J.B. Slater, J.S. Rosenblatt, C. Beer, & M. Milinski (Eds.), *Advances in the study of behaviour, 21*. New York: Academic Press.

Whiten, A., & Perner, J. (1991). Fundamental issues in the multidisciplinary study of mindreading. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading*. Oxford: Basil Blackwell.

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition, 13*, 103–128.

Wundt, W. (1916). *Elements of folk psychology: Outlines of a psychological history of the development of mankind*. London: Allen & Unwin.

4 Perceiving Attitudes, Conceiving Minds

R. Peter Hobson
The Tavistock Clinic and University College, London, UK

INTRODUCTION

One of the most challenging theoretical tasks for developmental psychology is to characterise the transition between an infant's modes of communicating with other people in the first year of life, and the emergence of a young child's increasingly sophisticated concepts of mind over the ensuing three or four years. In this chapter I shall offer an account that begins with the infant's abilities to perceive certain forms of "attitude" in the behaviour of other people, and ends with the young child's insight into the nature of intentional mental states. I shall be emphasising not only the special qualities of personal relatedness and interpersonal engagement that make this progression possible, but also the significance of a one-year-old's ability to perceive the directness of another person's attitudes towards a visually specified world. I shall argue that the child's capacity to disembed from his or her own perspective vis-à-vis the world, and to engage in creative symbolic play, are important stepping-stones along this social-development pathway.

I shall proceed by analysing each of the terms I have employed in the title of my chapter. I shall need to introduce a further notion to weld together the business of perceiving attitudes on the one hand, and conceiving of minds on the other—the young child's developing concept of "persons."