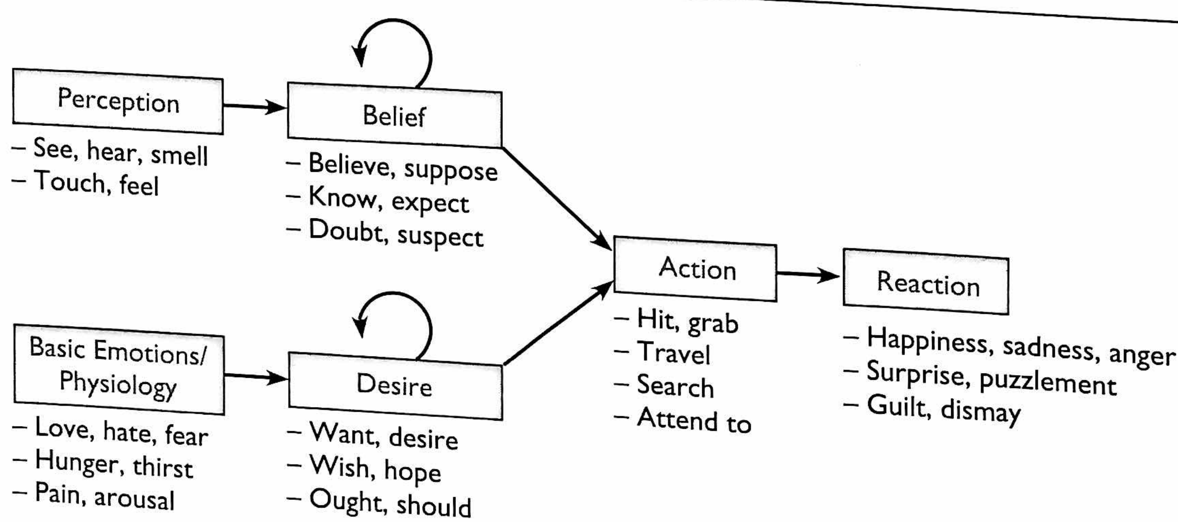
## FOLK PSYCHOLOGY: DEVELOPING A THEORY OF MIND

The topic of children's **theory of mind** has become immensely popular. In general, the term *theory of mind* is used to refer to children's developing concepts of mental activity. A theory of mind is more than just a collection of concepts, however. *Theory* implies some coherent framework for organizing facts and making predictions. Having a theory of mind implies recognizing different categories of mind, such as dreams, memories, imagination, beliefs, and so on, and having some causal-explanatory framework to account for the actions of other people (that is, to explain why someone behaves as he or she does). For example, Henry Wellman (1990) believes that adults' theory of mind is based on **belief-desire reasoning**. Basically, we explain and predict what people do based on what we understand their desires and beliefs to be—that is, by referring to their wants, wishes, hopes, and goals (their desires) and to their knowledge, ideas, opinions, and suppositions (their beliefs). Such belief-desire reasoning is depicted in Figure 6.1. Essentially, this is what researchers mean when they talk about children developing a theory of mind: To what extent do children have a coherent explanatory "theory" to understand, predict, and explain behavior?

Developmental differences in theory of mind are reflections of developmental differences in how children represent the world—in this case, the mental world. In fact, some of the research reviewed in Chapter 5 examining children's ability to distinguish between appearance and reality (Flavell, Green, & Flavell, 1986) or between imagining and experiencing (Harris et al., 1991) could properly be classified as theory-of-mind research (see Flavell & Miller, 1998).

FIGURE 6.1 **Children's perception of the world affects their knowledge, or beliefs, and their emotions influence their wants and desires.** Beliefs and desires, in turn, motivate one's actions. Children learn that such belief-desire reasoning not only describes their own behavior but also that of other people.




*Source:* Wellman, H. M. (1990). *The child's theory of mind.* Cambridge, MA: MIT Press. Copyright © 1990 Massachusetts Institute of Technology Press. Reprinted with permission.

The aspect of theory of mind that has spawned the most research, however, concerns children's abilities to "read the minds" of others (Perner, 1991; Wellman, Cross, & Watson, 2001). What we really mean is, to what extent do young children understand that the perceptions, knowledge, and thoughts of others may differ from their own? Children's representation of others and of themselves as thinkers is vitally important to our species' way of life. Adults make inferences about the minds of others all the time (although not always necessarily correctly). For instance, imagine you and a friend are walking in a downtown area when you pass by a cupcake shop. Your friend stops in his tracks, eyes the cupcakes through the window, and starts licking his lips. You likely infer that he wants a cupcake based on his behavior. Cooperation, competition, and social interaction in general would be radically different if we did not develop a theory of mind and the ability to "read" others' minds. We believe that one reason for the popularity of this topic is its significance for understanding the human condition. "Mind reading," however, is a relatively advanced aspect of theory of mind and is based on more basic social-cognitive abilities, which we examine in the following section.

## Basic Social-Cognitive Skills Underlying Theory of Mind

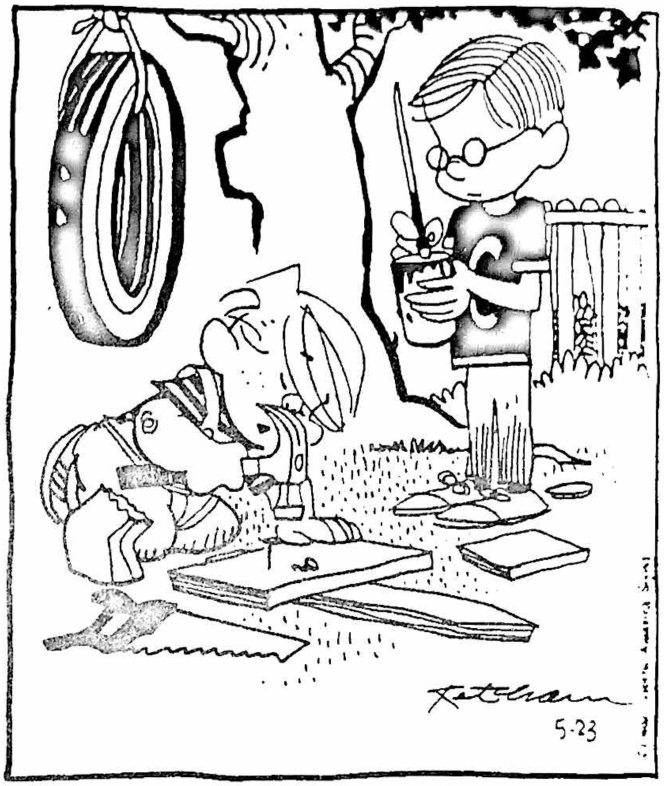
What are the most elementary social-cognitive abilities required for a theory of mind? The best candidates we believe are (a) viewing oneself and other individuals as **intentional agents**—that is, as individuals who do things on purpose or *cause* things to happen in an effort to achieve some goal (see Bandura, 2006; Tomasello & Carpenter, 2007)—and (b) the ability to take the perspective of another, which is to understand what the intentions of other people are (Machluf & Bjorklund, 2015).

Infants are not born with this knowledge; it develops over the first several years of life, beginning in infancy with **shared attention** (sometimes called *joint attention*) (Tomasello, 2009; Tomasello & Carpenter, 2007). Shared attention refers to the *triadic interaction* between two social partners (for example, an infant and her mother) and a third object (which can sometimes be another person). For instance, a mother may point or gaze at the family dog while catching her infant's attention, drawing the baby into a social relationship that extends beyond the mother-infant dyad. Although mothers (and fathers) may engage in this type of behavior from the earliest days of a baby's life, it takes infants a while to catch on, although they do seem to be oriented to social interactions from birth. For instance, neonates orient to the human face and quickly learn to seek their mothers' faces (Feldman & Eidelman, 2004).

Shared attention, however, is typically not seen in babies until about 9 months of age, when they will gaze in the direction adults are looking or pointing, engage in repetitive interaction with an adult and an object, imitate an adult's actions, and point or hold up objects to another person (see M. Carpenter, Nagell, & Tomasello, 1998; Tomasello, 2014). Pointing out distant objects is a form of *referential communication* and indicates the pointer understands that he or she sees something the observer does not. These abilities increase over the next year. For example, 12-month-olds will point to alert others about events they are not aware of (Liszkowski, Carpenter, & Tomasello, 2007), and from 12 to 18 months of age, infants use the eye gaze of others to achieve shared attention (Brooks & Meltzoff, 2002) and point to objects to direct an adult's attention to something that adult is searching for (Liszkowski et al., 2007). From 18 to 24 months of age, toddlers use eye gaze along with other directional cues, such as pointing and head orientation, for word learning and social referencing (Poulin-Dubois & Forbes, 2002). These findings indicate that beginning about 9 months of age, infants view other people as intentional agents, with this knowledge increasing over the next year or so (see Tomasello, 2009; Tomasello, Carpenter, & Liszkowski, 2007). Beate Sodian and Susanne Kristen-Antonow (2015) provide evidence consistent with the position that joint attention and referential communication are necessary skills in the development of more advanced forms of theory of mind. In their short-term longitudinal study, they assessed infants on a series of social-cognitive tasks from 12 to 50 months. They reported that 12-month-old infants' declarative pointing—intended to convey information about a target object and thus a form of referential communication—predicted children's performance on theory-of-mind tasks (false belief, discussed shortly) at 50 months.

Is there other evidence, independent of shared attention, that indicates more directly that infants and toddlers view others as intentional agents? Research on imitation indicates that babies are more likely to copy the behavior of a model when the model engages in the action on purpose as opposed to accidentally. (More is said about the development of imitation in Chapter 10.) For example, in research by Malinda Carpenter and her colleagues (M. Carpenter, Akhtar, & Tomasello, 1998), 14- to 18-month-old infants watched adults perform complex behavior sequences, some of which appeared to be intentional, as reflected by the model's vocal behavior, and others of which, based on what the models said, were accidental. When the infants were later given the chance to imitate the model, they reproduced twice as many intentional as accidental behaviors. One study even suggests that infants understand and selectively imitate a model's goal as young as 7 months (Hamlin, Hallinan, & Woodward, 2008). In other research, Andrew Meltzoff (1995) had 18-month-old infants watch as an adult performed actions on objects both successfully and unsuccessfully. For one task, a model picked up a dumbbell-shaped object and made deliberate movements to remove the wooden cube at the ends of the

*Knowing that someone else has thoughts and being able to infer those thoughts have important social and intellectual implications.*




"I KNOW WHAT I THINK, BUT WHAT'S IMPORTANT IS WHAT MY MOM THINKS I THINK!"

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dumbbell (successful condition). In the unsuccessful condition, toddlers watched as the model pulled on the ends of the dumbbell, but her hand slipped off the cubes, which stayed on the dumbbell. When the infants were later given the dumbbell, those who had watched both the successful and the unsuccessful demonstrations removed the ends of the dumbbell significantly more often than those infants in control conditions (who did not see a demonstration of the dumbbell). They seemed to understand what the model in the unsuccessful condition *intended* to do, and they imitated her behavior to achieve an inferred (but not witnessed) goal.

Eighteen-month-old infants also discriminate between intentional and unintentional actions of another person when deciding whether to render help. In a study by Felix Warneken and Michael Tomasello (2006), 18-month-old infants sat across a table from an adult who performed a series of tasks. The adult had difficulty performing the tasks, but in some cases it was obvious that the adult was trying to achieve a specific outcome (the intentional condition). For instance, in one task, the adult accidentally dropped a marker on the floor and reached unsuccessfully to retrieve it. In a control condition, the adult deliberately threw the marker on the floor. In another task, the adult attempted to place a book on a stack of other books, but it slipped and fell beside the stack. This was contrasted with a control condition, in which the person simply placed the book beside the stack. In 6 of 10 tasks, children helped the adult (for example, retrieved the marker, placed the book on top of the stack) more in the experimental than in the control condition, reflecting not only an understanding of another person's intention but a willingness to help (a form of altruistic behavior).

You may find it difficult to get too excited about infants and young children's abilities to share attention and attribute intention to others. These hardly appear to be high-level cognitive accomplishments. Yet nearly all forms of complex human social interaction start with the understanding that the people we are dealing with are intentional agents—that they do things on purpose and that they see us the same way. Treating others as intentional agents is a necessary, but not sufficient, condition for mind reading.

## Development of Mind Reading

When and how do children come to appreciate that other people have beliefs and desires, often different from their own, that motivate their behavior? To assess this question, researchers have developed tasks in which children must predict what another person will do or state, or what another person thinks, in an effort to determine what young children know about the minds of others.

### *False Belief*

The most frequently used tool to assess children's theory of mind is the **false-belief task**, first developed for use with chimpanzees (Premack & Woodruff, 1978). In a standard false-belief task (first used with children by H. Wimmer & Perner, 1983), children watch as candy (or some other treat) is hidden in a special location (in a cupboard, for example). Another person—for example, a puppet named Maxi—is present when the treat is hidden but then leaves the room. While Maxi is out of the room, the treat is moved from the cupboard to another container. When Maxi returns, will he know where the treat is hidden? The results of studies using variants of this standard task are relatively straightforward. Most 4-year-old children can solve the problem, stating that Maxi will look where the candy was originally hidden. Three-year-olds, in contrast, generally cannot solve the problem, stating that Maxi will look for the candy in the new hiding place, apparently not realizing that Maxi is not privy to the new information (Wellman et al., 2001). This pattern has been reported across the globe (Sabbagh et al., 2006; Tardif & Wellman, 2000), even among the children of Baka Pygmies living in the rain forests of Cameroon (Avis & Harris, 1991), although the timetable for passing false-belief tasks has been found to vary for children in different cultures (see, for examples, Mayer & Träuble, 2013; Shahaeian et al., 2011; Slaughter & Perez-Zapata, 2014; Wellman, 2011).

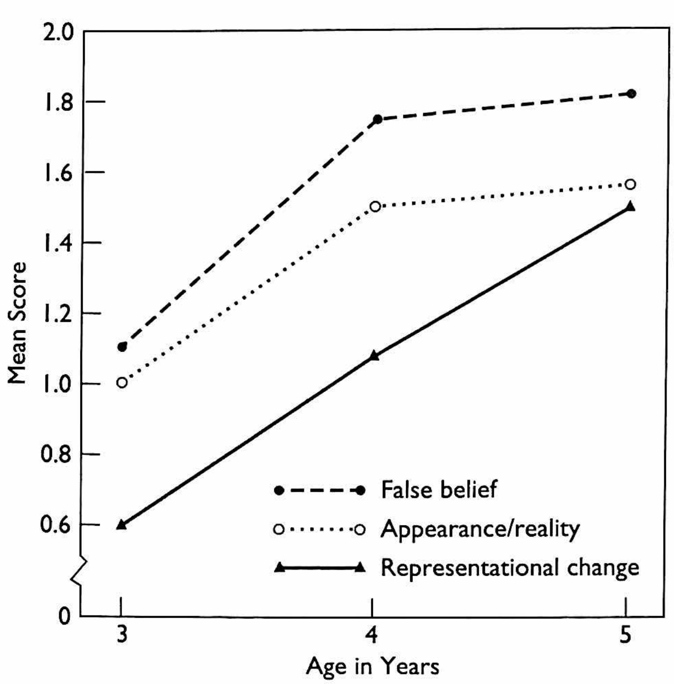
Why do 3-year-olds fail false-belief tasks? For one thing, they seem not to remember what they originally believed before any switch was made (A. Gopnik & Slaughter, 1991; Zelazo & Boseovski, 2001). For example, in a modification of the false-belief task, called the Smarties task, developed by G.-Juergen Hogrefe, Heinz Wimmer, and Josef Perner (1986), children are shown a box of Smarties (a type of candy in a distinctive box, with which British children are highly familiar) and asked what they think is in the box. Naturally, they say, "Smarties." The box is then opened, revealing not candy but pencils. Children are then asked what they originally thought (that is, what they believed was in the box before being shown the contents) and to predict what another child (who is not privy to the trick) will think is in the box. The first question assesses children's memory for their initial belief, whereas the second question assesses their ability to understand false belief. The correct answer to both of these questions, of course, is "Smarties," but most 3-year-olds say "pencils" to both questions—that is, they seem to forget their initial belief. Alison Gopnik and Virginia Slaughter (1991) found that this memory deficit is not a general one but is specific to beliefs (referred to as *representational change*). Three-year-olds have little difficulty remembering their past images, perceptions, or pretenses, but they have particular difficulty remembering their past beliefs.

If young children's problem with false-belief tasks is not one of general memory, what can account for their poor performance? Josef Perner (1991), among others, has proposed that 3-year-old children lack the conceptual structures necessary to solve problems dealing with beliefs. In other words, they have a *representational deficit* and do not possess a true theory of mind. One possibility along these lines, originally proposed by Heinz Wimmer and Perner (1983), is that young children have difficulty with contradictory evidence. They cannot deal with two representations of a single object simultaneously (the candy in Location 1 and in Location 2). This is similar to the *dual-encoding hypothesis* (or *dual-representation hypothesis*) John Flavell and Judy DeLoache proposed to explain representational differences between younger and older preschoolers discussed in Chapter 5. Basically, this position argues that young children will fail in situations where they must consider two different beliefs or representations for one target.

Support for this position comes from a study by Alison Gopnik and Janet Astington (1988), in which they assessed 3-, 4-, and 5-year-old children's performance on a series of tasks, each requiring the children to deal with contradictory evidence: false belief, appearance/reality distinction (Flavell et al., 1986), and representational change (remembering their past beliefs). The results of this study are graphed in Figure 6.2.

As you can see, performance on each of the three tasks varied with age, consistent with the idea that a single, domain-general mechanism underlies preschool children's representational abilities. This interpretation has received support from more recent research that showed that preschool children's performance on theory-of-mind tasks is associated with a variety of symbolic abilities (as reflected in language, pretend play, and understanding representations; Lillard & Kavanaugh, 2014).

FIGURE 6.2 **Scores on false-belief, appearance-reality, and representational change questions for 3-, 4-, and 5-year-olds.** Note the similar pattern of developmental change for each task.




*Source:* Gopnik, A., & Astington, J. W. (1988). Children's understanding of the representational change and its relation to the understanding of false belief and the appearance-reality distinction. *Child Development, 59,* 26–37. Copyright © 1988 The Society for Research in Child Development. Reprinted with permission.

Related to this interpretation is the idea that young children have a general lack of *executive function* (Carlson, Claxton, & Moses, 2015; R. T. Devine & Hughes, 2014; Perner & Lang, 2000). Executive function refers to the basic cognitive abilities involved in planning, executing, and inhibiting actions, which we discuss in greater detail in Chapter 7. From this perspective, rather than seeing young children's failure to solve false-belief tasks as a representational deficit, their failure results from an inability to regulate their own behavior. In other words, before children can display advanced levels of theory of mind, they must first develop some requisite, lower-level information-processing skills. Emma Flynn and her colleagues (2004) provided support for this hypothesis in a study in which 3-year-old children were tested on a battery of false-belief and executive-function tasks once every 4 weeks for six phases (24 weeks in all). They reported that most children performed well on the executive-function tasks *before* they performed well on the false-belief tasks. That is, having good executive control preceded and was necessary for successful performance on false-belief tasks. Executive function and measures of theory of mind continue to be related into middle childhood (R. T. Devine et al., 2016).

Of the various components of executive function related to theory of mind, inhibition mechanisms have received the most attention (Bjorklund & Kipp, 2002; Perner & Lang, 2000), and brain-imaging studies have established substantial neural overlap for both processes in specific prefrontal regions of the brain (Rothmayr et al., 2011). Cognitive inhibition refers to the ability to inhibit certain thoughts and behaviors at specified times. With respect to theory of mind, many tasks require children to inhibit a prepotent response if they are to "pass" the task. For example, Joan Peskin (1992) showed preschool children a series of stickers, some more attractive than others. She then introduced "Mean Monkey," a hand puppet controlled by the experimenter, who played a game with the children. Mean Monkey would ask the children which of the stickers they really wanted and which of the stickers they did not want; he then selected the children's favorite sticker, leaving them with the least desirable ones. By 4 years of age, children understood the dynamics of the interchange and quickly learned to tell Mean Monkey the opposite of their true desires. Younger children rarely caught on, however, and played most of the game telling Mean Monkey the truth and not getting the stickers they wanted. Similarly, in research by James Russell and his colleagues (1991), 3-year-old children were shown a series of windows, some of which had treats in them. To get the treat, the children had to select the nontreat window. Children had a difficult time doing this, and they repeatedly failed to get a treat, seemingly being unable to inhibit their "pick-the-treat" response.

What can we learn from these individual differences in 3- and 4-year-olds' performance on these tasks? In one study, David Liu and colleagues (2009) tested preschoolers on over two-dozen false-belief tasks. A close examination of the data revealed that not only did all children produce a mix of correct and incorrect answers, but they also provided a mix of explanations as to why Maxi, for instance, might be looking in the wrong place. Some reasoned that Maxi must not want his toy anymore, others said that Maxi doesn't know where it is, whereas others provided actual evidence of false-belief understanding, stating that Maxi "thinks his toy is there." Alison Gopnik and Henry Wellman (2012) interpret this variability as evidence that children are "sampling from a range of hypotheses" (p. 1098). Recall our discussion in Chapter 4 that infants and children might use Bayesian-like statistics to make probabilistic inferences about the world. According to this view, children's intuitive concepts of others' minds change as they continue to put forth "hypotheses," or explanations, and find evidence for or against these. As the evidence accumulates in favor of some explanations, for instance that others possess false beliefs, these explanations become more probable. And as a result, they are more likely to be sampled and confirmed in the future. In turn, other explanations become less probable (for instance, that Maxi doesn't want his toy anymore), and over time children test these less probable hypotheses less frequently. The development of theory of mind is much more continuous then, in contrast to Piaget's proposal that children develop in a stagelike fashion, with qualitative changes in thinking.

Do other factors contribute to individual differences in children's attainment of theory of mind? Research has found a host of factors that predict children's performance on these tasks, among them quality of attachment, parenting styles, and parent-child communication (Pavarini, de Hollanda Souza, & Hawk, 2013); language skills (Milligan, Astington, & Dack, 2007); and parental warmth and the extent to which parents use mental-state talk (that is, talking about what they and their children are thinking) (Lundy, 2013; Taumoepeau & Ruffman, 2008).

One interesting finding is that 3- and 4-year-old children's performance on false-belief tasks is related to family size (Jenkins & Astington, 1996; Perner, Ruffman, & Leekam, 1994). Children from larger families perform false-belief tasks better than do children from smaller families. Why should there be a relation between family size and theory-of-mind reasoning? One explanation has to do with the role of siblings. The type of interaction provided by siblings facilitates developing a sophisticated theory of mind. Jennifer Jenkins and Janet Astington (1996) showed that family size is particularly important for children with low linguistic skills. Apparently, having siblings can compensate for delayed language development in influencing performance on false-belief tasks. Subsequent research indicates that it is only having *older*, not younger, siblings that has a facilitative effect on theory-of-mind reasoning (Ruffman et al., 1998). Ted Ruffman and colleagues (1998) believe that having older siblings stimulates pretend play, which helps younger children represent counterfactual states of affairs, a necessary skill for solving false-belief tasks.

Although siblings may be important, they are not necessarily more effective tutors than adults. Charlie Lewis and his colleagues (1996) administered a series of theory-of-mind tests to 3- and 4-year-old children and found that the number of adults children interact with daily is the best single predictor of a child's performance on theory-of-mind tasks.

Denise Cummins (1998) suggested an alternative explanation based on dominance theory. Siblings are always competing for resources, with older siblings typically having the advantage because of their greater size and mental abilities. Younger children would be motivated to develop whatever latent talents they have to aid them in their social competition with their older siblings, and developing an understanding of the mind of one's chief competitor sooner rather than later would certainly be to the younger child's advantage. A similar argument can be made for interacting with older peers.

Despite the impressive demonstrations that most 3-year-old children cannot solve false-belief tasks, evidence that 3-year-olds do solve other tasks that seemingly require an understanding of other minds challenges the strong version of the representational-deficit hypothesis (see A. J. Caron, 2009). In one particularly interesting study, Wendy Clements and Josef Perner (1994) evaluated children's *implicit* understanding of false belief. In this study, children ranging in age from 2 years 5 months to 4 years 6 months were told a story about a mouse named Sam, who had placed a piece of cheese in a specific location (Location A) so that he could get it later when he was hungry. While Sam was sleeping, a mouse named Katie found the cheese and moved it to another place (Location B). When Sam woke up, he said, "I feel very hungry now. I'll go get the cheese." Children were then asked, "I wonder where he's going to look?" The answer most older children should give is Location A, where he originally hid it, whereas most younger children should say Location B, reflecting their lack of understanding of false belief. This is the standard, or *explicit*, false-belief task, and this was the pattern of results that Clements and Perner (1994) found. However, Clements and Perner also recorded where children *looked*, at Location A or Location B. This is an *implicit task*, requiring no verbal response and, presumably, no conscious awareness. Now all but the youngest children showed high levels of correct responding (that is, they looked at Location A). Figure 6.3 shows the average explicit and implicit understanding scores, based on children's performance on the tasks in this experiment. This finding has been replicated (Clements, Rustin, & McCallum, 2000; Garnham & Ruffman, 2001), and other studies, using looking time, spontaneous response tasks, and the violation-of-expectation paradigm, have suggested that infants as young as 7 months may have an implicit understanding of false belief (for a review, see Baillargeon, Scott, & Bian, 2016). In fact, an EEG experiment revealed that 6-month-old infants showed motor activation in the sensorimotor cortex when viewing an agent who falsely believed a box contained a ball, but they showed no motor activation when the agent falsely believed the box contained no ball. This suggests infants do more than *expect* what others believe, they actually *anticipate* others' behaviors based on this belief—for instance, that an agent would search for a ball when she falsely believed it was present but not when she falsely believed it was absent (Southgate & Vernetti, 2014). Others have shown that 3-year-olds successfully pass nonverbal versions of false-belief tasks and argued that verbal tasks disrupt children's effort to track a protagonist's perspective over the course of events (Rubio-Fernández & Geurts, 2012). Another study found that 18-month-olds' performance in an anticipatory-looking task, like that described by Clements and Perner (1994), was related to children's performance at 4 years old in tasks requiring children to predict another's behavior based on an understanding of false beliefs (Sodian, Kristen, & Licata, 2015). What these findings suggest is that by about 3 years of age, and perhaps younger, children have a well-developed *implicit*, or intuitive, understanding of false belief that exceeds their explicit (verbalizable) knowledge. However, much debate remains about how to interpret these findings. Some researchers argue these findings indicate that, before their second birthday, children understand the mental states of others and that toddlers "realize that others act on the basis of their beliefs and that these beliefs are representations that may or may not mirror reality" (Onishi & Baillargeon, 2005, p. 4). In contrast, others argue that infants' and toddlers' performance on these tasks can be explained by impressive statistical learning skills (see discussion of statistical learning and Bayesian statistical inference in infants in Chapter 4) and biases to attend to faces and motion (Ruffman, 2014).

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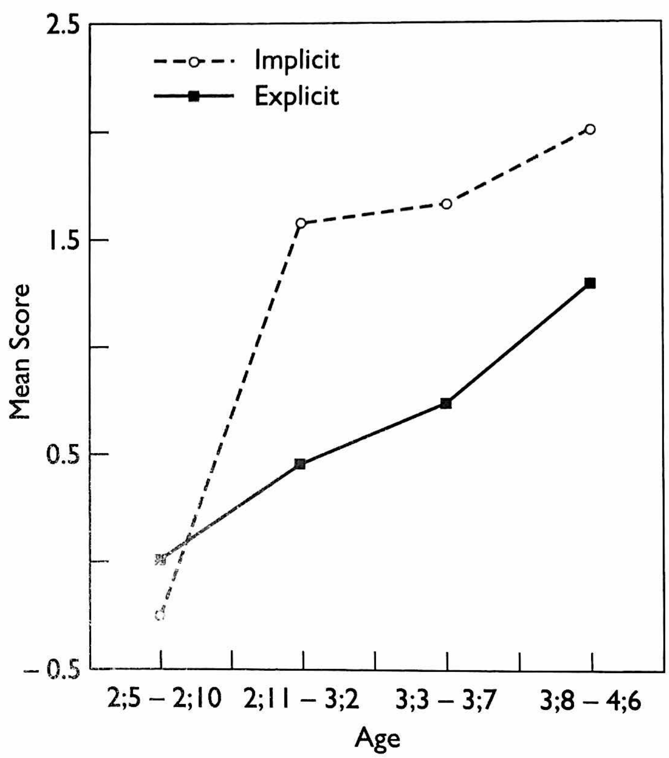
FIGURE 6.3 **Average implicit and explicit understanding scores on false-belief tasks by age.** Although most children much under 4 years of age could not correctly say where Sam the mouse would look to find the piece of cheese he had hidden earlier (explicit false-belief task), 3-year-old children *looked* in the proper location (implicit false-belief task), suggesting that they may have greater knowledge of false beliefs than they can verbalize.




*Source:* Clements, W. A., & Perner, J. (1994). Implicit understanding of belief. *Cognitive Development*, 9, 377–395.

## Deception

Another research area that has produced compelling evidence that young children have knowledge of the beliefs of other people concerns *deception*. Perhaps the consummate political skill, deception is useful in love, war, and poker games. In fact, some theorists have speculated that early hominins' abilities to deceive may have contributed significantly to the evolution of intelligence in our species (Bjorklund & Harnishfeger, 1995; Humphrey, 1976). But deception also reflects knowledge of other minds. However, if children are so self-centered in perspective that they assume that if they know something (for example, where an apple is hidden) then other people must know it too, they will see trying to deceive as fruitless. Deception is only reasonable when a person (the deceiver) of age use deception in a way that reflects mind reading (Peskin, 1992; Sodian et al., 1991). For example, Beate Sodian and her colleagues (1991) reported that 3-year-olds were just as likely to use a deceptive strategy whether they were asked to mislead a competitor or to help a collaborator (although Hala et al., 1991, reported evidence that 3-year-olds can use a deceptive strategy selectively). Subtle differences in the way the deception tasks are performed seem to make a big difference in whether children younger than 4 years use deception selectively or not.

Related to deception is lying. Perhaps not surprisingly, children's tendencies to tell lies (and the effectiveness of those lies) increase over the preschool years and are related to their improved executive function and theory-of-mind skills (Talwar & Crossman, 2011).

What can we make of the often-contradictory evidence concerning young children's theory of mind? There is actually much that the various researchers agree on. Three-year-olds seem to have a limited knowledge of other minds. In some circumstances, particularly involving deception or when implicit tasks are used, even 2.5-year-old children seem to be aware that they have knowledge not possessed by others. But young children's theory of mind, or belief-desire reasoning, is tenuous at best.

The findings we've discussed here suggest substantial continuity in early folk psychology. Indeed, Renee Baillargeon and colleagues (2016) have made the argument that we should forego the term *theory of mind* when referring to infants' ability to infer others' mental states and instead use the broader term *psychological reasoning*. Doing so underscores the similarities between the development of infants' folk theories across multiple domains, including psychology, physics, biology, and other core knowledge. It also frees us from the assumption that acquiring a theory of mind is some endpoint in psychological development, whereby an explicit form of knowledge replaces more implicit, intuitive forms. Intuitive psychological reasoning persists throughout the life span, just as theory testing does, and we are only at the beginnings of our understanding of its link to explicit psychological reasoning.

## Theory of Mind, Evolved Modules, and Autism

Some theorists have proposed that theory of mind evolved during the course of human evolution and is the basis of our social intelligence (Baron-Cohen, 1995; Leslie, 1994). The social complexity of human groups demands attention to the actions of fellow members, and having an idea of the beliefs and desires of others would provide a tremendous political advantage for anyone trying to predict the actions of other members of a group or of rival groups. Consistent with the premises of evolutionary psychology (see Chapter 2), many of the cognitive and brain mechanisms underlying theory of mind have been proposed to be domain specific and modular in nature rather than resulting from some domain-general ability. Thus, the theory goes, our ancestors developed specific skills relating to mind reading, and these skills are relatively independent of more general cognitive abilities. One modular-type account of theory of mind was presented by Simon Baron-Cohen (1995, 2005), who proposed two complementary systems of interacting modules involved in mind reading that develop during infancy and early childhood: (1) the *mindreading system* and (2) the *empathizing system* (see Table 6.2).

**TABLE 6.2 A description of Baron-Cohen's mindreading and empathizing systems of theory of mind.**

| | |
|---|---|
| **The Mindreading System** | |
| Intentionality Detector (ID) | Interprets moving objects as having some volition or intention. Develops by 9 months. |
| Eye-Direction Detector (EDD) | Detects the presence of eyes or eye-like stimuli, determines whether the eyes are looking toward it or toward something else, and infers that if an organism's eyes are looking at something, then that organism sees that thing. Develops by 9 months. |
| Shared-Attention Mechanism (SAM) | Involves triadic (three-way) interactions or representations, such as those that babies and their parents engage in during joint-attention episodes. Develops from 9 to 18 months. |
| Theory of Mind Module (ToMM) | Roughly equivalent to the belief-desire reasoning and reflected by passing false-belief tasks. Develops from 24 to 48 months. |
| **The Empathizing System** | |
| The Emotion Detector (TED) | Represents affective, or emotional, states between two people. Develops by 9 months. |
| The Empathizing SyStem (TESS) | Permits an empathic reaction of another person's emotions and assumes that there is an associated drive to help other people. Develops by 14 months. |

*Source:* Adapted from Baron-Cohen, S. (2005). The empathizing system: A revision of the 1994 model of the mindreading system. In B. J. Ellis & D. F. Bjorklund (Eds.), *Origins of the social mind: Evolutionary psychology and child development* (pp. 468–492). New York: Guilford.

## *The Mindreading System*

The earliest developing module in the mindreading system is the *Intentionality Detector (ID)*, which interprets moving objects as having some volition or intention. For example, an object that is moving toward an individual might be perceived as an agent with some intention toward that individual (for instance, it wants to harm me, to be near me). All animals that have nervous systems likely possess this very primitive skill, as do human infants by 9 months of age, if not younger. For example, in one study, 12-month-old infants watched a computer screen that depicted a ball repeatedly jumping over a barrier to land beside a ball on the other side (Csibra et al., 2003; Gergely et al., 1995). When adults see something like this, they attribute it to the ball "wanting" to jump the barrier to join the other ball. Infants apparently see this similarly. When the barrier was removed, the babies increased their looking time when the ball continued to jump, apparently surprised that it didn't just move straight across the screen to achieve its "intention" of getting to the other side.

The second module is the *Eye-Direction Detector (EDD)*, which has three related functions: (1) It detects the presence of eyes or eye-like stimuli, (2) it determines whether the eyes are looking toward it or toward something else, and (3) it infers that if an organism's eyes are looking at something, then that organism sees that thing. In other words, this module is responsible for our belief that knowledge is gained through the eyes (both ours and the eyes of others). According to Baron-Cohen (1995), this module also develops between birth and 9 months of age.

The third module in Baron-Cohen's mindreading system is the *Shared-Attention Mechanism (SAM)*. Whereas ID and EDD involve only two objects/individuals (that is, dyadic interactions/representations), SAM involves triadic (three-way) interactions/representations. These are the interactions that babies and their parents engage in during shared-attention episodes, and as noted previously, these abilities develop from about 9 to 18 months of age (Tomasello, 2009).

The final module, the *Theory-of-Mind Module (ToMM)*, is roughly equivalent to the belief-desire reasoning described earlier and is reflected by passing false-belief tasks. As we've seen in the research discussed in this section, this develops from the ages of about 24 to 48 months.

### The Empathizing System

More recently, Baron-Cohen (2005) updated his model, proposing that the mindreading system is accompanied in development by the empathizing system. In addition to ID and EDD, Baron-Cohen proposed a new, early developing mechanism, *The Emotion Detector (TED)*. According to Baron-Cohen, infants from an early age are sensitive to the emotions of others. The emotion detector can represent affective, or emotional, states between two people. For instance, an infant can represent the idea that "Mother is happy" or "Father is angry at me." Within their first 6 months of life, infants can detect another's emotional state through facial expressions or vocalizations, with infant-directed speech (see Chapter 9) being a particularly effective means by which infants pick up on the emotions of their mothers (or others). TED permits infants to detect the basic, or primary, emotions—for example, joy, anger, and sadness.

Beginning around 9 months, emotional information derived from TED can be converted into a triadic representation by SAM (just as information derived from EDD can be converted into a triadic representation). So, for example, infants who months before could represent the idea that "Mother is sad" can now represent the idea that "I'm sad that Mother is sad," or "Mother is sad that I am sad."

Beginning around 14 months of age, more than 2 years before the development of ToMM, *The Empathizing SyStem (TESS)* comes online. TESS permits an empathic reaction to another person's emotions and assumes that there is an associated drive to help other people. Baron-Cohen (2005, p. 473) illustrates the distinction between TESS and ToMM by using the following example: "I see you are in pain" requires ToMM. A child must use facial cues (perhaps) to infer the state of mind (in this case, pain) of another individual. In contrast, "I am devastated that you are in pain" requires TESS. The reactions of another individual trigger an empathic response and may cause children to act appropriately (for example, consoling the hurt person). This type of empathy is a secondary, or self-conscious, emotion, typically emerging late in the second year of life (M. Lewis, 1993). Baron-Cohen places the initial emergence of empathy as reflected by TESS a bit earlier, but all agree that the expression of empathy develops much earlier than theory of mind, as reflected by false-belief reasoning.

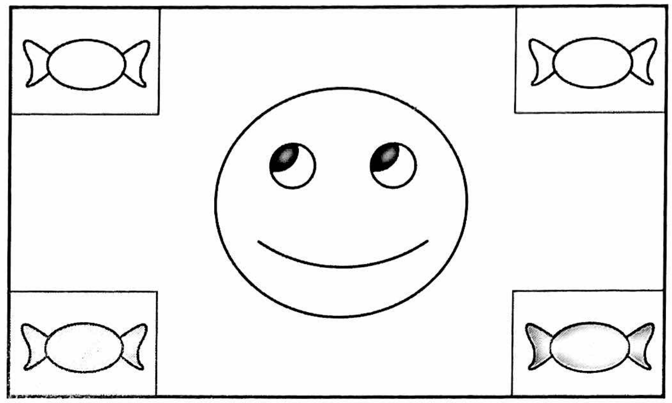
Baron-Cohen's proposal is that his various modules are specific to theory of mind and that they evolved to deal with the types of problems that are posed by having to cooperate and compete with other people. In other words, theory of mind is not a reflection of general intelligence. It is a set of mechanisms shaped by natural selection to handle the problems of living in a complex social world.

### Mindblindness

Baron-Cohen's primary source of evidence for his model is that the more advanced forms of mind reading (SAM and ToMM) and empathizing (TESS) are typically absent or significantly delayed in children with autism spectrum disorder (ASD), which is characterized by severe social and communication disabilities. Baron-Cohen (1995) claims that the primary deficit of these children is an inability to read minds, or what he calls **mindblindness.** Evidence for this comes from studies in which children with ASD are presented with false-belief and other theory-of-mind tasks and consistently fail them, despite performing well on other, nonsocial tasks. This is in contrast to children with intellectual impairment, such as Down syndrome, who perform the theory-of-mind tasks easily, despite often doing poorly on other tasks that assess more general intelligence (Baron-Cohen, Leslie, & Frith, 1985). Most children with ASD are able to perform well on the simpler tasks requiring ID, EDD, or TED modules, but they fail tasks involving SAM and, especially, ToMM and TESS. An example of this can be demonstrated using the very simple stimuli depicted in Figure 6.5, in a task known as the Charlie task (Baron-Cohen, 1995). When children are shown the picture of Charlie and asked, "Which candy is Charlie looking at?," both ASD and typically developing children identify the correct candy (in this case, the top left one). Answering this question requires EDD. However, when asked, "Which candy does Charlie *want*?," children with ASD are unable to answer correctly, whereas typically developing children can correctly infer Charlie's desires from Charlie's gaze. This question requires more than EDD, it also requires SAM and ToMM.

However, it is not just the more advanced forms of theory-of-mind abilities that children with ASD lack. For example, 3- and 4-year-old children with ASD perform significantly worse than typically developing children in social orientation, shared attention, attending to the distress of another, and attending to faces (Dawson et al., 2004; Hobson et al., 2006; Kikuchi et al., 2009). According to Baron-Cohen (2005) children with autism are unable to understand other people's different feelings and beliefs, and as a result, the world consisting of humans must be a confusing and frightening one, even for those children who are functioning at a relatively high intellectual level.

FIGURE 6.5 **Illustration of the Charlie task.** Typically developing and ASD children can correctly indicate where Charlie is looking (at the top left candy), but ASD children cannot answer the question, "Which candy does Charlie want?" whereas typically developing children 4 years and older are able to infer Charlie's desires from his gaze.



*Source:* Ward, J. (2015). *The student's guide to cognitive neuroscience* (3rd ed., p. 316). New York: Psychology Press.

## Extending Theory of Mind

As we've seen from our discussion so far, theory of mind seems to be based on two underlying abilities. The first is the tendency to view the actions of others as intentional, executed on purpose to achieve specific goals (that is, to view