Developing Theories of Intention

Social Understanding and Self-Control

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Toddlers' Understanding of Intentions, Desires, and Emotions: Explorations of the Dark Ages

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Our sensory experience of other people tells us about their movements in space but does not tell us directly about their mental states. Although a few radical philosophers and psychologists may deny the existence of mental states, most regular "folk" feel sure that they themselves and others have them. It is adaptive to read another person's mental state because it allows us to explain the actions they have taken in the past and predict their actions in the future. The general aim of "theory-of-mind" research is to illuminate the development of this everyday, folk psychological framework for understanding people (e.g., Astington & Gopnik, 1991b; Astington, Harris, & Olson, 1988; Flavell & Miller, 1998; Perner, 1991; Taylor, 1996; Wellman, 1990).

This research has taught us that children's understanding of mental life is not all of one piece. There is no single moment at which children develop a theory of mind. Instead, children gradually converge on an adult understanding of mind. The focus on when children understand "false belief" has been misleading in this regard. Beliefs are only one of many mental states that children understand and use in their everyday interactions with people. Children may only develop a firm understanding of false beliefs at about 4 years old, but they have started on their path of developing a folk psychological understanding of people much earlier. Preschoolers understand a great deal about perceiving, wanting, and intending at an age when they still have only a shaky understanding of false beliefs (e.g., Astington & Gopnik, 1991a; Flavell, Flavell, Green, & Moses, 1990; Gopnik & Slaughter, 1991; Gopnik, Slaughter, & Meltzoff, 1994; Wellman, 1990, 1993).

However, just as it is a distortion to think that children don't have an understanding of mind until they pass a false-belief exam, it is likewise a distortion to hold that infants have the adult conception of the mind as soon as they show a special interest in people. An alternative is a genuinely developmental account of children's understanding of the mind. The view we favor is that infants are given a jump start in understanding people because of certain innate structures, but they gradually come to understand the whole range of psychological flora and fauna including pretenses, images, emotions, perceptions, desires, intentions, and beliefs. Newborns do not have anything like this full understanding of the mind, but they do have privileged ways of understanding other people and human acts.

In earlier work, we argued that infant imitation may provide the first groundwork for later understanding of the mind (Gopnik & Meltzoff, 1994; Meltzoff & Gopnik, 1993). Imitation is a behavioral measure indicating that newborns, at some level of processing no matter how primitive, can map actions of other people onto actions of their own body. The findings of early imitation have now been replicated and extended in 25 different studies from 13 independent laboratories, both in this country and cross-culturally (for a history and literature review, see Meltzoff & Moore, 1977, 1994, 1997).

A comprehensive model of early imitation was offered by Meltzoff and Moore (1997) and dubbed the AIM (active intermodal mapping) model. The central notion is that imitation, even early imitation, is a matching-to-target process. The goal or behavioral target is specified visually. Infants' self-produced movements provide proprioceptive feedback that can be compared to the visually specified target. AIM proposes that when babies imitate, they are linking the visual appearance of other people to their own internal kinesthetic and proprioceptive feelings, connecting the visible bodily actions of others and their own internal states.

This type of initial state would provide a jump start for infants' understanding of persons and commonsense psychology because it provides the first and most fundamental building block of the folk psychological framework: "Those entities are like me." Thus, when newborns look at the moving adults, they do not simply see "visual complexity," "high-contrast areas," or mere physical motions, but special acts that are like the acts they can and do perform. Newborns are not alone; they perceive that other entity is "like me."[1]

[1]In using the English word "me," we do not suggest that the infant has the full-fledged adult sense of self. Indeed, we have argued that such a sense of self is a developmental product (Meltzoff & Moore, 1995). Our argument could be rephrased by purging the "me" word and instead saying, "*That* looks like *this* feels." Elsewhere we have attempted to describe the initial state in a precise technical manner, using a computational model and avoiding the glosses of everyday English (Meltzoff & Moore, 1997). Interested readers are referred to this work for detailed arguments about early self-other relations.

Development in social cognition depends on two-way traffic between self and other, on what might be called "projection" from one's own case to the other and "appropriation" from the other to the self. But this depends on a prior assumption that self and other have anything whatever to do with one another. Newborn imitation provides a demonstration that at some primitive level this link has been made in the normal infant. Without this fundamental connectedness, there would be no reasoning bidirectionally from one's own case to another's because the two cases would not be known to be similar (Meltzoff & Moore, 1995).

Regardless of our theory about the initial state, there is, admittedly, a substantial gap in the findings between early infancy and early childhood. We know something about the initial state of newborns from studying imitation and other early phenomena like interactional synchrony and face recognition. We know something about the state of 3-year-olds who are on the verge of understanding belief. However, "the dark ages," from about 15 to 36 months, remain something of a mystery. Ask graduate students to test 2-year-olds and they will often shudder and scurry out of the lab; the "terrible-twos" lead to both subject and graduate student attrition. In the dark ages, the established techniques of infancy (e.g., preference-for-novelty procedures) do not work because the children are too old to sit and passively watch; conversely, tests demanding subtle verbal distinctions do not work ("When I first asked you, before we did X, what did you believe. . . ."), because toddlers are too young for such verbal gymnastics. We're left guessing. The absence of empirical findings from this period has contributed to our difficulty in laying out a fine-grained developmental theory. It is as if biologists had only seen frogs and tadpoles without the transitions in between. It would be hard to tell a developmental story, and no one would believe it if you did.[2]

A variety of techniques, however, have recently been developed to test children during the dark ages. One set of techniques uses toddlers' language abilities. Such studies suggest, for example, that 18-month-old children understand that words refer to objects and can use an adult's attentional cues (e.g., gaze direction, gestures) to identify the referent of a novel label (e.g., Baldwin, 1993a, 1993b; Baldwin et al., 1996). At a similar age, children also take into account the intentions of the other person in their attempts to determine the referent of a novel word (e.g., Tomasello, 1995; Tomasello

[2]We do not mean to imply that there has been no work in the 15- to 36-month-old age range. There has been a great deal of work (e.g. Damon, 1998; Kagan, 1981), but not much from the "theory-of-mind" viewpoint linking what infants know about persons and what 3- to 5-year-olds know about the intentional mental states of persons. Researchers have discovered a good deal about social cognition in infancy and a good deal about social cognition in 3- to 5-year-olds, but not enough about what happens in between. We expect that future research will shed increasing light on "the dark ages."

& Barton, 1994; Tomasello, Strosberg, & Akhtar, 1996). Finally, analyses of naturalistic studies of early conversation have illuminated children's understanding of the mind (e.g., Bartsch & Wellman, 1995).

A second newly developed technique, called the "behavioral reenactment procedure" (Meltzoff, 1995), also explores what children know about the mind, but does not rely on language. The behavioral reenactment procedure capitalizes on children's natural tendency to reenact or imitate the behaviors they see, but uses it in a more abstract way. A host of research indicates that children, even young infants, do not imitate by rote; they do not immediately imitate the events they see, but rather their interpretation of them (Meltzoff & Moore, 1995, 1997, 1998). This means that if we arrange a situation correctly, we can use their natural tendency to reenact adult behavior as a "read out" of how they understand the world. Such an approach has been extensively used in the psycholinguistic literature to assess children's linguistic structure. This work shows that children who are asked to imitate a sentence of the adult language tend to respond with a similar sentence, often synonymous with the to-be-imitated one, but which conforms to the child's own linguistic rules. The behavioral reenactment procedure uses the imitation of goal-directed acts to examine the psychological structures children use in interpreting human behavior.

A third set of techniques capitalizes on children's very early tendency to read meaning into human emotional expressions. This underlies early "social referencing" studies but also has been developed in a more sophisticated way by Repacholi (Repacholi, 1998; Repacholi & Gopnik, 1997). There is evidence that basic emotions such as happiness, sadness, and disgust are associated with particular facial expressions from early infancy and universally across cultures (e.g., Darwin, 1872; Ekman, 1980). Emotions are closely and intricately connected to intentions and desires in our adult understanding of mind. In the everyday adult framework, we assume that getting what we want or acting as we intend to will lead to happy emotions, whereas failure will lead to negative emotions. We also assume that we act in a way that will bring about positive but not negative emotions. Some of the new techniques we discuss in this chapter exploit the early nonverbal ability to read emotional expressions as a way of investigating children's understanding of the mind.

Taken together, these recent procedural advances in addressing questions to very young children are starting to reveal some of what children understand in the dark ages. There are two important foci of children's developing understanding of the mind in this period. One is their understanding of perception and attention (e.g., Baldwin, 1993a, 1993b; Gopnik, Slaughter, & Meltzoff, 1994; Gopnik & Wellman, 1994; O'Neill, 1996; Slaughter & Gopnik, 1996; Tomasello, 1995). The other is an understanding

of what Searle (1983) called "world-to-mind states" such as desire and intention. We focus on the latter in the present chapter.

UNDERSTANDING DIRECTEDNESS

In full-fledged adult psychology, an important feature of desires and intentions is that they are "directed at" objects and events. In fact, in adult psychology this is one thing that distinguishes desires and intentions from mere moods, feelings, or emotions and makes them similar to perceptions and beliefs. At the same time, desires, intentions, and emotions, unlike perceptions and beliefs, share what we might call valence. Desires carry with them an implication of certain positive or negative attitudes towards objects and events. Getting what we want is good, and being frustrated is bad. Doing what we intend to do is good, failing to do so is bad.

A Conceptual Clarification: Intention and Intentionality

What we are calling the "directedness" of these states sometimes is referred to in psychology as the "intentional" character of desire and intention, but this derives from a misunderstanding (or loose adaptation) of a technical philosophical term. *Intention* in the technical philosophical sense refers to the propositional character of a mental state, not solely the fact that it is directed at objects in the world. This is an important distinction inasmuch as some mental states may be directly or causally related to real objects or events in the world, without being intentional. The classical philosophical example is "seeing" (as opposed to "believing" or "seeing that"). This mental state is related to real objects and events in the world, not to mental representations of events, and this has important consequences. I can substitute different descriptions of the same event and preserve the truth of the sentence when "see" is used in the nonintentional sense. For example, it is true to say that someone sees the author of *Waverley* when they see Scott, but it is not true to say that someone, who believes this person is Scott, also believes that he is the author of *Waverley*. The same holds for world-to-mind states such as wanting and intending. These states may simply be directed at objects or events, which means that descriptions can be substituted preserving truth, or they may be genuinely intentional (in the technical, philosophical sense), which means that they cannot.

The terminological distinction is important for developmental psychologists because it lets us discriminate between two different ways young children might understand the "aboutness" or "directedness" of mental states. It also should prevent us from assuming that if a child has the minimal idea of the directedness of mental states, they must also have an under-

standing of the fact that mental states have propositional content, involve representations, and therefore are "intentional." In fact, there is likely a developmental change from children first understanding the nonintentional aspects of mind to later understanding its intentional character.

To make things even worse, these philosophical concerns about what it means to be "intentional" have literally nothing to do with the everyday use of "intention," as in the intention to act—it is just a homonym, although it is related to the "intension" of sentences (no wonder philosophers prefer to talk about x's and y's). To assume a deep link between the two intentions, as psychologists sometimes do, is like assuming that the Federal bank must be an historical outcome of the economic importance of rivers. Of course, intentions, in the sense of intending to act, are mental states and can be "intentional" (in the sense of having propositional content), although they need not necessarily be, just as desires, perception, and other mental states may or may not be "intentional." But then the Federal bank may (for all we know) have something to do with the economic importance of rivers. The similarity of the two words is obviously not an indication of any deeper link between the two concepts: Beliefs are "intentional" mental states par excellence, and there's no homonym at play in this case. Finally, it may be true (we think it is) that the earliest "intentional" concepts of children concern intention, desire, and perception, but if so, this will be an empirical discovery of developmentalists, not a logical truth embodied in the homonyms.

Exploring Toddlers' Understanding of the Directedness of Emotional Attitudes

Infant imitation and other phenomena of early infancy show that infants can link their own feelings and those of others. However, these early behaviors do not involve objects. The feelings that children understand at first are just that, purely internal feelings. When do infants understand both the valenced and directed character of adults' attitudes toward objects? The literature on social referencing suggests to some that this may be understood as early as 9 months of age. In these studies, mothers reacted to objects and events with particular emotions, and babies seemed to adopt these emotional attitudes. However, a closer look at the experiments in that paradigm suggests that this conclusion may be unwarranted. The fact that infants adopted the mother's attitude does not demonstrate that they understood that this attitude was directed at a particular object. First, typically only one object is presented, so it remains unclear whether infants truly understood that the emotional message was directed toward this and not other objects. Second, the fact that infants adopted the mother's attitude does not necessarily mean that they understood that her

attitude was directed at any object whatever. Various forms of emotional contagion and/or simple associative processes (e.g., temporal contiguity, stimulus salience) could be at work in these studies, as argued by advocates of a "lean interpretation" of the standard social referencing work (Baldwin & Moses, 1994).

To demonstrate that children really understand directedness, you need to show that they understand that a person can have one attitude toward one object and a different attitude toward another object. At least two objects should be presented, and these should be equally attractive and salient. Some researchers have recently adopted a dual-object display (e.g., Baldwin & Moses, 1994; Mumme, Won, & Fernald, 1994), but this by itself has not been sufficient to eliminate the possibility of all simpler nonreferential processes (see Repacholi, 1998, for a discussion).

Repacholi (1998) developed a technique to test infants' understanding of directedness of emotional signals that rules out nonreferential mechanisms. In these studies, 14-month-old infants saw the same experimenter produce two different emotional expressions, an expression of disgust and an expression of joy, toward two different objects. The objects were in closed boxes so that the children did not see the objects at the time that they saw the emotions. Instead they saw the experimenter peek into each box and make a different emotional response. The children were then given the two boxes.

The results showed that children touched and handled both boxes equally quickly and frequently, indicating that there was no simple emotional contagion at work. The important result was that they opened the box with the "happy" object inside significantly more frequently than they opened the box with the "disgust" object. We conclude that the children had inferred that the adult's attitude was specifically directed at the object inside the containers, even though they had not seen the emotions and the objects at the same time.

On the basis of these results, we can also firmly address the temporal contiguity and salience issues that have bedeviled social-referencing research. How do we know that infants were not simply noting the temporal contiguity between the emotional signal and whichever stimulus they were looking at, at the time the signal was issued? This is ruled out because the only visible objects were the two boxes, not the objects they contained. Moreover, infants should have connected an emotion to whichever box was the focus of their own attention when the expression was displayed, and the results showed that this was not the case (because they handled both boxes equally). Similarly, the paradigm rules out the possibility that simple salience was at work. Both boxes were extremely salient and the experimenter's actions (e.g., picking the boxes up, opening their lids) made them all the more so. Yet infants did not link these salient stimuli

to the emotions: They were not loathe to touch and examine either box, even the box containing the disgust object. They just did not want to grab the object that was hidden inside that box. Because the object was hidden, it could hardly have been visually salient when the emotion was originally displayed.

We conclude that the interpretation of the social referencing demonstrated in 9- to 13-month-old infants is still equivocal. Perhaps a "lean" interpretation of those effects are still in order. However, the work discussed here shows that by 14 months infants genuinely understand that emotional attitudes with particular valences may be directed at particular objects. They understand that the objects to which an adult's emotions are directed may be ones that are neither perceptually salient, nor even perceptually present, contiguously with the emotional expression. This is an important step toward the adult understanding of desire.

EARLY UNDERSTANDING OF SIMPLE INTENTIONS

Another important aspect of the adult understanding of the mind is a distinction between the actual actions someone performs and their intention in performing those actions. Wittgenstein (1953) asked, "What is left over if I subtract the fact that my arm goes up from the fact that I raise my arm?" (p. 161). Answer: Intention.

This pithy example shows that intention is not wholly reducible to bodily movement. Intentions are mental states and bodily movements are physical events in the world. The two have an intimate relation because intentions underlie and cause bodily movements. If we know a person's intentions, we (often) can predict her actions, and conversely if we see her actions, we can often reason backwards to what her intentions must have been. Moreover, within the adult framework, only certain types of movements are ascribed to intention. Chairs and boulders move, but their rocking and rolling are not seen as intentional. Most prototypically, human acts are the types of movement patterns that are seen as caused by intentions. Just as the youngest infants do not show evidence of understanding the directedness of mental states, they also show little evidence of understanding this distinction between underlying intentions and visible movements, although they do link their own intentional movements to the intentional movements of others (as in body imitation). When do children begin to differentiate bodily movements from the underlying psychological states that cause them, and when do they begin to understand that only certain types of movements and not others are intentional?

To address these questions, it is not enough to show that young infants act intentionally themselves. We want to know when they begin to understand the intentions of others, and most important, when they begin to differentiate surface actions from underlying intentions. There has been some excellent research on this question using verbal tests on young children just beyond "the dark ages," between 3 and 4 years of age (e.g., Astington & Gopnik, 1991b; Moses, 1993; Shultz, 1980; Shultz, Wells, & Sarda, 1980). Our goal was to use the behavioral reenactment technique to pose the question to preverbal children.

In one study, we tested whether 18-month-old children could read below the literal surface behavior demonstrated in an adult act (Meltzoff, 1995). The study involved showing infants an unsuccessful act. For example, the adult accidentally under- or overshot his target, or he tried to perform a behavior but his hand slipped several times. Thus the goal-state was not achieved (Fig. 2.1). To an adult, it was easy to read the actor's intentions, even though he was not able to fulfill them. The experimental question was whether children interpreted this behavior in purely physical terms or whether they too read through the literal body movements to the underlying goal or intention of the act. The measure of how they interpreted the event was what they chose to reenact, in particular whether they chose to produce the intended act despite the fact that it was never present to the senses. In a sense, the "correct answer" was to not copy the literal movement, but the intended act that remained unfulfilled and therefore invisible.

Using this behavioral reenactment paradigm, Meltzoff (1995) tested four groups of 18-month-old infants. The demonstration-target group saw the adult successfully fulfill his intentions and perform a series of target acts on five different objects. The demonstration-intention group saw accidental failures for five different events. With each object, the adult strove

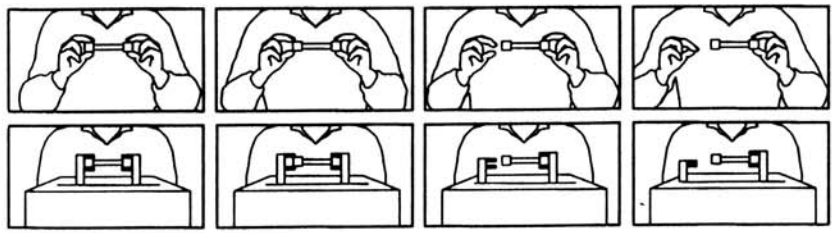

FIG. 2.1. The displays used in the study of toddlers' understanding of simple intentions. The top panel shows the human's acts. The adult tried to pull apart the dumbbell three times. Each time, his hand slipped off the end of the cube (first to one side, then the other, and then the first side again). The children did not copy this surface behavior. When given their turn with the dumbbell, they wrapped their hands around the cubes and firmly pulled it apart. The bottom panel shows the inanimate device. Results showed that children did not try to pull the dumbbell apart after seeing these motions. They interpreted the human acts differently than the similar motions of the inanimate device. (From Meltzoff, 1995.)

to reach the goal but did not successfully carry out his intention. The adult's motor actions were realistic-looking attempts to reach the goal, but he did not verbalize or show facial expressions of frustration at his failures. Two control groups were used. The control-1 group simply omitted any adult demonstrations. The control-2 group saw the adult perform control actions on the objects for the same length of time as in the two demonstration groups, but the adult showed neither the target acts nor the intention to achieve them. The control acts were carefully designed so as to control for the possibility that spatial proximity of the adult's hands to the target, or proximity of two objects with each other, might "suggest" the target behavior (see Meltzoff, 1995, for details).

The results were very clear cut. Infants in the control groups did not tend to produce the target acts spontaneously or by chance. However, infants in the two demonstration groups produced more than 75% of the target acts. They reproduced the targets after observing the adult do so, which is straightforward imitation. The important, new finding is that they also produced the targets in the intention condition. Indeed infants were equally likely to produce the target after seeing the adult "trying" but failing as they were when the target was actually achieved. They seemed to interpret the adult's effortful behavior as going beyond the literal surface behavior itself, and as being about something else, about the unseen but inferred goal of the act (see also Tomasello & Barton, 1994, for work using a slightly different approach and yielding compatible results).

Several follow-up studies have now been completed that confirm and expand the original findings. If infants are picking up the underlying goal or intention of the human act from seeing the failed attempt they should be able to achieve the act using a variety of means. This was tested in a recent study (Meltzoff, 1996b). As before, the adult showed the failed attempt with his hands sliding off the ends. Then he handed the infant a gigantic dumbbell that was too big for the infant's hands. The infants did not even make an attempt to grasp the ends of the dumbbell. They did not appear to be trying to mimic the surface behavior. Instead, they used novel ways to struggle to get the gigantic toy apart. They put one end of the dumbbell on the table and used both hands to pull the other end upwards; or they put their hands inside the toy and pushed outwards, and so on. In short, they use different means than had been demonstrated by the experimenter, but used them toward the same end. Of course, the interesting thing is that they had never seen the end. They inferred the end and then used previously unseen means to get there. This eliminates the possibility that infants in the original study had merely tried to imitate the surface behavior of the adult (hands slipping off the cubes) and had pulled the toy apart by mistake. It is consistent with the hypothesis that

infants had inferred the goal of the act, differentiating it from the literal surface behavior that was observed.

Another experiment pressed this point further. In this study, infants were shown the standard "failed attempt" display, but they were handed a trick toy. The toy had been glued shut before the study began. When infants picked it up and attempted to pull it apart, their hands slipped off the ends of the cubes. This of course matched the surface behavior of the adult. The question was whether this match to the adults' behavior satisfied them. The results showed it did not. Infants were not satisfied when they matched the surface behavior of the adult; this did not terminate their behavior. They repeatedly grabbed the toy and yanked on it in different ways, and appealed to their mothers and the adult. Ninety percent of the infants looked up at an adult immediately after the infant failed to pull the trick toy apart. They did so with an average latency of less than 2 seconds and accompanied by vocalizations while they stared into the adults' faces (Meltzoff, 1996b). Why were they appealing for help? They had matched the adult's surface behavior, but evidently were striving toward another goal, not the behavior itself. (Of course it did not make a lot of sense to seek the adult's help because he had already failed. If a large adult failed, the infant's failure was perhaps inevitable. This subtlety escaped them, however.)

We have begun to explore the aspects of the adult's behavioral envelope that carry the information that an action was a failed-attempt and not a success. When we see an adult relaunch the act and vary the means, we interpret the adult as "effortfully trying" to accomplish something beyond what he is doing. We tested whether infants were sensitive to this try-and-try-again aspect of intentional action (Meltzoff, 1996a). In this study, four independent groups of 18-month-olds saw the adult perform either the failed-attempt or the successful target act either one or three times. (Recall that infants in the original Meltzoff, 1995, study saw three failed attempts.) Infants who saw one failed attempt performed poorly. Their behavior dropped to chance levels, significantly lower than infants who saw three failed attempts. On the other hand, the infants who saw the adult perform the successful target behavior only once did as well as if they saw it three times. This establishes that it is not an across-the-board sensory limitation of some kind.

These results suggest that seeing a person relaunch his behavior several times is an important cue to the purposiveness of the act for infants, just as it is for adults (Heider, 1958). When an adult relaunches his behavior several times, using different but related actions, infants infer that there is a common cause unifying this surface behavior. In short, 18-month-olds use the whole pattern of behavior to indicate whether the adult is aiming to do what they are doing or something else.

What Kind of Entities Are Interpreted as Purposive?

The results we have discussed so far suggest that normal infants can pick up the simple intentions of human actors. One interesting question is whether this intentional-reading of behavior is specific to people or at least most readily ascribed to them. To begin to examine this, Meltzoff (1995) tested how 18-month-olds responded to a mechanical device that mimicked the same movements as the actor in the failed-attempt condition. An inanimate device was constructed that had poles for arms and mechanical pincers for hands. It did not look human but it could move very similarly to the human (Fig. 2.1, bottom panel). For the test, the pincers "grasped" the dumbbell at the two ends just as the human hands did. One mechanical arm was then moved outwards, just as in the human case, and its pincer slipped off the end of the dumbbell just as the human hand did. The movement patterns of machine and man were closely matched from a purely spatiotemporal description of movements in space.

The results showed that infants did not attribute a goal or intention to the movements of the inanimate device. Although they were not frightened by the device and looked at it as long as at the human display, they simply did not see the sequence of actions as implying a goal. Infants were no more (or less) likely to pull apart the toy after seeing the failed attempt of the inanimate device than they did in baseline levels when they saw nothing.

Another study pursued this point. In this study, we had the inanimate device succeed. The inanimate device held the dumbbell from the two ends and successfully pulled it apart. After witnessing this display, infants were given the dumbbell. The results showed that they too pulled it apart (Meltzoff, 1996b). It appears that infants can pick up certain information from the inanimate device (they pull it apart after seeing the device do so), but they cannot pick up other information (concerning failed attempts).

We believe 18-month-olds interpret the person's actions within a psychological framework that differentiates between the surface behavior of people and a deeper level involving goals and intentions. When they see a person's hands slip off the ends of the dumbbell, they infer what the adult was "trying" to do (which is different from what he did do). When they see the inanimate device slip off the end of the dumbbell, they see it as mechanical slippage and sliding with no implications for purposiveness.[3]

[3]It is quite likely that displays can be constructed that fool infants, analogously to those that fool adults (is my computer intentional?). We do not know the necessary and sufficient conditions for attribution of intention, but under certain circumstances infants may see purposiveness in the actions of pretend humans (e.g., stuffed dolls or animals) or in dynamic displays that may seem to be ambiguous as to animacy (2-D spots that leap and move spontaneously, as in Gergely, Nádasdy, Csibra, & Bíró, 1995). This does not contradict our thesis, but underscores the need for research on boundary conditions. The 3-D, clearly inanimate object used by Meltzoff (1995) gives a lower boundary (infants fail) and real people give an upper boundary (infants succeed). There is a lot of room in between.

Human Acts Versus Mechanical Motions

On the basis of these findings, it is useful to introduce a distinction that is discussed later in the chapter. We wish to distinguish between construing the behaviors of others in purely physical versus psychological terms. To help keep this distinction clear, we call the former movements or motions and the latter human acts. The behavior of another person can be described using either physics or psychology. We can say, "The president's hand contacted the cup; the cup fell over," or "The president was trying to pick up the cup." Strict behaviorists (and some lawyers) stick to the former description precisely because they eschew appealing to invisible psychological states. Evidently, infants are not behaviorists (not to mention lawyers). They do not construe the behavior of others simply as, "Hold the dumbbell and then remove one hand quickly," but rather construe it as an effort at pulling. Moreover, the new work shows that infants have a differentiation in the kinds of attributions they make to people versus things. By 18 months of age children have already adopted a fundamental aspect of a folk psychology: Persons are understood within a framework involving goals and intentions. Human acts are seen as dripping with purposiveness and are mapped onto one's own like acts.

Using a Person's Emotional Reactions to Understand Their Intentions

In the adult framework, it makes sense that the same external event may cause one person to become happy and another sad. This is because emotions do not map directly onto outcomes, but are mediated by the person's desires. Using a variety of verbal tests, it has been shown that young children understand quite a bit about the linkage between desires, actions, and emotional reactions. For example, they know that fulfilled desires lead to happiness and a cessation of searching, whereas unfulfilled ones lead to sadness and a continuance of search for the desired object (Hadwin & Perner, 1991; Harris, 1989; Stein & Levine, 1989; Wellman & Banerjee, 1991; Yuill, 1984). There is clear evidence for this sort of understanding in 3- to 4-year-olds and some evidence that children as young as 34 months (Wellman & Woolley, 1990) can correctly predict whether a protagonist in a story will be happy or sad, depending on the match between her desires and the outcome.

The behavioral reenactment procedure provides a nonverbal way of beginning to explore children's understanding of the links between desire/intention → action → emotional reaction. In one study, children ranging from 18 to 36 months old were shown an adult performing an action and the adult's emotional reaction to her action was systematically

manipulated (Meltzoff, 1996b). After the action was completed, the adult reacted in one of two ways. For half the children, the adult reacted with happy/satisfied facial expressions and exclaimed, "Yeah! There!" and for the other half she reacted with unhappy/dissatisfied facial expressions and exclaimed, "Uh-oh! Oh dear!" The important point is that the adult's physical actions were identical in both cases. What differed was the adult's reaction to the event she caused. The question was whether the children's inference about the adult's desire/intention changed as a function of her emotional reactions.

Using the behavioral reenactment procedure, three groups of infants aged 18, 24, and 36 months old were randomly assigned to the see the happy/satisfied and unhappy/dissatisfied reaction. The events in themselves were carefully designed on the basis of pilot studies to be ambiguous in themselves. For example, the adult put a toy unstably on top of a 12-inch-high shelf and the toy toppled off making a banging sound as it hit the table. The usual response after the toy fell was to look at his face to clarify the ambiguous event. Immediately after the object fell, the adult gave one of the reactions, happy/satisfied or sad/dissatisfied. The objects were then given to the child. This proved to be a very motivating task, and children leapt at the opportunity to play with the objects.

The results revealed an interesting developmental change. The behavior of the 18- and 24-month-olds did not systematically vary as a function of the adult's emotional reactions. The 36-month-olds showed a highly significant and orderly response. They carefully put the toy stably on the shelf (which is not what they saw) in the case that the adult seemed dissatisfied by the outcome. Conversely, they exaggeratedly knocked the toy off the shelf if the adult had shown the happy/satisfied reaction.

We conclude that in an ambiguous situation children use the adult's emotional reactions to clarify the meaning of the adult's behavior. On this interpretation, children by 36 months but not 18- to 24-month-olds can reason backwards from an emotional reaction to what the adult was striving to do. It is interesting that this age estimate fits well with that obtained by verbal methods (Wellman & Woolley, 1990). A modest additional piece of information provided by the behavioral reenactment procedure is that children are not simply presented with a multiple-choice verbal response ("will he be happy or sad"). The children are surrounded with the clutter of real-world activity and have to create for themselves the desired end state. The adult never put the toy stably on the shelf and the children who tuck it firmly up there, far from the edge, are imagining and creating the result of what the adult "had in mind" but never achieved. Another interesting point is that the children were forced to reason backwards from emotional reaction to the unseen desire or intention, not forward, as in many of the verbal story scenarios, from the desire and events to the

predicted emotion. The results indicate that at least by 36 months old, children know that the adult may desire/intend to do something different from what they do and that the person's emotional reactions after the event are a clue to the underlying desire/intention of the person. It makes some developmental sense that children can first read the goal of the adult's act (by 18 months) and then later can detect regularities in how they themselves and others emotionally react to the successes and failures of goal-directed actions. Presumably, this is the database that allows them (at 36 months) to give meaning to messy, naturally occurring events such as an actor who reacts either positively or negatively to toppling toys.

UNDERSTANDING DIFFERENCES BETWEEN ONE'S OWN DESIRES AND THOSE OF OTHERS

The work discussed so far has focused on one important aspect of our adult understanding of intention, the ability to "read through" surface actions to determine the intentions of the person who performed them. One important aspect of this ability is that the child seems to go beyond the immediate action itself. Children also seem to take into account other aspects of the situation, for example the actor's attendant emotional reactions, to determine intentions. This research assumes that the child identifies their own intentions with the intentions of adults. In fact, one reason both the behavioral reenactment and social referencing paradigms are so effective is that the children so readily "take on" the intentions, desires, and attitudes of adults, even when those intentions are not their own initially.

However, an important aspect of our adult theory of mind is the fact that we can differentiate between our own intentions and desires and the intentions and desires of others. We understand that our desires and intentions may differ from and even be in conflict with, the desires of those around us. In some ways these differences among desires parallel the differences in belief that are tested in false-belief paradigms. This understanding of differences in desires emerges considerably earlier than the understanding of differences in belief (e.g., Flavell et al., 1990; Gopnik & Slaughter, 1991). As in the case of intention, there is a considerable body of work suggesting that children understand this aspect of desire by the time they are about 3 years old (Astington & Gopnik, 1991a; Bartsch and Wellman, 1995), but the origins of this understanding have been lost in "the dark ages."

Repacholi and Gopnik (1997) devised a nonverbal method to explore young children's understanding of differences in desires. The method, like that in the previous study of intention and the earlier study on "di-

rectedness," capitalized on young children's ability to detect emotions. Here, however, we asked a rather different question about emotions. In this work, 14- and 18-month-old infants were presented with a plate of raw broccoli and a plate of goldfish crackers. Infants consistently prefer the crackers. The experimenter indicated her preference for one object or another by tasting it and producing a particular emotional expression (disgust or pleasure). Infants were randomly assigned such that half of them saw the adult apparently like the goldfish crackers (the child's own preference) and half saw her apparently like the broccoli (the child's nonpreferred food). In the crucial test condition, the experimenter then reached her hand out to the infant midway between the foods and asked the infant to give her an (unspecified) food.

The results showed that 18-month-old infants consistently gave the adult the object for which she had expressed a preference, even when the preference differed from their own desire. They gave her broccoli when she had previously expressed a desire for the broccoli, and crackers when she expressed a desire for crackers. This is a developmental achievement inasmuch as 14-month-olds did not do this. Instead, they always gave the experimenter crackers, their own preference, regardless of the experimenter's expressed desires. This work suggests that even very young children, 18-month-olds, may have a nonegocentric understanding of the differences between their own mental states and those of others in some cases.

This early understanding of desire, like the understanding of intention, goes beyond the simple cues of action or emotion themselves. It confirms that 18-month-old children are not limited to the immediate evidence of the experimenter's perceptually present action, or their own present feelings, in determining the adult's desires. Instead, they take into account an earlier, and superficially quite different, piece of evidence about the experimenter's underlying mental state, namely her emotional expression. Like the earlier understanding of social referencing, it also shows that young children understand the directedness of mental states. They understand that disgust and pleasure were directed at different objects. But this understanding also goes beyond understanding the directedness and valence of mental states and the fact that they underlie, but are not identified with, actions. It shows that 18-month-olds, although not 14-month-olds, understand *differences* between their own desires and those of others. By 18 months, a complexity of folk psychology has dawned on children. They have come to understand that people not only have mental states, just as they do, but these mental states may sometimes not be the same as their own. Other people are like me but do not necessarily have my likes. The children no longer live in a mental Garden of Eden without conflict in which everyone is conceived of as sharing the same desires.

DEVELOPING THEORIES OF INTENTION FOR OURSELVES AND IN OUR CHILDREN

We first summarize some of the developmental changes that have been described in children's understanding of mind between 0 and 3 years of age. Next we sketch three mechanisms of change that may induce these developments.

Conceptual Change Between Birth and 3 Years of Age

Newborns are not as sophisticated as 18-month-olds, no less 3-year-olds. Newborns can imitate actions themselves. They can link the actions they see to internal feelings. However, they do not initially appreciate that those feelings may be directed toward objects. Imitation of object-directed acts arises in the second half year of life (Meltzoff, 1988; Meltzoff & Moore, 1998). Similarly, young infants can imitate what the adult actually does, but they can't imitate what the adult intends to do but fails to achieve. One of us has tried in vain to get neonates to imitate intended actions (e.g., an adult straining to produce a tongue protrusion or mouth opening). They simply do not seem to read through the actions. Hence a developmental change from the youngest infants imitating what we *do* to older ones imitating what we *meant* to do. Younger infants also initially do not appreciate fully the differences between their own states and those of others. In fact, we have seen that they seem to begin by assuming that the two will be similar. By 18 months, they will have learned about all these characteristics of the mind. So there is a rich initial state but also profound developmental change. The fact that newborns have any way at all of interpreting others as equivalent to the self provides a foundation for the development of the notion of persons that will eventually include desire and intention.

As we have seen, the 18-month-old's abilities are quite different from the newborn's abilities. At the same time, they are also quite different from young 3-year-old abilities. Eighteen-month-olds differentiate between intentional and unintentional actions, between their own desires and those of others, and understand that desires and intentions are directed at objects. However, there is no evidence that they conceptualize desires or intentions as mental states that exist in the mind prior to and independent from any action at all, although there is evidence that older children do so. Nor, in fact, is there any evidence that they differentiate between desires, intentions, and emotional attitudes toward objects, although we have been using those adult terms differentially in this chapter.

Reconstructing the child's world view in terms of adult language is always difficult. One idea we find helpful is Searle's (1983) notion of

"intention-in-action." Searle suggests that even adults often understand action as informed and shaped by desires and intentions, even if they do not think a separate mental state preceded that action. When I sit down in the morning to drink my tea and go over my plans for the coming day, I may be said to have formulated the intention and the desire to drive to the office at 9:45 a.m. When in the course of that drive, I swerve to avoid the construction pothole, I do so intentionally and have the desire to do so, but I could not be said to have had those desires and intentions before I started out that morning or even right before I swerved. When, in the course of the drive, my mind is so full of the intention and desire to make a good argument at the 10:00 a.m. meeting that I actually drive into the next construction pothole, the damage to my axle is neither intentional nor desired. We suggest that the 18-month-old's conception of desire/intention is akin to my conception of the intention involved in swerving to avoid the pothole. It is not identified with or reducible to any bodily movement in particular, but it is assumed to accompany actions.

Mechanisms of Development

We are suggesting then that there are important developmental changes in the child's conception of the mind, in particular in their understanding of desire and intention, between birth and 3 years (for a more complete account see Gopnik & Meltzoff, 1997). What mechanisms are responsible for those changes? We suggest that three mechanisms may be particularly important: imitation and interpretation of human acts, spontaneous experimentation, and integration of the evidence.

Imitation and Interpretation of Human Acts as "Like Me." We believe that infants start off with a well-stocked toolkit for developing a folk psychology. We can be precise about how the initial state enables later development. In our view, the "human act" may be the most elementary parsing of the world for social cognition. Human acts are especially relevant to infants because they look like the infant feels himself to be and because they are things infants can intend. When a human act is shown to a newborn baby, it may provide a primordial "Aha" experience: "Something interpretable! That (seen) event is like this (felt) event." It is not simply the attractive eyes and lips of the adults that are special for infants but the way the body moves and its relation to the self. The fact that infants can recreate the act allows them to imbue it with special meaning.

Thus, we propose that the initial parsing infants impose on the world is not any one of the "usual suspects" found in textbooks and commonly discussed at the biennial meetings of the Society for Research on Child Development. It is not the Gelman-Spelke distinction between "animate versus inanimate" (because armadillos are only of passing interest to infants). It is not the Premack-Leslie-Mandler distinction between "self-propelled versus moved-by-a-seen force" (because swinging clock pendulums and falling leaves are not viewed by infants as special). It is not even the philosopher's distinction between "people (as adults know them) versus things." We believe that the primordial distinction may be something closer to "human acts versus other events" (see Meltzoff & Moore, 1995, 1997, for more detailed arguments along this line).

Infants' construing certain movements in the environment in terms of human acts that can be imitated has cascading developmental effects: (a) The world of material objects is then divisible into those that perform human acts (people) and those that do not (things); and (b) having made the division in the external world, new meanings are possible. I can imitate others, and those entities out there can generatively imitate me. Persons are special entities, the only entities in the world with whom I can share behavioral states.

Furthermore, the recognition that others share your states lays the foundation for making further progress toward ascribing psychological properties to these people. This may come about in part because the infant detects regularities in their own behaviors and feelings. When they are acting in a "try-and-try-again" manner they are striving to reach a goal that is not achieved. When they feel happy, they regularly produce a smiling face. There are regularities between the way they act and the way they feel. This would have no interpersonal significance if infants could not recognize that others are acting just like them. But as we have discovered from studies of imitation, infants *can* readily act like others and recognize when others are acting like them. This recognition of sharing behavioral states is crucial because it allows a foothold for infants attributing like mental states to others. We envision a three-step developmental sequence: (a) When I perform that bodily act I have such and such a phenomenal experience, (b) I recognize that others perform the same type of bodily acts as me, (c) the other is sharing my behavioral state; ergo, perhaps the other is having the same phenomenal experience. (For further analysis of this developmental sequence, see Meltzoff, 1990; Meltzoff & Moore, 1995, 1997.)

On this view, imitation and the cross-modal representation of human acts provide a kick start for getting folk psychological thinking off the ground. Without it, people would not be seen as psychological entities, "just like me." The "like-me-ness" of others is the essential foundation for all later social cognition—from the attribution of mental states, to empathy, to moral judgments.

Experimentation. We have suggested elsewhere that young children use psychological devices that bear an interesting similarity to the cognitive devices that are involved in theory change in science (Gopnik, 1996, 1998;

Gopnik & Meltzoff, 1997). One such device is active experimentation. We have proposed that normal infants have an early, and perhaps innate, drive to actively experiment with the world in a way that will increase their understanding of it and that this experimentation plays an important role in development.

There is evidence for a period of experimentation accompanying the new understanding of desire and intention that emerges in "the dark ages." We can demonstrate this discovery in the laboratory, but it is also dramatically apparent in ordinary life. Parents know it as the "terrible twos." (The dark ages, in development as in history, are dark in both senses, in mystery and in retchedness.) What makes the terrible twos so terrible is not that the babies do things you do not want them to do, but that they do things *because* you do not want them to. Two-year-olds are deliberately perverse, what the British call bloody-minded. The 2-year-old does not even look at the forbidden computer keyboard as you type your grant proposal. Instead his hand goes out as he looks, steadily, gravely, and with great deliberation, at you. Why do they torture us by seeking to play with the very things in the world we desire that they do not touch—the computer, the lamp cord, the lipstick, the power tools?

This perverse behavior may turn out to be quite rational. Consider that 2-year-olds are only just in the course of discovering that people may have different desires. The broccoli experiment shows that children first start to realize that there are differences between their own desires and those of others when they are about 18 months old. The terrible twos seem to involve a systematic exploration of that idea, almost a kind of experimental research program (see Gopnik & Meltzoff, 1997; Repacholi & Gopnik, 1997, for further arguments).

Toddlers are systematically testing the dimensions on which their desires and the desires of others may be in conflict. The grave look is directed at you because you and your reactions, rather than the forbidden power tools, are the really interesting things. If the child is a budding psychologist, parents are the laboratory rats. Moreover, the experimentation is striking because it actually conflicts with the child's apparent interest in domestic peace. The Fall has come: The young child now understands that their own desires and those of others are not only not the same but that they often conflict. They are forced from the mental Garden of Eden.

Integration of Evidence. A further common factor in both conceptual changes in childhood and theory change in science is the importance of relevant evidence. Children have extensive evidence about the nature of human action, intention, and desire. There are two sets of experimental findings suggesting that evidence about desires and intentions may induce

developmental change and propel toddlers toward a fuller understanding of mind.

First, there is a consistent finding in the literature that younger siblings do better on theory-of-mind tasks than only or older children (Jenkins & Astington, 1996; Perner, Ruffman, & Leekam, 1994). The most likely explanation for this effect is that siblings provide children with rich evidence about the mind and particularly about differences in minds. Remember that much of what children learn involves the differences between their own minds and the minds of others. They largely take the similarities for granted; in fact, the assumption that we are like other people seems to be part of a basic foundation for understanding mind found in infancy. Parents, and perhaps especially some mothers, tend to minimize the distance between their own mental states and those of the babies. They look for commonality and understanding instead of difference, and their lessons are largely lessons about congruence. Siblings may provide a necessary counterweight. They are much more likely to emphasize differences between what they want and the baby wants, or to witheringly contrast their highly superior 4-year-old knowledge and the baby's pitiful 2-year-old ignorance. Other data showing a positive correlation between early parent–child talk about feelings and later performance on theory-of-mind tasks (Dunn, Brown, & Beardsall, 1991; Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991) might also be interpreted from this viewpoint, assuming that the frequency-of-conversations measures capture increased talk about conflicts in desires, not solely increased congruence talk, a reasonable assumption given the functions of everyday conversations (e.g., Bruner, 1990).

The second set of data comes from work in which we explicitly tried to induce changes in children's understanding of the mind by giving them evidence (Slaughter & Gopnik, 1996). The focus in this study was on developments in false-belief, appearance-reality, and source understanding between 3 and 4 years of age. The theory guiding the research was similar to that of this chapter—that an understanding of mental states such as beliefs emerge from a prior understanding of the mind that includes concepts such as desire, intention, perception, and so on. One prediction from this viewpoint is that giving children experience with understanding these earlier states should induce them to develop more quickly and to acquire an understanding of belief-like mental states even though the latter were not part of the training. Such an acceleration study was conducted and the results confirmed that providing children with evidence relevant to desire and perception significantly increased their understanding of belief-like mental states, including passing the false-belief exam. This acceleration study strongly suggests that experience with reasoning about desires and perceptions are developmental precursors to understanding of belief.

CONCLUSIONS

The challenge now is to articulate a theory about early development that takes seriously the richness of the initial state of infants' understanding of persons, as revealed in modern infancy research, and still embraces developmental change (Gopnik & Meltzoff, 1994, 1997; Meltzoff & Moore, 1997, 1998). We have argued for what we call a "starting-state nativism" that doesn't reduce to Fodor's (1987) "modularity or final state nativism" in which the outcomes are fixed to begin with and simply mature with age. On the contrary, we propose that development proceeds by a constant process of revision, like the process of theory change in science. Infants never face the empiricist dilemma of inducing the existence of the mind from the raw data of behavior. On the other hand, they also are not trapped by the constraints of a single, biologically fixed construal of other people.

The analogy to science enables us to suggest that the sophisticated mental life of the 4-year-old could emerge without being preprogrammed in the mind of the newborn. The folk psychological framework of Western adults is neither innate nor maturationally determined; it is fashioned by the child largely to account for his experiences with other persons. Children, like the adults who study them, start off with certain powerful assumptions, they experiment, and the theory they construct is deeply influenced by the evidence they receive. Our understanding of children and their understanding of us is not fixed by nature but cobbled together as we interact with each other.

REFERENCES

Astington, J. W., & Gopnik, A. (1991a). Developing understanding of desire and intention. In A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading* (pp. 39–50). Oxford: Basil Blackwell.

Astington, J. W., & Gopnik, A. (1991b). Theoretical explanations of children's understanding of the mind. *British Journal of Developmental Psychology, 9,* 7–31.

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

Baldwin, D. A. (1993a). Early referential understanding: Infants' ability to recognize referential acts for what they are. *Developmental Psychology, 29,* 832–843.

Baldwin, D. A. (1993b). Infants' ability to consult the speaker for clues to word reference. *Journal of Child Language, 20,* 395–418.

Baldwin, D. A., Markman, E. M., Bill, B., Desjardins, R. N., Irwin, J. M., & Tidball, G. (1996). Infants' reliance on a social criterion for establishing word-object relations. *Child Development, 67,* 3135–3153.

Baldwin, D. A., & Moses, L. J. (1994). Early understanding of referential intent and attentional focus: Evidence from language and emotion. In C. Lewis & P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development* (pp. 133–156). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bartsch, K., & Wellman, H. M. (1995). *Children talk about the mind.* New York: Oxford University Press.

Bruner, J. S. (1990). *Acts of meaning.* Cambridge, MA: Harvard University Press.

Damon, W. (1998). *Handbook of child psychology* (5th ed.). New York: Wiley.

Darwin, C. (1872). *The expression of the emotions in man and animals.* Chicago: University of Chicago Press.

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

Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development, 62,* 1352–1366.

Ekman, P. (1980). *The face of man: Expressions of universal emotions in a New Guinea village.* New York: Garland STMP Press.

Flavell, J. H., Flavell, E. R., Green, F. L., & Moses, L. J. (1990). Young children's understanding of fact beliefs versus value beliefs. *Child Development, 61,* 915–928.

Flavell, J. H., & Miller, P. H. (1998). Social cognition. In W. Damon (Series Ed.) & D. Kuhn & R. Siegler (Eds.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (pp. 851–898). New York: Wiley.

Fodor, J. A. (1987). *Psychosemantics: The problem of meaning in the philosophy of mind.* Cambridge, MA: MIT Press.

Gergely, G., Nádasdy, Z., Csibra, G., & Bíró, S. (1995). Taking the intentional stance at 12 months of age. *Cognition, 56,* 165–193.

Gopnik, A. (1996). The scientist as child. *Philosophy of Science, 63,* 485–514.

Gopnik, A. (1998). Explanation as orgasm. *Minds & Machines, 8,* 101–118.

Gopnik, A., & Meltzoff, A. N. (1994). Minds, bodies, and persons: Young children's understanding of the self and others as reflected in imitation and theory of mind research. In S. T. Parker, R. W. Mitchell, & M. L. Boccia (Eds.), *Self-awareness in animals and humans: Developmental perspectives* (pp. 166–186). New York: Cambridge University Press.

Gopnik, A., & Meltzoff, A. N. (1997). *Words, thoughts, and theories.* Cambridge, MA: MIT Press.

Gopnik, A., & Slaughter, V. (1991). Young children's understanding of changes in their mental states. *Child Development, 62,* 98–110.

Gopnik, A., Slaughter, V., & Meltzoff, A. N. (1994). Changing your views: How understanding visual perception can lead to a new theory of the mind. In C. Lewis & P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development* (pp. 157–181). Hillsdale, NJ: Lawrence Erlbaum Associates.

Gopnik, A., & Wellman, H. M. (1994). The theory theory. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 257–293). New York: Cambridge University Press.

Hadwin, J., & Perner, J. (1991). Pleased and surprised: Children's cognitive theory of emotion. *British Journal of Developmental Psychology, 9,* 215–234.

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

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

Jenkins, J. M., & Astington, J. W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology, 32,* 70–78.

Kagan, J. (1981). *The second year.* Cambridge, MA: Harvard University Press.

Meltzoff, A. N. (1988). Infant imitation and memory: Nine-month-olds in immediate and deferred tests. *Child Development, 59,* 217–225.

Meltzoff, A. N. (1990). Foundations for developing a concept of self: The role of imitation in relating self to other and the value of social mirroring, social modeling, and self practice in infancy. In D. Cicchetti & M. Beeghly (Eds.), *The self in transition: Infancy to childhood* (pp. 139–164). Chicago: University of Chicago Press.

Meltzoff, A. N. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Developmental Psychology, 31,* 838–850.

Meltzoff, A. N. (1996a, April). The role of imitation in developing a theory of mind. In P. D. Zelazo (Chair), *Intentionality: An interdisciplinary approach.* Symposium conducted at the meeting of the International Conference on Infant Studies, Providence, RI.

Meltzoff, A. N. (1996b, August). Understanding intentions in infancy. In A. Leslie (Chair), *Children's theory of mind.* Symposium conducted at the XXVI International Congress of Psychology, Montreal, Canada.

Meltzoff, A. N., & Gopnik, A. (1993). The role of imitation in understanding persons and developing a theory of mind. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from autism* (pp. 335–366). New York: Oxford University Press.

Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science, 198,* 75–78.

Meltzoff, A. N., & Moore, M. K. (1994). Imitation, memory, and the representation of persons. *Infant Behavior and Development, 17,* 83–99.

Meltzoff, A. N., & Moore, M. K. (1995). Infants' understanding of people and things: From body imitation to folk psychology. In J. Bermúdez, A. J. Marcel, & N. Eilan (Eds.), *The body and the self* (pp. 43–69). Cambridge, MA: MIT Press.

Meltzoff, A. N., & Moore, M. K. (1997). Explaining facial imitation: A theoretical model. *Early Development and Parenting, 6,* 179–192.

Meltzoff, A. N., & Moore, M. K. (1998). Object representation, identity, and the paradox of early permanence: Steps toward a new framework. *Infant Behavior and Development, 21,* 201–235.

Moses, L. J. (1993). Young children's understanding of belief constraints on intention. *Cognitive Development, 8,* 1–25.

Mumme, D. L., Won, D., & Fernald, A. (1994, June). *Do one year old infants show referent specific responding to emotional signals?* Poster presented at the meeting of the International Conference on Infant Studies, Paris, France.

O'Neill, D. K. (1996). Two-year-old children's sensitivity to a parent's knowledge state when making requests. *Child Development, 67,* 659–677.

Perner, J. (1991). *Understanding the representational mind.* Cambridge, MA: MIT Press.

Perner, J., Ruffman, T., & Leekam, S. R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development, 65,* 1228–1238.

Repacholi, B. M. (1998). Infants' use of attentional cues to identify the referent of another person's emotional expression. *Developmental Psychology, 34,* 1017–1025.

Repacholi, B. M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14- and 18-month olds. *Developmental Psychology, 33,* 12–21.

Searle, J. R. (1983). *Intentionality: An essay in the philosophy of mind.* New York: Cambridge University Press.

Shultz, T. R. (1980). Development of the concept of intention. In W. A. Collins (Ed.), *The Minnesota Symposium on Child Psychology* (Vol. 13, pp. 131–164). Hillsdale, NJ: Lawrence Erlbaum Associates.

Shultz, T. R., Wells, D., & Sarda, M. (1980). Development of the ability to distinguish intended actions from mistakes, reflexes, and passive movements. *British Journal of Social and Clinical Psychology, 19,* 301–310.

Slaughter, V., & Gopnik, A. (1996). Conceptual coherence in the child's theory of mind: Training children to understand belief. *Child Development, 67,* 2967–2988.

Stein, N. L., & Levine, L. J. (1989). The causal organization of emotional knowledge: A developmental study. *Cognition and Emotion, 3,* 343–378.

Taylor, M. (1996). A theory of mind perspective on social cognitive development. In R. Gelman & T. Au (Eds.), *Handbook of perception and cognition: Vol. 13. Perceptual and cognitive development* (pp. 283–329). New York: Academic Press.

Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. J. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103–130). Hillsdale, NJ: Lawrence Erlbaum Associates.

Tomasello, M., & Barton, M. E. (1994). Learning words in nonostensive contexts. *Developmental Psychology, 30,* 639–650.

Tomasello, M., Strosberg, R., & Akhtar, N. (1996). Eighteen-month-old children learn words in non-ostensive contexts. *Journal of Child Language, 23,* 157–176.

Wellman, H. M. (1990). *The child's theory of mind.* Cambridge, MA: MIT Press.

Wellman, H. M. (1993). Early understanding of mind: The normal case. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from autism* (pp. 10–39). New York: Oxford University Press.

Wellman, H. M., & Banerjee, M. (1991). Mind and emotion: Children's understanding of the emotional consequences of beliefs and desires. *British Journal of Developmental Psychology, 9,* 191–214.

Wellman, H. M., & Woolley, J. D. (1990). From simple desires to ordinary beliefs: The early development of everyday psychology. *Cognition, 35,* 245–275.

Wittgenstein, L. (1953). *Philosophical investigations* (G. E. M. Anscombe, Trans.). New York: Macmillan.

Yuill, N. (1984). Young children's coordination of motive and outcome in judgments of satisfaction and morality. *British Journal of Developmental Psychology, 2,* 73–81.