COGNITIVE DEVELOPMENT: Children's Knowledge About the Mind

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ABSTRACT

This chapter reviews theory and research on the development of children's knowledge about the mental world, focusing especially on work done during the past 15 years under the rubric of theory-of-mind development. The three principal approaches to explaining this development—theory theory, modular theory, and simulation theory—are described first. Next comes a description of infant precursors or protoforms of theory-of-mind knowledge in infancy, including a beginning awareness of the intentionality and goal-directedness of human actions. This discussion is followed by a summary of the postinfancy development of children's understanding of visual perception, attention, desires, emotions, intentions, beliefs, knowledge, pretense, and thinking. Briefly considered next are intracultural, intercultural, and interspecies differences in theory-of-mind development. The chapter then concludes with some guesses about the future of the field.

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INTRODUCTION

Historically, there have been three main waves of research on the development of children's knowledge about the mind (Flavell & Miller 1998). The earliest stemmed directly or indirectly from Piaget's theory and research. Piaget believed that children begin development by being cognitively egocentric. That is, initially, they do not know that there exist such things as conceptual, perceptual, and affective perspectives. As a result, they naturally cannot know that they themselves have such perspectives, or that other people do, or that their own perspective may differ from those of others, or that they may be unwittingly reporting their own perspective when asked to report another person's. Even after children become aware of the existence of perspectives and perspective differences, they only gradually acquire skill in discriminating their own from other people's. Consistent with the Piagetian view, many studies since the 1950s have documented increases with age in various perspective-taking abilities (Flavell 1992, Shantz 1983).

The second wave comprises theory and research on children's metacognitive development, beginning in the early 1970s (Flavell et al 1993). Metacognition includes knowledge about the nature of people as cognizers, about the nature of different cognitive tasks, and about possible strategies that can be applied to the solution of different tasks. It also includes executive skills for monitoring and regulating one's cognitive activities. The majority of metacognitive studies have dealt with children's metamemory, especially their knowledge and use of memory strategies, but a large number have also investigated children's metacognition regarding language and communication, perception and attention, comprehension, and problem solving.

The third wave—theory-of-mind development—began in the 1980s and currently dominates the area (Astington 1993, Flavell & Miller 1998). Indeed, it could be argued that it almost dominates the whole field of cognitive development: Publications dealing with theory-of-mind development now number in the hundreds, and the flow shows no signs of diminishing. Consequently, virtually all of the theory and research cited in this chapter belong to this third wave. With the exception of one article by Wellman & Gelman (1992), no previous *Annual Review of Psychology* chapter has surveyed developmental theory and research in this area.

Most theory-of-mind studies have investigated children's knowledge about our most basic mental states—desires, percepts, beliefs, knowledge, thoughts, intentions, feelings, and so on. Theory-of-mind researchers try to find out what children know about the existence and behavior of the different types of states that inhabit the mind and also what children know about how mental states are causally linked to perceptual inputs, to behavioral outputs, and to other mental states. For example, do young children know what a false belief is, or do they know that unsatisfied desires typically cause negative feelings and renewed behavioral efforts to satisfy those desires?

The following is a well-known example of a developmental finding from the theory-of-mind research wave. An experimenter shows a 5-year-old a candy box with pictures of candy on it and asks her what she thinks is in it. "Candy," she replies. Then the child gets to look inside and discovers to her surprise that it actually contains crayons, not candy. The experimenter then asks her what another child who had not yet seen inside the box would think it contained. "Candy," the child answers, amused at the deception. The experimenter tries the same procedure with a 3-year-old. The response to the initial question is the expected "candy," but the response to the second is surprising—an unamused "crayons." Even more surprising is that in response to further questioning, the 3-year-old claims that she had initially thought that there were crayons in the box and had even said that there were (e.g. Gopnik & Astington 1988, Perner et al 1987). Similar developmental results are obtained with a different false-belief test. In this unexpected-transfer test, person A puts an object in box X and then departs. Person B moves the object to box Y during A's absence. When A returns, the question to the child subject is: Where will A search for the object—in X or in Y? Older preschoolers say X, younger ones say Y.

A frequent interpretation of this sort of finding has been that young preschoolers do not yet possess a mental representational conception of the mind. That is, they do not yet realize that people think and act in accordance with the way they represent the world mentally rather than the way the world actually is. Consequently, young preschoolers do not understand that people can believe to be true, and act in accordance with, a mental representation that does not correspond to reality—that is, a false belief.

THEORIES OF DEVELOPMENT

Theory Theory

Several types of theories have been proposed to explain the development of children's knowledge about the mind (Carruthers & Smith 1996, Flavell & Miller 1998, Gopnik & Wellman 1994, Moore 1996). One is the so-called theory theory (Gopnik & Meltzoff 1997, Gopnik & Wellman 1994, Perner 1991, Wellman & Gelman 1998). Theory theorists argue that our knowledge about the mind comprises not an actual scientific theory but an everyday "framework" or "foundational" theory. To constitute such an informal theory, they claim, a body of knowledge must have three properties. First, it must specify a set of entities or processes (an ontology, philosophers call it) that are found in its domain of application and not in other domains. Second, it must use causal principles that are likewise unique to the theory's domain. Finally, the body of knowledge must comprise a system of interrelated concepts and beliefs rather than just a collection of unrelated contents.

Theory theorists claim that our informal theory of mind satisfies all three of these conditions. First, entities or processes such as beliefs, desires, and thinking are found only in the domain of the mental and thus satisfy the ontological criterion. Second, psychological causality (she tried to get it because she wanted it and thought she could get it, etc) is also found only in the domain of the psychological; physical objects are not caused to move by such mental states. Finally, our knowledge about the mind is organized and richly interconnected with different mental states conceptualized as being causally linked to one another, to environmental input, and to behavioral output. As examples of these interconnections, we recognize that what we perceive influences what we think about and believe; that what we believe may bias what we perceive; that various mental and physiological states engender our desires; that beliefs and desires may lead to behavioral intentions, which in turn may lead to goal-directed actions; and that the success or failure of these actions will cause emotional reactions, which will in turn engender additional mental and behavioral activity.

Researchers have identified a number of steps or milestones in children's developmental itinerary toward the adult theory of mind. For example, Bartsch & Wellman (1995) presented evidence for the following three-step developmental sequence. First, around age 2, children acquire a *desire psychology.* This psychology includes an elementary conception not only of simple desires but also of simple emotions and simple perceptual experience or attention. The conception is elementary in that although mentalistic, it is nonrepresentational rather than representational. That is, the child understands that people are subjectively connected to things in the sense of having the inner experience of

wanting them, fearing them, seeing them, and so on, but the child does not yet understand that people mentally represent these things, accurately or inaccurately, as being a certain way. Second, around age 3, children begin to talk about beliefs and thoughts as well as desires, and they seem to understand that beliefs are mental representations that can be false as well as true and can differ from person to person. However, at this age they continue to explain their own and other people's actions by appeal to desires rather than beliefs. Bartsch & Wellman (1995) refer to this second level of understanding as a *desire-belief psychology.* Finally, at about age 4, children begin to understand that what people think and believe, as well as what they desire, crucially affects how they behave. That is, they acquire our adult *belief-desire psychology,* in which beliefs and desires are thought to determine actions jointly.

Theory theorists argue that experience plays a formative role in children's theory-of-mind development. They believe that experience provides young children with information that cannot be accounted for by their present theory of mind, information that will eventually cause them to revise and improve that theory. For example, desire psychologists will gradually become belief-desire psychologists by repeatedly seeing people behave in ways that require for their explanation a concept of belief as well as a concept of desire. Thus, the role of experience is viewed as similar to that in Piaget's equilibration theory (Piaget 1985): That is, experience engenders disequilibrium and, eventually, a new, higher state of equilibrium (a new theory).

Modularity Theory

Other theorists have different views about what gets acquired in theory-of-mind development and how. Modularity theorists like Leslie (1994, Leslie & Roth 1993) believe that young children are not acquiring a theory about mental representations at all. Rather, Leslie postulates the acquisition through neurological maturation of a succession of three domain-specific and modular mechanisms for dealing with agents versus nonagent objects. Although experience may be necessary to trigger the operation of these mechanisms, it does not determine their nature. The first mechanism, called Theory of Body mechanism (abbreviated ToBY), develops early in the first year. It allows the baby to recognize, among other things, that agents have an internal source of energy that permits them to move on their own. The next two, called Theory of Mind mechanisms (ToMM), deal with the intentionality or "aboutness" of agents rather than with their mechanical properties. $ToMM_1$, which comes into play later in the first year, will allow the infant to construe people and other agents as perceiving the environment and as pursuing goals. Finally, $ToMM_2$ begins to develop during the second year of life. This third mechanism allows children to represent agents as holding attitudes toward the truth of proposi-

tion—what philosophers refer to as *propositional attitudes.* Propositional attitudes are mental states such as *pretending that, believing that, imagining that, desiring that,* and the like. Equipped with ToMM2, children are able to compute that Mary is pretending that this empty cup is filled with tea, that John thinks that this candy box contains candy, and other propositional attitudes. Other theorists proposing innate or early maturing modular mechanisms dedicated to mental state computations are Fodor (1992), Mitchell (1994), and especially Baron-Cohen (1995).

Simulation Theory

Harris (1992) and others have proposed yet a third approach. According to their simulation theory, children are introspectively aware of their own mental states and can use this awareness to infer the mental states of other people through a kind of role-taking or simulation process. For example, in the false-belief task, children could predict what a naive other child would think the candy box contained by imagining or mentally simulating what they themselves would think if they were in his or her shoes and had only the appearance of the box to go on. What develops is the ability to make increasingly accurate simulations of this kind. Although not denying that people also resort to theories in predicting and explaining behavior, Harris (1992) stresses the importance of such mental-simulation processes in the acquisition of social-cognitive knowledge and skills. Like theory theorists, simulation theorists (e.g. Harris 1991) also assume that experience plays an important formative role, in that it is through practice in role taking that children improve their simulation skills.

Other Views

A number of investigators have argued that young children's failures on false-belief and other theory-of-mind tasks are due to more domain-general information-processing or "performance" (as contrasted with "competence") problems (Flavell & Miller 1998). Examples are limited memory abilities and the inability to inhibit a dominant, ready-to-go response; an example of the latter would be the tendency to blurt out the cognitively salient real contents of the candy box when asked for the naive child's belief about its contents (e.g. Carlson et al 1998). Other investigators try to explain young children's failures in other ways. For example, they claim that the tasks may be misunderstood by young children or may not be sufficiently engaging to elicit optimal performance (Flavell & Miller 1998).

As would be expected, advocates of these different theoretical positions have not failed to cite arguments and evidence for their own views and against those of their competitors. My judgment is that the theory theorists have been

the most persuasive in this regard so far (e.g. Gopnik & Wellman 1994). How-ever, it is also my judgment that an adequate theory will finally have to include elements from each of these perspectives; indeed, some of the theorists explic-itly allow for this possibility. That is, the following seem likely: (*a*) that devel-opment in this area builds on some innate or early maturing people-reading ca-pacities; (*b*) that we have some introspective ability that we can and do exploit when trying to infer the mental states of other creatures who are like ourselves but in a different psychological situation (e.g. ignorant of the facts, differently motivated); (*c*) that much of our knowledge of the mind can be characterized as an informal theory; (*d*) that improved information-processing and other abilities (e.g. linguistic skills) enable and facilitate theory-of-mind develop-ment (and certainly help children show what they know on theory-of-mind tasks); and (*e*) that a variety of experiences serve to engender and change chil-dren's conceptions of the mental world and their ability to use these concep-tions in predicting and explaining their own and other people's behavior.

DEVELOPMENTS DURING INFANCY

There recently has been a quickening of research interest in the infant begin-nings of theory-of-mind development (Flavell & Miller 1998). At least two questions are of interest. First, what behaviors do infants of different ages show that seem relevant to the development of knowledge about people? Sec-ond, how should these behaviors be interpreted? That is, exactly how much and what kind of knowledge about the mind (if any) should we attribute to in-fants who exhibit them?

Basic Discrimination Abilities

It is clear that infants are born with or acquire early a number of abilities and dispositions that will help them learn about people. They find human faces, voices, and movements particularly interesting stimuli to attend and respond to. They also possess and further develop impressive abilities to perceptually analyze and discriminate human stimuli.

In the case of faces, infants develop considerable skill in discriminating different facial expressions over the first 2 years of life, and there is reason to suspect that a component of the ability to recognize facial expressions is un-learned (Nelson 1987). Infants are also very attracted to people's eyes and de-velop the ability to follow another person's eye gaze (Butterworth & Jarrett 1991). This ability to use eye gaze to detect what another person is looking at makes it possible for the infant to initiate acts of joint visual attention with an adult, acts that will serve to improve the infant's communicative and other social-cognitive abilities.

In the case of voices, infants are highly attentive to voices from the beginning and can distinguish one voice from another. Incredibly, young infants have even been shown capable of distinguishing their mother's voice from another woman's based on prenatal, intrauterine auditory experience with her voice (Cooper & Aslin 1989). Young babies also have an unlearned ability to hear fine differences between consonant sounds and to perceive them categorically (Kuhl 1987).

Regarding motor movements, studies by Meltzoff and others (e.g. Meltzoff & Moore 1994) have shown that, remarkably, even newborns seem able to perceptually represent and imitate another person's movements (though more conservative interpretations of the results are possible, e.g. Anisfeld 1991). For example, the neonate will imitatively stick out its tongue after it has seen an adult do this. Older infants apparently can tell when they are being imitated and prefer to attend to adults who imitate them (Meltzoff 1990). Babies are also capable of other feats of intermodal perceptual representation involving people. For instance, by the middle of the first year of life they can apparently match a happy voice with a happy face, and a parent's voice with that same parent's face.

All this intense and differentiated responsiveness to people must serve the infant's social-cognitive development. If one wanted to design an infant who would learn much about people, one would obviously want to start by making it deeply interested in and attentive to them. One would also want to design it so that its appearance and behavior would cause adults to interact with it, and by doing so provide additional evidence as to what people—both the adults and the infant—are like. Human infants do indeed seem to be built with these two developmentally useful properties. They are impelled to attend to and interact with other people, and they impel other people to attend to and interact with them.

There is evidence that infants respond differently to people than they do to objects and seem to expect people to behave differently than objects do (Golinkoff 1983, Legerstee 1992, Spelke et al 1995). For example, Legerstee (1991) found that 5- to 8-week-old babies would imitate mouth openings and tongue protrusions produced by an adult but would not imitate similar-looking behaviors produced by an object. Likewise, infants try to retrieve a just-disappeared object by reaching toward its place of disappearance but try to retrieve a just-disappeared person merely by vocalizing to the person (Legerstee 1992). They also tend to act more surprised when an inanimate object seems to move entirely on its own, with nothing pushing it, than when a person does (Golinkoff 1983, Poulin-Dubois & Shultz 1988, Spelke et al 1995). In summary, fairly early on, infants come to construe people as "compliant agents" (Flavell et al 1993:184): that is, entities that are self-propelled and capable of

independent movement (agents) but also influenceable at a distance by communicative signals (compliant).

Understanding "Aboutness"

As just described, early in the first year, babies begin to learn how people *differ* from objects. Late in the first year, they begin to learn how people *relate* to objects psychologically. Philosophers have noted that people and other animates are related to objects in ways that other objects are not. This special relation is called "aboutness" or "intentionality" (intentionality in a broad sense—not just in the narrow sense of "on purpose"). A person's behavior is "about" an object in this sense if the person perceptually attends to it, labels it, thinks about it, wants it, fears it, intends or tries to get it, or relates to it in any other psychological way.

Infants do a variety of things that reflect a dawning awareness of intentionality or some precursor thereof. They attempt to engender new "aboutnesses" in others through various communicative gestures, and they also check to see whether their attempts have succeeded. For example, they may look at, point to, hold up, or vocalize about an object or event and check to see whether the other person looks at, comments on, or otherwise responds to it (Bates 1976). They also develop skill at reading the aboutnesses the other person already has going. As one example, we have already noted that babies become able to follow another person's direction of gaze and thereby succeed in looking at what the person is looking at. This state of joint attention, in which baby and adult achieve a common cognitive focus, is of course requisite for all communication and communication development. Recent studies by Meltzoff (1995) have also shown that 18-month-olds can infer what action another person is trying to perform (e.g. trying to pull one object away from another object to which it is attached), even though the person is unsuccessful in the attempt (does not succeed in pulling it away) and therefore never actually demonstrates the intended action. This finding suggests that infants of this age may have some beginning understanding that people's actions are intentional and goal-directed.

Research reported by Spelke et al (1995) further suggests that 12-month-olds expect a person to reach for an object that the person is looking at with positive affect rather than for another one to which the person is not attending. By age 18 months, infants even seem to understand that they should give an experimenter a food that the experimenter reacts to with apparent happiness rather than one toward which the experimenter acts disgusted, even when they themselves prefer the latter food; in contrast, 14-month-olds do not show this understanding (Repacholi & Gopnik 1997). This finding appears to be the first empirical evidence that infants of this age have at least some limited ability to reason nonegocentrically about people's desires.

Infants also learn the names for things by noting what object the adult appears to be attending to when the adult says the label (Baldwin & Moses 1994, Tomasello 1995, Woodward & Markman 1998). For example, Baldwin (1991, 1993; Baldwin & Moses 1994) showed that infants of 19–20 months of age sense that the verbal label an adult utters refers to the object the adult shows clear signs of attending to at that moment. They recognize that it does not refer to other perceptually salient objects that the adult is not focused on, such as an object that they rather than the adult is currently attending to. In short, infants of this age seem to recognize that it is the adult's attentional focus rather than their own that gives clues as to the adult's referential intent.

As just noted, infants develop the ability to learn what an object is *called* by reading the adult's attentional focus when the adult labels it. They also develop the ability to learn what an object is *like* by reading the adult's attentional focus when the adult is expressing a positive or negative emotional reaction to it; for example, they may tend to avoid an object toward which their parent shows negative affect. Thus, they can recognize that the adult's emotional display refers to or is "about" a particular object just as they can recognize that the adult's spoken label refers to or is "about" a particular object. Seeking or using information about objects' positive or negative qualities conveyed by adults' emotional reactions to these objects has been called *social referencing.* One question that has arisen in the social referencing literature is whether the baby actually realizes that the adult's expressions of affect are about the object. An alternative possibility is that these expressions just alter the baby's mood, which in turn alters the baby's reactions to all objects, for instance, dampening them when the mood thus induced is negative. However, recent studies suggest that although such mood modification effects also can occur, by 12 months or so infants are capable of understanding that the adult's behavior is about the object the adult is attending to when expressing the positive or negative affect (Baldwin & Moses 1994, Hornik et al 1987, Mumme et al 1994).

Other Competencies

Older infants also do other things suggestive of a beginning understanding of human psychology. They sometimes appear to be trying to manipulate other people's emotional responses rather than, as in social referencing, just reading these responses for the information about reacted-to objects that they may provide. Even toddlers occasionally seem to try to change other people's feelings, or at least change their affective behavior. In the second year of life, they begin to comfort younger siblings in distress by patting, hugging, or kissing them, and they may even bring a security blanket to an adult in pain (Zahn-Waxler et al 1992). Less positively, young children sometimes tease or otherwise annoy siblings, as though hoping to frustrate or anger them (Dunn 1988). Such behaviors, positive or negative, are revealing, for they suggest that young children

are beginning to identify the conditions that elicit or change emotions or be-
haviors.

Around 1.5 to 2 years of age, children may also begin to evince a more ex-
plicit understanding of certain mental states by using words that refer to them
(Bartsch & Wellman 1995, Bretherton & Beeghly 1982, Wellman 1993). The
states most commonly talked about at this early age are seeing ("I see a car"),
wanting ("Want juice"), and reacting emotionally ("Those ladies scare me")
(Wellman 1993). Older infants likewise show signs of having acquired at least
the beginnings of a self concept (Harter 1998).

Problems of Interpretation

It is apparent from the foregoing review that infants show a number of behav-
iors that seem relevant to the development of knowledge about people. As
Baldwin & Moses (1994), Moore & Corkum (1994), and others have pointed
out, however, there is considerable disagreement in the field as to how richly
or generously these behaviors should be interpreted. Do the available findings
indicate that infants actually represent people as having inner mental states or
do they merely show that infants represent various regularities in people's
overt behaviors? Many investigators are relatively generous in their interpreta-
tions here, crediting infants with at least some genuine understanding of some
mental states, whereas others are more cautious, preferring leaner, less mental-
istic explanations of infants' actions (Flavell & Miller 1998). To illustrate the
latter stance, several theorists have argued that social behaviors such as joint
visual attention, social referencing, and various communicative acts should
not be taken as evidence that 1-year-olds have any sort of theory of mind (But-
terworth & Jarrett 1991, Moore & Corkum 1994). For example, they argue that
behaviors such as showing objects to people and checking to see if the people's
eyes orient toward those objects do not warrant the inference that infants are
actually aware that people have seeing experiences and mentally attend to ob-
jects (see also Perner 1991). Although such behaviors may constitute develop-
mental stepping stones to an eventual awareness of mental states, according to
these authors they do not attest to the present existence of any such awareness
in the 1-year-old.

It is easy to be sympathetic with such lean interpretations. They seem scien-
tifically parsimonious, and they appeal to familiar, general-purpose learning
mechanisms rather than to mysterious inborn sensitivities to mental states or
the like. Moreover, a convincing case can be made that infants would not
necessarily need to be aware of people's mental states to do many of the social-
cognitive things that they do (Perner 1991). For example, they would not actu-
ally have to realize that their mother felt afraid of an object in order for them to
learn to avoid it in cases of social referencing. They would only have to read
her visible expressions of fear as meaning "this object is dangerous," some-

thing they could have learned through some conditioning process. That is, the received message could be all about the object rather than about both the object and her inner subjective feelings regarding it. Likewise, infants could respond appropriately in many situations if they could merely predict people's overt behavior from their gaze direction. They would not actually have to be aware that the people are also having perceptual and cognitive experiences as their eyes move about (Moore & Corkum 1994).

On the other hand, a case could be made that we ought not to be overly stingy in our interpretation of infants' behavior in this domain, even when—as is usually the case—a knock-down argument for a rich interpretation cannot be made. If our pet puppy looks as though it is attributing seeing and other mental states to us, we are right to interpret that look stingily, because it is not clear that even adult dogs make such attributions. A similar argument for parsimony may even be made for more humanlike creatures such as chimpanzees (Povinelli & Eddy 1997). In contrast, older human infants who show a similar look are undeniably going to be making genuine mental state attributions in a few short months. Given that fact, it is not unreasonable to suppose that they might be doing some precursor or early version of the same thing now. Indeed, theory theorists, modularity theorists, and simulation theorists have all made the argument that it would be hard to imagine how infants could learn to make mental state attributions later if *wholly* incapable of anything like it earlier. In the case of older children, developmentalists have often argued correctly that subjects who look as though they lack a certain understanding in task situations (e.g. of false belief, of conservation of quantity) may nevertheless "really" possess that understanding, down deep. Real competence often lurks beneath apparent lack of competence, they say. In the present case, in contrast, the parsimoniously inclined are wont to deny genuine social-cognitive understanding to infants who look as though they *possess* it rather than lack it. The present argument, then, is that if infant members of a mind-reading species give us the strong feeling that they are doing some kind of mind reading, they probably are.

A final argument for some charity in interpretation here is that older infants do not do just one or two things suggestive of a mentalistic conception of others. Rather, they do a variety of things, all of which point to the dawning of some such conception (Baldwin & Moses 1994, Tomasello 1995, Wellman 1993): "For example, around this age important developments take place in areas as diverse as pretence . . . , self-recognition . . . , imitation . . . , empathy . . . , and internal state language . . . , suggesting that infants may have already achieved some general conceptual insight into the minds of others" (Baldwin & Moses 1994:150).

It is worth emphasizing, however, that all of us who labor in this area—rich and lean interpreters alike—would happily trade all our arguments for better

empirical evidence on the matter. The truth is that we really do not know what infants actually impute to themselves and others in the way of mental states and subjective experiences.

LATER DEVELOPMENTS

A vast literature has accrued since the early 1980s on postinfancy developments in the theory-of-mind domain. What follows is a brief summary of what seems to get acquired and when, organized by type of mental state. Most specific references are omitted in the interests of saving space; for many of the primary sources, see reviews by Astington (1993), Bennett (1993), Flavell & Miller (1998), Forguson (1989), Lewis & Mitchell (1994), Mitchell (1997), Perner (1991), Taylor (1996), and Wellman & Gelman (1998).

Visual Perception

It is clear that by the end of infancy, if not earlier, children have some understanding that people see things. They start using vision-related words like "see" correctly as early as 1.5 to 2 years of age. During the early preschool period, they understand that a person will see an object if and only if the person's eyes are open and aimed in the general direction of the object and if there are no vision-blocking obstacles interposed between the person and the object (Flavell 1992). With this understanding, they are able to do simple, nonegocentric visual perspective-taking; for example, they can infer that you may see something that they do not and vice versa (referred to as Level 1 knowledge about visual perception). Later in the preschool period, they go on to recognize that the same thing may present different visual appearances to two people if they view it from different positions (called Level 2 knowledge about visual perception).

Attention

As already described, infants come to understand that people show by their gaze direction and other actions that they are psychologically connected to various objects and events in the world. In this sense, infants could be said to have at least a rudimentary understanding of attention. In subsequent years, children go on to acquire, in greater or lesser degree, at least the following four facts about attention (Fabricius & Schwanenflugel 1994, Flavell et al 1995a, Pillow 1995). First, attention is selective; people do not attend to everything that is in their field of vision or within earshot. Second, attention entails constructive processing of what has been attended to; different people may mentally represent the same perceptual input differently. Third, attention is limited; people can attend to only a very limited number of things at the same time. Fourth, stimuli can be responded to at different levels of attention or awareness. For example, when a videotaped sleeping person stirs in response

to a light touch but does not wake up, older children and adults are inclined to believe that the sleeper "sort of" felt it but did not consciously think that he or she had been touched; in contrast, kindergartners tend not to make this distinction, usually saying that the person would experience the conscious thought as well as the low-level feeling (Flavell et al 1998).

Desires

Children seem to show some awareness of the mental state of desire by the end of infancy; recall the study by Repacholi & Gopnik (1997) cited in the "Developments During Infancy" section. Children also begin to use some desire terms appropriately by age 1.5 to 2 (Bartsch & Wellman 1995). By age 3 they tend to grasp simple causal relations among desires, outcomes, emotions, and actions—suggestive evidence that they are developing something like an implicit theory. That is, they seem to recognize that people will feel good if they get what they want and feel bad if they do not, and they seem to understand that people will quit searching if they find the desired object they have been looking for but keep searching if they do not.

Emotions

The use of emotion-descriptive language begins late in the second year and increases rapidly during the third year (Bretherton & Beeghly 1982, Wellman et al 1995). Words such as *happy, sad, mad,* and *scared* are among the first to appear. Here is a sample of 2-year-olds' sagacity concerning emotions: "Santa will be happy if I pee in the potty" (Bretherton & Beeghly 1982:913). Although we do not know yet whether infants actually impute inner feelings to people who display emotions (see the work on social referencing cited in the "Developments During Infancy" section), it seems certain that young preschoolers "evidence an understanding of emotions as experiential states of persons, as distinguished from the actions (e.g., hitting) and expressions (e.g., smiling) that emotions cause, and they distinguish between the subjective emotional experiences of different individuals" (Wellman et al 1995:118). In subsequent years children come to understand subtler and more complex things about emotions: for example, that people do not always really feel what they appear to feel, that people's emotional reactions to an event may be influenced by earlier emotional experiences to similar events or by their current mood, and that people can experience two conflicting emotions more or less simultaneously (Flavell & Miller 1998).

Intentions

Developing the concept of an intention is highly significant for at least two reasons. First, it clarifies how people differ from other objects; human behavior,

unlike that of other objects, is driven by intentions and goals. Second, children must draw on the intentional-unintentional distinction to understand personal responsibility and morality. As mentioned earlier, there is evidence that infants come to construe people as agents, that is, as animate beings that, unlike inanimate objects, can move and behave under their own steam; in addition, we have seen that older infants seem able to recognize what a person is trying to do even if the person does not succeed in doing it (Meltzoff 1995).

Shultz (1991) argues that children elaborate their early, possibly innate, concept of agent into the concept of intentions. The latter goes beyond notions of agency and animacy by positing an internal mental state that guides behavior. People not only *can* act, they deliberately *plan* to and *try* to act. By age 3, children may have some ability to distinguish intended actions from nonintentional behaviors such as reflexes and mistakes (Shultz 1980). For example, when 3-year-olds in Shultz's study tried to repeat a tongue twister (e.g. "She sells sea shells by the sea shore") but made errors, they reported that they did not mean to say the sentence wrong. By age 4 or 5 they are able to distinguish intentions from desires or preferences and from the outcomes of intentional actions (Astington 1993, Astington & Lee 1991, Moses 1993, Schult 1996). For example, unlike 3-year-olds, they recognize that a person who tried to get object A but chanced to obtain the more desirable object B instead nevertheless originally intended to get A rather than B (K Abbott, PP Lee, JH Flavell, unpublished data). Children also come to appreciate psychological causes of behavior other than intentions: emotions, motives, abilities, percepts, knowledge, beliefs, and personality traits. In addition, research by Schult & Wellman (1997) has shown that even 3- and 4-year-old children distinguish appropriately between psychological states (e.g. beliefs and desires), biological processes (e.g. reflexes), and physical forces (e.g. gravity) as possible causes of human actions and movements.

Beliefs and Related Mental Representations

There have been a great many investigations of children's developing understanding of "serious" mental representations, that is, nonpretense mental states meant by their owners to portray reality accurately (Flavell & Miller 1998). The majority of these have dealt with children's comprehension of representations that differ from person to person or differ from reality. Principal examples are studies dealing with the appearance-reality distinction (perceptual appearance versus reality), Level 2 knowledge of visual perception (perceptual appearance of something from one position versus another), interpretation and constructive processing, deception, and, most studied of all, false belief. Recall from the Introduction that 3-year-olds tend to fail false-belief tests and that 4- and 5-year-olds tend to pass them; the same is true for tests of Level 2 knowledge of visual perception.

Similar developmental trends are usually seen when children's ability to think about the appearance-reality is assessed—another case in which an erroneous mental impression is pitted against a known reality. For example, after pretraining on the appearance-reality distinction and associated terminology, subjects may be presented with a sponge made to look like a rock or a little object that looks big when viewed through a magnifying glass (Flavell et al 1986). After discovering each object's true identity or property, subjects are asked how the object currently appears to their eyes (rock; big) and how or what it really and truly is (sponge; little). The usual finding is that 3-year-olds tend to give the same answer to both questions, reporting either the appearance twice or the reality twice, as though they do not distinguish conceptually between the misleading perceptual appearance and the underlying reality. In contrast, children of age 4 and older typically show some command of the distinction. As just noted, the distinction between perceptual appearance and reality is conceptually very similar both to the distinction between false belief and reality and to the Level 2 distinction between two different perceptual appearances resulting from different observer perspectives. Consistent with this fact, there is some correlational evidence that these distinctions tend to develop together; that is, young children who perform well (or poorly) on appearance-reality tasks also tend to perform well (or poorly) on false-belief tasks, Level 2 visual perspective-taking tasks, and other conceptually related measures (Flavell & Miller 1998, Taylor & Carlson 1997; but see Slaughter & Gopnik 1996). However, exactly what false-belief and appearance-reality tests measure remains the subject of considerable controversy; some researchers (including me) believe they measure the child's developing understanding of mental representation, albeit imperfectly, but others disagree.

Finally, children's knowledge about mental representations clearly continues to increase after the age of 4. In particular, not until middle childhood and later do children appear to gain any appreciable understanding of the mind as an interpretive, constructive processor (Carpendale & Chandler 1996, Fabricius & Schwanenflugel 1994, Pillow 1995, Taylor 1988, Wellman & Hickling 1994). For example, recognizing that the way people interpret an ambiguous event may be influenced by their preexisting biases or expectations seems to be a middle-childhood rather than an early childhood insight (Pillow & Henrichon 1996).

Knowledge

By the end of the preschool period, children appear to have acquired some important truths about the mental state of knowing (Flavell & Miller 1998, Montgomery 1992, Perner 1991, Taylor 1996). They realize that the word *know* expresses more speaker certainty than *think* or *guess* and is a surer guide

to the true state of affairs. Unlike young preschoolers, young elementary school children are good at knowing how and when they came to know some recently acquired fact, for example, by witnessing it firsthand rather than by hearing about it from someone else. Although young preschoolers may have some minimal understanding of knowing (O'Neill 1996), in general they seem to have only a hazy conception of what it means for someone to know something and about how knowledge is acquired (Taylor 1996). Surprisingly, even 4- and 5-year-olds will blithely claim that they have always known information that they have just learned during the experimental session (Taylor et al 1994). In the late preschool and middle-childhood periods, children discover that to acquire knowledge through exposure to perceptual information, that information has to be adequate as well as merely present. In contrast to younger children, for example, they realize that one cannot know an object's color merely by feeling the object, that one often cannot be certain of an object's identity when only a little bit of it is visible, and—as mentioned in the previous paragraph—that one's interpretation of an impoverished or ambiguous perceptual input may be influenced by one's biases or expectations.

Pretense

The development of pretend-play skills during early childhood has been studied for many years. Only recently, however, has it been viewed as part of the development of children's knowledge about the mind, thanks largely to an important analysis by Leslie (1987). According to Leslie (1987, 1994), the maturation of a modular theory-of-mind mechanism, ToMM$_2$ (see the "Theories of Development" section), permits the 18- to 24-month-old to engage in pretend play and to understand as pretense the pretend actions of others. This *metarepresentational* capacity, as Leslie calls it, prevents the child from being confused when, for example, someone pretends that a banana is a telephone. It does so by *decoupling,* or quarantining off cognitively, the temporary pretend identity of the banana (telephone) from its permanent real identity (banana). The child can then compute the relation: "This person is pretending that this banana is a telephone." Leslie's idea that the ability to understand pretense and the ability to understand false-belief and other mental states are mediated by a common, early maturing metarepresentational or theory-of-mind mechanism is certainly plausible on its face. "Pretending that" and "believing that" are both propositional attitudes. Moreover, both are understood by adults as being mental representations or construals of something as being a certain way—either for real (belief) or just temporarily, for play purposes (pretense). Nevertheless, Leslie's claim is currently very controversial, and there are arguments and evidence both for it and against it.

One argument against this claim is the roughly two-year age gap between children's comprehension of pretense and their comprehension of false-belief, deception, appearance-reality, and Level 2 perceptual perspectives. If understanding of pretense and understanding of false belief are both mediated by Leslie's ToMM$_2$, then why does the former appear so much earlier in childhood than the latter? Although Leslie and others have argued that performance obstacles explain the late display of false-belief understanding on standard tests, it is hard for most of us to believe that 2-year-olds really do understand false belief.

Another possible problem is that 2-year-olds and even older children may lack a fully mentalistic conception of pretense as well as belief (Harris 1994; Lillard 1996, 1998c; Perner 1991). Lillard has provided some striking experimental support for this possibility. One of her methods (Lillard 1993) was to present children with, for example, a doll named Moe who knows nothing at all about rabbits but chances to be hopping like one. The children were then asked if Moe was or was not pretending to be a rabbit. The majority of the 4-year-olds and even many 5-year-olds claimed that Moe was indeed pretending to be a rabbit, despite their having agreed that he did not know how rabbits hop. She has further demonstrated (Lillard 1996) that many children of this age classify pretense with physical activities, such as clapping one's hands, rather than with mental activities, such as thinking. By the age of 7 or 8 most children responded like adult subjects to such tasks, insisting that pretense actions were necessarily generated by pretense mentation. However, other studies (e.g. Custer 1996, Hickling et al 1997) suggest that preschoolers might have a more mentalistic conception of pretense than Lillard's tasks give them credit for. Perhaps these studies are assessing a more rudimentary understanding of pretense than Lillard has been tapping (Lillard 1998c). Finally, research has been done on the related topic of children's developing understanding of the imagination and dreams (for a review of this interesting work, see Woolley 1995).

Thinking

Evidence indicates that children acquire some important elementary knowledge and skills concerning thinking during the early preschool years (see Flavell et al 1995b for a summary). First, preschoolers seem to know that thinking is an activity that only people and perhaps some other animates engage in. Second, preschoolers also realize that mental entities like thoughts and images are internal, in-the-head affairs, not to be confused with physical actions or other external objects and events, and they regard the mind and the brain as necessary for mental actions. Third, they realize that like desires and other mental entities, thinking has content and makes reference, and that

thoughts can take as their objects nonpresent and even nonreal things. Thus, preschoolers understand some of the most basic and important facts about thinking: namely, that it is an internal human activity that refers to or represents real or imaginary things. Finally, they have some ability to infer the presence of thinking in another person provided that the cues are very strong and clear, and they also can differentiate thinking from other activities in such situations.

However, preschoolers clearly lack other important knowledge and skills concerning thinking. They tend to be poor at determining when a person (self or other) is thinking and also what the person is and is not thinking about. As to when, they greatly underestimate the amount of mental activity that goes on in people. They do not realize that people are continually experiencing mental content of one kind or other spontaneously in an ever-flowing stream of consciousness. For example, unlike older subjects, preschoolers do not consistently attribute any mental activity at all to a person who just sits quietly, "waiting." Even more surprising, they do not automatically assume that something must be "going on in a person's mind" or that the person's mind must be "doing something," even when they know that the person is looking at or listening to something, reading, or talking to another person—activities that adults would regard as necessarily involving some cognition. As to what, on those occasions when preschoolers do assert that a person is thinking, they are often surprisingly poor at inferring what the person is and is not thinking about, even when the evidence is very clear.

These same difficulties are equally evident when preschoolers are asked to report their own mental activity rather than another person's. That is, they tend to be very poor at recalling or reconstructing both the fact and the content of their own recent or present thinking, even in situations especially designed to make such introspection extremely easy (Flavell et al 1995b, but see Estes 1998 for an exception). Similarly, they seem largely unaware of their own ongoing inner speech and may not even know that speech *can* be covert (Flavell et al 1997). Finally, there is evidence (Flavell et al 1998) that younger children are more inclined than older children and adults to attribute self-awareness and decision-making abilities to an unconscious person ("sound asleep and not dreaming"). In one study, for instance, the percentage of 5-year-olds, 7-year-olds, 8-year-olds, and adults claiming that people know they are asleep while they are deeply asleep and not dreaming were 61%, 39%, 28%, and 11%, respectively. These and other findings suggest that young children do not have a clear idea of what it is like, experientially, to be conscious as opposed to unconscious. In particular, they tend to attribute too little ongoing ideation to a conscious person (they are unaware of the stream of consciousness in people who are awake) and too much to an unconscious one (they attribute self-awareness to people who are unconscious).

DIFFERENCES IN DEVELOPMENT

Intracultural Differences

Considerable research attention is currently being paid to three kinds of differences in development: intracultural, intercultural, and interspecies (Flavell & Miller 1998). Studies of intracultural differences in development have identified social experiences that appear to foster theory-of-mind development (Bartsch & Estes 1996). For example, Jenkins & Astington (1996) and Perner et al (1994) have shown that preschoolers who have more siblings to interact with perform better on false-belief tasks than those who have fewer or none. Similarly, deaf children whose hearing parents are not fluent in sign language (as most are not) perform much more poorly on a false-belief test than deaf children of fluent-signing deaf parents (Peterson & Siegal 1997; see also deVilliers et al 1997). These studies suggest the importance of social-communicative experiences for theory-of-mind development. The most striking intracultural differences, however, are seen in the pronounced deficits in theory-of-mind development of autistic children and adults (Baron-Cohen et al 1993). The extent to which these tragic deficits can be reduced or compensated for by training is currently under investigation (S Baron-Cohen, H Wellman, JC Gomez, J Swettenham, E Toye, unpublished research).

   What about intracultural differences among unimpaired individuals? Dweck and co-workers have identified some intriguing ones (Dweck et al 1995). Needless to say, they do not find some normal adults who have a concept of false belief and others who lack it—nothing akin to normal-autistic differences. However, they do find important individual differences in people's implicit theories about human attributes. For example, some people think of intelligence as a fixed, uncontrollable trait or entity (*entity theory*), and others think of it as a malleable, controllable quality that can be improved with effort and training (*incremental theory*). Moreover, these differences in people's naive theory of intelligence have important consequences for their achievement motivation and intellectual performance. A perusal of textbooks in the fields of personality, social psychology, and social cognition would reveal many other ways that normal adults have been shown to differ from one another in their naive theories and knowledge regarding themselves and other people. And of course psychologists and other scientists have espoused widely different conceptions of human cognition and personality over the years.

Intercultural Differences

The question of intercultural similarities and differences in this area is a fascinating one about which we still have little solid information. How universal are the developments described in this chapter? An important review of the exist-

ing evidence—mostly from ethnographic studies—suggests that there are important differences among cultures in adult theories of mind (Lillard 1998a; see also critiques of this review by Gauvain 1998 and Wellman 1998, and Lillard's 1998b reply). Important similarities also appear to exist across cultures and languages in theory-of-mind development (Avis & Harris 1991; T Tardif, H Wellman, unpublished research).

Interspecies Differences

Similarly unsettled is the question of whether, or to what extent, other primates possess theory-of-mind knowledge and abilities. Observations such as the following suggest that chimpanzees may possess some (Byrne & Whiten 1988): Chimp A observed Chimp B acting as though no food were available at a feeding hopper, although there really was food there. Then Chimp A appeared to depart but actually hid behind a nearby tree and watched until Chimp B took the food, whereupon Chimp A emerged from hiding and snatched it from him! Although such observations may seem persuasive, most recent experimental work with chimps suggests that they may actually be less knowledgeable about the mental world than we had thought previously (Povinelli & Eddy 1996, Tomasello 1997). For example, Povinelli & Eddy (1996) have evidence suggesting that chimps may have a behavioristic rather than mentalistic conception of seeing. Although they follow a person's gaze, they do not seem to understand that the person sees and knows about things as a consequence of directing his or her gaze at them.

CONCLUSIONS

We have learned a great deal about the development of children's knowledge about the mental world, especially since the advent of theory-of-mind-development research some 15 years ago. What will the next 15 years bring? The following are some guesses (see also Flavell & Miller 1998:882–87). The present intense study of infant theory-of-mind competencies will continue, with major breakthroughs awaiting the discovery of better methods for peering into the infant mind. At the other end of ontogenesis, researchers will inquire into the limitations as well as the strengths of adult people-reading and will try to explain why seemingly knowledgeable adults sometimes reason so poorly in this domain (Ross & Ward 1996). This inquiry will inform, and be informed by, further study of intracultural and intercultural differences in adult theory-of-mind competencies. And what researchers learn about the determinants of intracultural differences in development should, in turn, suggest ways of helping children who need such help to acquire socially and academically useful competencies in this area (Flavell 1997). Finally, progress will be made in

identifying the neural bases of mentalistic thinking, and this finding may lead to a better understanding of normal and abnormal (especially autistic) development in this important area (Fletcher et al 1995).

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