

Development of children's knowledge about the mental world

John H. Flavell

Stanford University, Stanford, CA, USA

This article is a survey of research on the childhood acquisition of knowledge about the mind, especially work done during the past two decades under the heading of theory-of-mind development. It begins with a history of research in this area. This is followed by a brief summary of principal theories and findings. The article concludes with some guesses about future research in this exciting area of cognitive development.

A developmental psychologist shows a 5-year-old a cookies box with a picture of cookies on it and asks her what is in it. "Cookies", is the ready answer. The child then looks inside the box and to her surprise sees that it actually contains crayons, not cookies. "What would another child who had not yet opened the box think was in it?" the experimenter now asks. "Cookies!" says the child, amused at the trick. The experimenter then tries the same procedure with a 3-year-old. The answer to the first question is the expected "cookies", but the response to the second is unexpected: "crayons". Even more surprising, the child also maintains that he himself had initially thought that the box would contain crayons. Unlike the 5-year-old, the 3-year-old shows no evidence of understanding that either he or other people could hold a belief that is false.

Results such as this are found in a currently flourishing research area concerning the development of our knowledge and beliefs about the mental world—our folk psychology or naive theory of mind. More than did earlier metacognitive and social-cognitive investigations in the same domain, this approach probes children's conceptions of the most fundamental components of the mind, such as beliefs and desires, and children's knowledge of how these components affect and are affected by perceptual inputs and behavioural inputs. In less than 20 years, this fast-growing area has spawned hundreds of research articles and scores of book- and monograph-length treatments. Indeed, the spate of papers and posters on this topic at recent meetings of the Society for Research in Child Development reminded several older participants of the way Piagetian research dominated the programme in years past. To illustrate, a recent meta-analysis of false belief studies alone—just one topic in this area—included 77 research articles, encompassing 177 separate studies, and 591 false-belief conditions (Wellman, Gross, & Watson, 1999). Developmental findings in this area have also recently become of interest to philosophers of mind, who believe that these findings may help clarify philosophical disputes about the nature of folk psychology.

Why this intense research interest in the development of knowledge about the mental world? One answer is that human

social and cognitive life bereft of such knowledge seems virtually unimaginable, and that the development of something that important is surely worth learning about. In her lectures on this topic, Alison Gopnik likes to make the point in the following way: Imagine what it would be like for you to give a lecture to an audience if you had no conception of mental states. The audience might appear to you as bags of meat with two small holes at the top. You would see these bags and the shiny things in their holes shift around unpredictably in a way that perplexes and terrifies you, although of course you do not realise that you are perplexed and terrified. Gopnik's scenario may not be as imaginary as it seems. Autistic individuals are known to be deficient in knowledge about the mind, and sometimes act as if they view other people as unpredictable and scary in much this way.

The plan of this article is as follows: The article begins with a history of this research area. Next comes a summary of its main theories and research findings. The article then concludes with some speculations about the future of the area.

History

As with so many other areas of cognitive development, the history of this one mainly begins with Piaget (Flavell & Miller, 1998; Shantz, 1983). A central Piagetian claim was that children begin development by being cognitively *egocentric* (Flavell, 1992). By this, Piaget meant that they initially do not know that there are such things as conceptual, perceptual, and emotional perspectives or points of view. As a result, they naturally cannot be aware that they themselves have such perspectives *vis-à-vis* external objects and events, or that others do, or that their own perspective may not be the same as those of others, or that they may be unwittingly reporting their own perspectives when asked to report another person's. Piaget also considered as egocentric children who have some awareness that perspectives exist but who are not skilled at discriminating their own from another person's. Piaget and his colleagues used egocentrism and other concepts to interpret their

developmental studies of a wide variety of social-cognitive topics: Perceptual perspective-taking; egocentric communication; the misattribution of mental characteristics to physical objects (animism) and physical characteristics to mental events (realism); and understanding of thoughts, dreams, intentions, and morality. Research on these and related topics still continues, although usually not from a Piagetian theoretical perspective (e.g., Feinfield, Lee, Flavell, Green, & Flavell, in press; Flavell, 1992; Flavell, Green, & Flavell, 1995b; Woolley & Wellman, 1992). Shantz (1983) also describes more recent stage theories of various aspects of social-cognitive development in the Piagetian tradition by Damon, Selman, and Turiel. She also summarises numerous studies of perspective-taking and related Piagetian topics by Borke, Chandler, Feffer, Flavell, Selman, and many other researchers. There is widespread agreement today that young children are not as totally egocentric as Piaget believed them to be, but also that perspective-taking abilities and related psychological knowledge do show marked increases with age, much as he said they did. Those of us trying to peer into the ontogenesis of knowledge about the mind are clearly standing on Piaget's shoulders.

A second wave of theory and research in this general area was the extensive work on metacognitive development that began in the early 1970s. Useful reviews of this large literature include Brown, Bransford, Ferrara, and Campione (1983), Flavell, Miller, and Miller (1993), Kuhn (1999), Moshman (1998), and Schneider and Bjorklund (1998). Metacognition (cognition about cognition—hence the “meta”) has been defined as any knowledge or cognitive activity that takes as its cognitive object, or that regulates, any aspect of any cognitive activity (Flavell et al., 1993, p. 150). It is a broad concept that encompasses people's knowledge about the nature of people as cognisers, about the nature of different cognitive tasks, and about possible strategies for coping with different tasks. It also includes executive skills for monitoring and regulating one's own cognitive activities. The majority of developmental studies classified as metacognitive have investigated children's metamemory, that is, their knowledge about variables affecting memory performance and, especially, their knowledge and use of memory strategies. The term has also been applied to numerous studies of children's cognition concerning comprehension, communication, language, perception, and attention, and problem solving. Research in the metacognitive development tradition is still being done, although it is not the hot topic it used to be.

The third wave in our history is still very much in motion, and is the primary concern of this article. It is commonly referred to as theory-of-mind research. Prior to about 1983, most investigators of children's knowledge about the mental world would probably classify their work as either metacognitive or in the general Piagetian tradition. Today, most would say they are doing one or another kind of theory-of-mind research. In fact, they would likely use that label as a shorthand, easily recognisable characterisation of the general line of work they are in even if they were not convinced, as some are not, that children actually acquire bona fide theories of mind rather than just knowledge and skills concerning it. Since the mid 1980s, theory-of-mind research has been one of the liveliest, most productive research areas in all of developmental psychology. I predict that it will continue to be so for some time to come. How did this third wave come to be?

In the 1978 issue of *Behavioral and Brain Sciences*, Premack

and Woodruff (p. 515) reported some research in which they attempted to test whether chimpanzees have a theory of mind, which they defined as follows:

An individual has a theory of mind if he imputes mental states to himself and others. A system of inferences of this kind is properly viewed as a theory because such states are not directly observable, and the system can be used to make predictions about the behavior of others. As to the mental states the chimpanzees may infer, consider those inferred by our own species, for example, *purpose* or *intention*, as well as *knowledge*, *belief*, *thinking*, *doubt*, *guessing*, *pretending*, *liking*, and so forth.

In their commentaries on this article, three philosophers independently suggested that one might be able to find out whether an animal possessed the concept of belief in something like the following fashion (Bennett, 1978; Dennett, 1978; Harman, 1978). The subject animal sees another individual put object X in container A and then leave the scene. The subject then sees someone else move X from container A into container B while the individual is still absent. The subject animal should then be credited with some understanding of belief if it acts as if it expects that the returning individual will search for X in A rather than B: “If the subject chimpanzee expects the second chimpanzee to reach into the pot which originally contained the banana, that would seem to show that it has a conception of mere belief” (Dennett, 1978, p. 557). Philosophers and developmental psychologists consider false-belief tasks to be better tests of the concept of belief than are true-belief tasks because children could be correct on true-belief tasks by egocentrically assuming that others know what they themselves know and just reporting the true state of affairs.

These ideas were taken up in the early 1980s by two Austrian psychologists, Josef Perner and Heinz Wimmer. In a pioneering and highly influential series of studies, they used the “unexpected transfer” method proposed by the philosophers to test young children's understanding of false belief (Wimmer & Perner, 1983). Similarly, Bretherton and her colleagues examined infants' gestural and verbal communication for evidence that infants have “what Premack and Woodruff (1978) have called a ‘theory of mind’” (Bretherton, McNew, & Beeghly-Smith, 1981, p. 339). Around the same time, Wellman and his co-workers had independently begun to conceptualise children's developing metacognitive knowledge and understanding of mental terms as the development of a theory of mind (e.g., Johnson & Wellman, 1980; Shatz, Wellman, & Silber, 1983; Wellman, 1983, 1985). In addition, a number of other researchers who had not yet begun to conceptualise children's social-cognitive development in quite this way had been doing research that subsequently became part of the theory-of-mind movement. An example would be the work on children's knowledge about perception and about the appearance-reality distinction by Flavell and colleagues (e.g., Flavell, Flavell, & Green, 1983; Flavell, Flavell, Green, & Wilcox, 1980; see Astington, Harris, & Olsen, 1988, for other such projects).

The movement was given added identity and coherence by two conferences that were held in the spring of 1986: the International Conference on Developing Theories of Mind, organised by Janet Astington, Lynd Ferguson, Alison Gopnik, and David Olson at the University of Toronto, and the Workshop on Children's Early Concept of Mind, organised by

Paul Harris at the University of Oxford. The presentations given at these two conferences were later published in a book entitled *Developing Theories of Mind* (Astington et al., 1988), and the movement was officially launched. A look through this milestone publication provides an immediate sense of the broad and diverse array of acquisitions judged to be instances of theory-of-mind development, and more have been added since. What it does not convey is the high excitement felt by the conference participants as they sensed the birth of a new approach to the development of children's knowledge about the mental world.

The rest, as they say, is history. Publications concerned with theory-of-mind development must now number well up in the hundreds and the flow continues unabated. Reviews of work on this topic include Astington (1993), Bartsch and Wellman (1995), Carpenter, Nagell, and Tomasello (1998), Flavell (1999), Flavell and Miller (1998), Hala (1997), Mitchell (1997), Moore (1996), Taylor (1996), Wellman (1993), and Wellman and Gelman (1998).

It may be helpful in understanding the metacognition and theory-of-mind approaches to compare and contrast them. In a general sense, researchers in both traditions share the same overall objective, that is, to investigate the development of children's knowledge and cognition about mental phenomena. In fact, most psychologists would probably consider the terms "metacognition" and "theory of mind" as being more or less synonymous—as just alternative ways of designating the same general set of cognitive phenomena. This sense of synonymy is further heightened by the extensive use of the expression "metarepresentational" in the theory-of-mind development literature: "Metarepresentational" and "metacognitive" sound like they mean pretty much the same thing.

Despite these commonalities, the research literatures in these two areas have been surprisingly distinct and unconnected. Most theory-of-mind articles do not cite research in the metacognitive development tradition—for example, research on metamemory development—and conversely, most metacognitive development articles do not refer to work in the theory-in-mind tradition (for a clear exception, see a recent chapter by Kuhn, 1999). One gets a further sense of discontinuity when one looks for the adult counterparts of these two research traditions. There is currently a fair amount of psychological research being done with adults under the rubric "metacognition"—on feelings of knowing, for example (Jost, Kruglanski, & Nelson, 1998; Metcalfe & Shimamura, 1994)—but very little that is construed as research on adult theory of mind.¹

Why this lack of connection? I do not think it is due to provincialism or lack of vision on the part of researchers concerned. More likely, it is because the two traditions have tended to focus on different developments within the broad cognition-about-cognition umbrella.

Most theory-of-mind studies have investigated children's initial knowledge about our most basic mental states—desires, percepts, beliefs, knowledge, thoughts, intentions, feelings, and so on. Researchers in this tradition attempt to determine what children of different ages know about the existence and behaviour of these various states, and also what they know about how mental states are causally linked to perceptual

inputs, to behaviour, and to other mental states. For example, do young children understand what it means to know something, or do they realise that unsatisfied desires typically cause negative feelings and renewed behavioural efforts to satisfy these desires?

In contrast, students of metacognitive development have usually focused more on task-related mental activities—often, on what one should do with one's mind in trying to solve some problem or task. These metacognitive activities include strategies for making cognitive progress on various tasks and problems—on memory or comprehension tasks, for example—and also attempts to monitor that progress. Much of the metacognition studied is therefore problem-centred and goal-oriented; one could think of it as a kind of "applied theory-of-mind".

Because most theory-of-mind researchers have been looking for the origins and earliest expressions of knowledge about the most elementary types of mental states (desires, beliefs, etc.), they have tended to study infants and young children predominantly. Conversely, because the knowledge and skills metacognition researchers investigate usually presuppose the prior acquisition of some understanding of these states, they have mainly tested older children and adolescents. One cannot test for a child's understanding of memory strategies (metacognition) if the child is too young even to know what remembering something means (theory-of-mind).

Because it has this applied theory-of-mind focus, most metacognitive development research is concerned with what the subject knows about how to use his/her own mind rather than somebody else's. How often other people or people in general use their minds in task situations may be useful as models for how the subject should use his/hers, but it is the subject's own use or non-use that is usually of primary interest. In contrast, it is the subject's understanding of some other person's mind, or of minds in general, that is usually of concern in theory-of-mind studies. For example, in a false-belief task the child subject is typically asked what a naive other child would think is in the cookies box—the deceptive box which the subject has just learned really contains crayons rather than cookies.

Main theories and findings

Figure 1 illustrates the main directions that theory-of-mind development research has taken since it began in the early 1980s. Much of the earliest work was focused on documenting a striking improvement between 3 and 5 years of age in children's performance on various false-belief (FB), appearance-reality (AR), and Level 2 visual perspective-taking (PT) tasks. Thus, for example, older but not younger preschoolers were usually found to show an understanding that the naive other child cited in the first paragraph of this article would falsely believe that the cookie box contains cookies (false belief), that a fake rock looks like a rock but is really a sponge (appearance-reality), and that a picture book oriented correctly for them on the table will look upside down to a person seated opposite (Level 2 visual perspective-taking).

From those beginnings work has progressed more or less concurrently in a variety of directions, as shown by the arrows in Figure 1. Researchers have charted the development of children's understanding of many additional mental states. They have elaborated several classes of theories to explain

¹ There is relevant work here in the area of adult social cognition, to be sure, but it is scarcely ever presented as research on adult theory of mind (i.e., as research on the adult outcome of a process of theory-of-mind development).

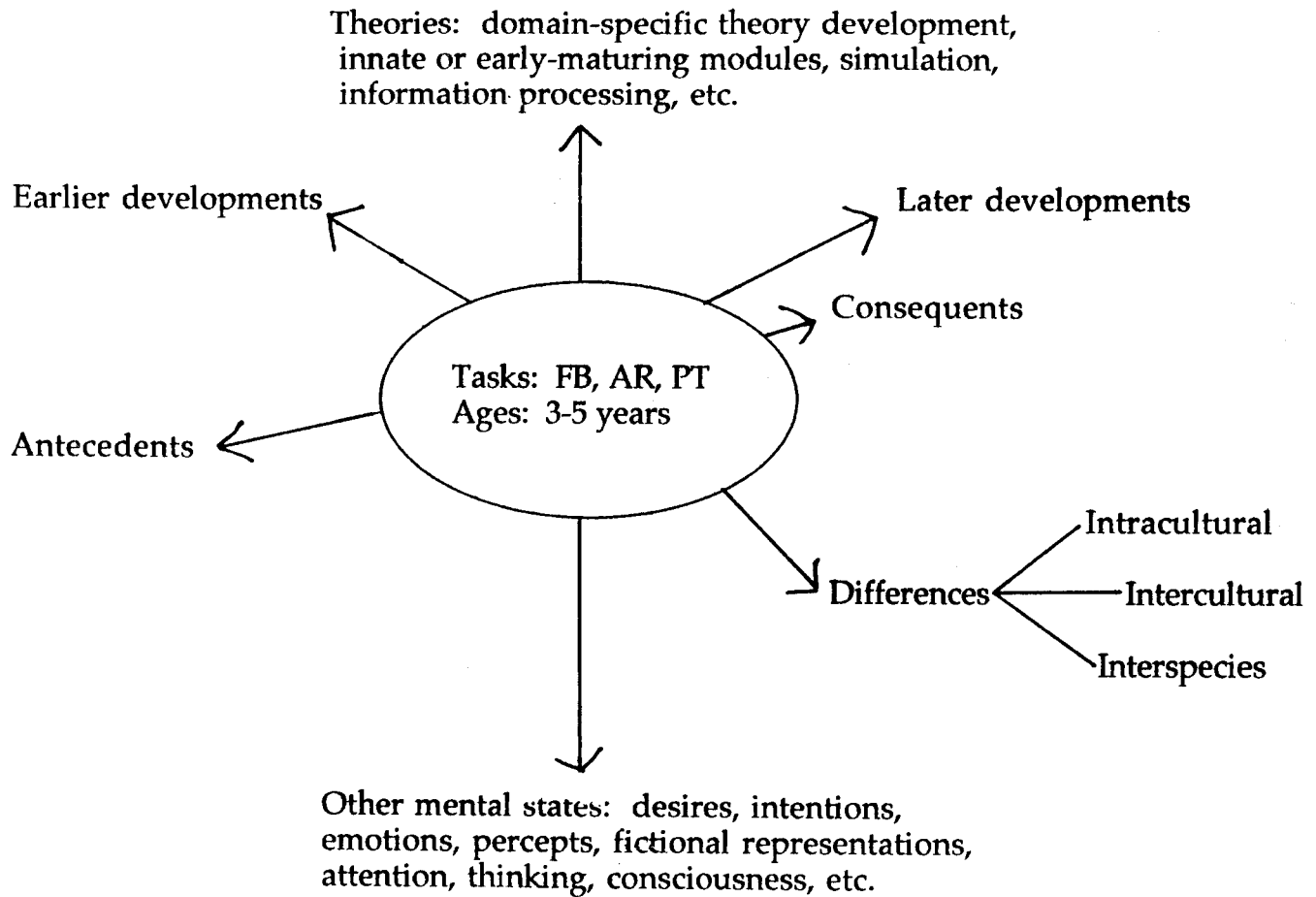


Figure 1. Overview of research directions in the area of theory-of-mind development.

theory-of-mind development. They have extended their inquiries both downward into infancy and upward into middle childhood and adolescence. A few attempts have been made to identify child rearing or other variables that predict facility with theory-of-mind tasks (antecedents) and to identify behaviours that such facility might mediate (consequents). Finally, investigators have examined differences in theory-of-mind understandings—differences within the same culture, differences between cultures, and differences between humans and other primates. These points are briefly elaborated in the sections that follow. Fuller discussion of them can be found in the substantive reviews cited earlier.

Theories

Several types of theories have been offered as explanations for the development of children's mentalistic understanding. 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 a formal scientific theory but an informal, everyday "framework" or "foundational" theory. A number of steps in children's progression toward the adult theory of mind have been described. For instance, Bartsch and Wellman (1995) have argued that children begin with a *desire psychology*, then progress to a *desire-belief psychology*, and finally attain our adult *belief-desire psychology*, in which one recognises that what people believe, as well as what they desire, crucially affects how

they behave. Theory theorists argue that experience plays a major formative role in children's theory-of-mind development.

In contrast, modularity theorists such as Leslie (1994) argue 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. Baron-Cohen (1995) also has a developmental theory involving innate or early-maturing modular mechanisms dedicated to mental state computations.

Harris (1992) and others have proposed yet a third approach. According to their simulation theory, children become able to compute the mental states of other people through a kind of role-taking or simulation process. What develops is the ability to make increasingly accurate simulations of this kind. Like theory theorists, simulation theorists also assume that experience plays a crucial formative role, in that it is through practice in role taking that children improve their simulation abilities.

Still other developmentalists believe that young children's failures on false-belief and other theory-of-mind tasks may be caused by more domain-general limitations in executive functioning (e.g., Carlson, Moses, & Hix, 1998; Hughes, 1998). For example, an inability to inhibit a dominant, ready-to-go response could cause the child subject to blurt out the

cognitively salient real contents of the cookies box when asked what the naive other child thought it contained. Other investigators have argued that the tasks may be misunderstood by young children or may not be engaging enough to elicit their best thinking (Flavell & Miller, 1998).

How shall we evaluate all these different theories? It seems likely to me that an adequate theory here will finally have to include elements from all of them:

That is, the following seem likely: (a) that development in this area builds from innate or early maturing people-reading capacities; (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 development (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 children's conceptions of the mental world and their ability to use these conceptions in predicting and explaining their own and other people's behaviour. (Flavell, 1999, p. 27).

Developments during infancy

Infants are born with or develop early a number of abilities and dispositions that will help them learn about people. They find human faces, voices, and movements highly interesting. They have impressive abilities to perceptually analyse and discriminate human stimuli. They seem impelled to attend to and interact with other people and they certainly impel other people to attend to and interact with them. Babies respond differently to people than they do to objects and seem to expect people to behave differently than objects do (Poulin-Dubois, 1999). More specifically, we could say that they come to construe people as "compliant agents", that is, as objects that are self-propelled and capable of independent movement (agents) but also influenceable at a distance by communicative signals (compliant). One can hardly imagine a more felicitous initial design for a creature destined for theory-of-mind development.

Late in the first year infants start to learn that people's behaviour possesses "aboutness" or "intentionality" (intentionality in a broad sense—not just the narrow sense of "on purpose"). An individual behaviour is "about" an object in this sense if the individual 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 beginning awareness of intentionality. They try to engender new "aboutness" in others through various communicative gestures, such as pointing to or vocalising about an object and checking to see if the other person attends to it. They also develop skill at reading the aboutnesses the other person already has going, as when they follow the person's gaze. Carpenter et al. (1998) have recently documented a three-step developmental sequence in which infants progress from *sharing* to *following* to *directing* others' attention and behaviour. Studies by Meltzoff (1995) have also demonstrated that 18-month-olds can infer what action another person is trying to perform (e.g., attempting 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 suggests that infants of this age have some sense that people's actions are intentional and goal-directed. Precursors of such understanding can even be observed in early infancy (Woodward, 1998). By age 18 months, infants understand that they should give an experimenter a food that she reacts to with pleasure rather than one towards which she acts disgusted, even when they themselves prefer the latter food (Repacholi & Gopnik, 1997); this suggests at least some limited ability to reason nonegocentrically about people's desires.

Infants also recognise that it is the adult's attentional focus rather than their own that gives clues as to the adult's referential intent when the adult labels an object (Woodward & Markman, 1998). Similarly, they 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 (a process called *social referencing*). For instance, they may selectively avoid an object towards which their parent shows negative affect. Thus, by 12 months or so they can recognise that the adult's emotional display refers to or is "about" a particular object much as they can recognise that the adult's spoken label refers to or is "about" a particular object (Moses, Baldwin, Rosicky, & Tidball, in press). By the end of infancy children may also do other things suggestive of a beginning understanding of human psychology, such as trying to comfort people in distress and correctly using mental state terms such as "want" and "see".

Later developments

A very large literature has accrued since the early 1980s on theory-of-mind acquisitions that occur subsequently to the infancy period. What follows is a brief synopsis of some of the major findings, organised by type of mental state.

Visual perception. During the early preschool period children already understand that a person will see an object if and only if the person's eyes are 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 recognise that the same thing may present different visual appearances to two people if they view it from different positions (called Level 2 knowledge).

Attention. As already mentioned, even infants pay attention to other people's attending and seem to have some understanding of its implications. In subsequent years they come to appreciate that attention is selective and limited, and that different people may mentally represent the same attended-to input differently (Fabricius & Schwanenflugel, 1994; Flavell, Green, & Flavell, 1995a; Pillow, 1995).

Desires. By the age of 3 years, children are not only using some desire terms correctly, they also seem to grasp simple causal relations among desires, outcomes, emotions, and actions—suggestive evidence that they are developing something like an implicit theory. For example, they understand that people will feel good if they get what they want and feel

bad if they do not, and that people will quit searching if they find a sought-after desired object but will keep searching if they do not (Bartsch & Wellman, 1995).

Emotions. Although we do not know yet whether infants actually impute inner feelings to people who display emotions, it seems clear 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, Harris, Banerjee, & Sinclair, 1995, p. 118). In later years, children gradually learn more advanced truths about emotions, for example, that people do not always really feel what they appear to feel, that their affective reactions to an event may be influenced by earlier emotional experiences with similar events or by their current mood, and that people can experience two conflicting emotions more or less simultaneously (Flavell & Miller, 1998).

Beliefs and related mental representations. There have been a great many studies of children’s developing understanding of “serious” mental representations, that is, nonpretence mental states such as beliefs that are meant to represent 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: The appearance-reality distinction, Level 2 knowledge of visual perception, interpretation, and constructive processing, deception, and most studied of all, false belief. The distinction between perceptual appearance and reality is conceptually similar both to the distinction between false belief and reality and to the Level 2 distinction between two different perceptual perspectives. Consistent with this fact, there is some correlational evidence suggesting that these three distinctions tend to develop synchronously, within subjects, during the preschool years. As noted in the Theories section, however, exactly what false-belief and appearance-reality tasks measure remains uncertain; some researchers (including me) believe they mainly assess the child’s nascent understanding of mental representation, but others disagree. The evidence indicates that children’s knowledge about mental representations continues to increase after the preschool period. In particular, it is not until middle childhood and later that children appear to gain any substantial understanding of the mind as an active, interpretive, constructive processor (e.g., Carpendale & Chandler, 1996). For instance, understanding that people’s interpretation of an ambiguous event may be influenced by their preexisting biases or expectations seems to be a middle childhood insight (Pillow & Henrichon, 1996).

Knowledge. Young preschoolers appear to be unclear about just what it means for someone to know something and about how knowledge is acquired (Flavell & Miller, 1998). Even 4- and 5-year-olds may claim that they have always known information that they have just learned during the experimental session (Taylor, Esbensen, & Bennett, 1994). An important early-middle childhood discovery is that perceptual information has to be adequate as well as merely present to engender knowledge. For example, children come to realise that a person often cannot be certain of an object’s identity when only a little bit of it is visible; this realisation is another example of their burgeoning conception of the mind as an interpretive device.

Pretence. The acquisition of pretend-play skills during early childhood is currently viewed as part of the development of children’s knowledge about the mind, thanks largely to an important analysis by Leslie (1987, 1994). Leslie argues that the ability to understand pretence and the ability to understand false belief and other mental states are mediated by a common, early-maturing theory-of-mind module. This argument has some plausibility: “Pretending that” and “believing that” are both prepositional attitudes. Moreover, adults regard both as mental representations or construals of something as being a certain way—either for real (belief) or just temporarily, for play purposes (pretence). Nevertheless, Leslie’s claim is currently controversial (Lillard, 1998a). The related topic of children’s understanding of imagination is also receiving considerable study (Woolley, 1995).

Thinking Children achieve some important elementary knowledge and skills concerning thinking during the early preschool years. For example, they come to construe it as an internal human activity that refers to or represents real or imaginary things. However, there are also important knowledge and skills concerning thinking that preschoolers clearly lack (Flavell et al., 1995b; Flavell & O’Donnell, 1999). They are not aware that people are continually experiencing mental content spontaneously in an ever-flowing stream of consciousness. For example, unlike older children, preschoolers do not consistently attribute any mental activity at all to a person who just sits quietly, “waiting”. These same difficulties are equally evident when preschoolers are asked to report their own mental activity rather than another person’s (Flavell, Green, & Flavell, 2000). That is, they tend to be very poor at reporting their own recent or present thinking, even in situations especially designed to make such introspection extremely easy (but see Estes, 1998 for an exception). They also do not differentiate very clearly between the mental contents of conscious and unconscious states (Flavell, Green, Flavell, & Lin, 1999). In particular, just as they tend to attribute too little ongoing ideation to a conscious person (they are unaware of the stream of consciousness), they also attribute too much to an unconscious one (they attribute conscious thought and self-awareness to people who are unconscious).

Differences in development

Intracultural differences. Investigators have recently been examining three kinds of differences in development: Intracultural, intercultural, and interspecies (Flavell & Miller, 1998). Regarding intracultural differences, researchers have identified some social experiences that appear to facilitate theory-of-mind development (Bartsch & Estes, 1996). For example, Jenkins and Astington (1996) and Perner, Ruffman, and Leekam (1994) have shown that young children who have more siblings to interact with perform better on false-belief tasks than those who have fewer or none. Likewise, deaf children whose hearing parents are not fluent in sign language (as most are not) perform more poorly on a false-belief test than deaf children of fluent-signing deaf parents (e.g., Peterson & Siegal, 1997). Such findings suggest the importance of social-communicative experiences for the development of mentalistic understanding. This understanding in its turn undoubtedly facilitates the development of social skills (Watson, Nixon, Wilson, & Capage, 1999). The most striking intracultural differences, however, are manifest in the severe deficits in theory-of-mind

development exhibited by autistic children and adults (Baron-Cohen, Tager-Flusberg, & Cohen, 1993). How well these tragic deficits can be reduced or compensated for by training is currently under study (Wellman, Baron-Cohen, Gomez, Swettenham, & Toye, manuscript in preparation).

There are also significant intracultural differences among unimpaired individuals. Dweck and her co-workers have documented important individual differences in people's implicit theories about intelligence and other human attributes (Dweck, Chiu, & Hong, 1995). Textbooks in the fields of personality, social psychology, and social cognition also describe many other ways that normal adults differ from one another in their naive theories and knowledge regarding themselves and other people; great works of literature are an even richer source. And, of course, psychologists and other scientists have espoused widely different conceptions of human cognition and personality over the years: Just think of the differences between B.F. Skinner's and Freud's views of the mind.

Intercultural differences. The question of between-culture similarities and differences in theory-of-mind development is a fascinating one. How universal are the developments described in this article? An important review of the existing evidence—mostly from ethnographic studies—suggests that there are important differences between cultures in adult theories of mind (Lillard, 1998b). However, there is also reason to think that there are some deep universals as well (Avis & Harris, 1991; Wellman, 1998).

Interspecies differences. Researchers have also tested for theory-of-mind knowledge and abilities in other primates. Recent experimental work with chimps suggests that they may actually be less knowledgeable in this area than originally thought (Call & Tomasello, 1999; Reaux, Theall, & Povinelli, 1999). For instance, Reaux et al. (1999) present evidence suggesting that chimps may possess a behaviouristic rather than mentalistic conception of seeing. That is, although they follow a person's gaze, they appear not to understand that the person sees and knows about things as a result of directing his/her gaze at them.

Future Research

Researchers have learned a considerable amount about the development of children's mentalistic understanding, especially from the theory-of-mind investigations of the past two decades. What will the next few decades bring? The following are some guesses (see also Flavell & Miller, 1998, pp. 882–887).

As indicated in the Theories section, there is no shortage of theories intended to explain how children acquire an understanding of the mental world. It is a safe prediction that the future will see further theoretical and experimental work in this area. In particular, how the development of executive functioning may be related to theory-of-mind development will likely continue to be the subject of considerable enquiry (Hughes, 1998).

Infant development is the hottest research area in the theory-of-mind field currently and will probably continue to be for some time to come. It seems unlikely that researchers will discover new theory-of-mind acquisitions in this age period (i.e., things we did not know developed). Rather, they will be

better able to date, describe, and explain developments already under study. The nonverbal research measures presently used are ingenious (e.g., looking time) but one can hope for even better ones in the future. Nonverbal measures will also continue to be used to compare the performance of other primates with that of human children. The recent work of Call and Tomasello (1999) and Reaux et al. (1999) demonstrate how fruitful this research strategy can be. My bet is that such comparisons will continue to show a lack of significant understanding of mental states in nonhuman subjects.

Toward the other end of ontogenesis, we can expect to see more research on middle childhood, adolescent, and adult understanding. What do adolescents and adults know or believe about the mental world that elementary schoolchildren do not, and what understanding do the latter have that preschoolers do not? We still lack adequate answers to these questions. My guess is that there exist advanced competencies in this area that we have not yet identified. How similar these more complex and subtle forms of understanding are from adult to adult, within and between cultures, is an important and clearly researchable question. One possible difference between children and adults that has not been explored much may lie, not in what mental states they are capable of having consciously thoughts about, but rather in how easily and how often they are spontaneously aware of their own or other people's mentation. It is one thing to know what thoughts and feelings are and that people have them, but quite another to spontaneously detect or infer their occurrence when they happen. Such increased sensitivity may be one of the products of life's advanced courses on mind-reading.

In future research investigators will also try to tell longer and richer developmental stories about each acquisition they study. Consider, for example, the acquisition of an understanding of belief (Flavell & Miller, 1998, pp. 873–875). Even if one accepts (still controversial) that 3-year-olds do not understand beliefs but 4-year-olds do, it is becoming clear that this developmental story is incomplete. For the later part of the story, there is evidence that children continue to acquire knowledge about beliefs after the age of 4 years (Carpendale & Chandler, 1996; Fabricius & Imbens-Bailey, 2000). As to the early part, Clements and Perner (1994) have found that young 3-year-olds who respond incorrectly to standard false-belief task questions nonetheless show by their eye movements that they may have some sort of rudimentary, implicit understanding of false beliefs. In a recent review, Haith and Benson called for "a graded approach to understanding infant cognition", one that considers the succession of "partial accomplishments" that is likely to occur in each domain (1998, p. 245). Future research on theory-of-mind development will likely follow their prescription and try to identify a number of different levels of understanding of each mental state concept.

There is very little research to date on how new acquisitions in this area translate into changes in children's everyday social and cognitive behaviours (Flavell & Miller, 1998). We will likely see much more of this kind of research in the future. There will also be efforts to find out how best to help children who need such help to acquire socially and academically useful theory-of-mind competencies.

Whatever else it may turn out to be, the 21st century seems certain to be the Century of the Brain. My final prediction (more of a hope than a prediction) is that advances in neuroscience will help us better understand the child's

developing understanding of the mental world (Stone, Baron-Cohen, & Knight, 1998).

Manuscript received September 1999

References

- Astington, J.W. (1993). *The child's discovery of the mind*. Cambridge, MA: Harvard University Press.
- Astington, J.W., Harris, P.L., & Olson, D. (Eds.) (1988). *Developing theories of mind*. Cambridge, UK: Cambridge University Press.
- Avis, J., & Harris, P.L. (1991). Belief-desire reasoning among Baka children: Evidence for a universal conception of mind. *Child Development*, 62, 460-467.
- Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: MIT Press.
- Baron-Cohen, S., Tager-Flusberg, H., & Cohen, D.J. (1993). *Understanding other minds: Perspectives from autism*. Oxford, UK: Oxford University Press.
- Bartsch, K., & Estes, D. (1996). Individual differences in children's developing theory of mind and implications for metacognition. *Learning and Individual Differences*, 8, 281-304.
- Bartsch, K., & Wellman, H.M. (1995). *Children talk about the mind*. New York: Oxford University Press.
- Bennett, J. (1978). Some remarks about concepts. *Behavioral and Brain Sciences*, 1, 557-560.
- Bretherton, I., McNew, S., & Beeghly-Smith, M. (1981). Early person knowledge as expressed in gestural and verbal communication: When do infants acquire a "theory of mind"? In M. Lamb & L. Sherrod (Eds.), *Social cognition in infancy* (pp. 333-373). Hillsdale, NJ: Erlbaum.
- Brown, A.L., Bransford, J.D., Ferrara, R.A., & Campione, J.C. (1983). Learning, remembering, and understanding. In P.H. Mussen (Series Ed.), J.H. Flavell & E.M. Markman (Eds.), *Handbook of child psychology: Vol. 3, Cognitive development* (pp. 177-166). New York: Wiley.
- Call, J., & Tomasello, M. (1999). A nonverbal false belief task: The performance of children and great apes. *Child Development*, 70, 381-395.
- Carlson, S.M., Moses, L.J., & Hix, H.R. (1998). The role of inhibitory processes in young children's difficulties with deception and false belief. *Child Development*, 69, 672-691.
- Carpendale, J.I., & Chandler, M.J. (1996). On the distinction between false belief understanding and subscribing to an interpretive theory of mind. *Child Development*, 67, 1686-1706.
- Carpenter, M., Nagel, K., & Tomasello, M. (1998). Social cognition, joint attention, and communicative competence from 9-15 months of age. *Monographs of the Society for Research in Child Development*, 63, (4, Serial No. 255).
- Clements, W.A., & Perner, J. (1994). Implicit understanding of belief. *Cognitive Development*, 9, 377-395.
- Dennett, D.C. (1978). Beliefs about beliefs. *Behavioral and Brain Sciences*, 1, 568-570.
- Dweck, C.S., Chiu, C.Y., & Hong, Y.Y. (1995). Implicit theories and their role in judgements and reactions: A world from two perspectives. *Psychological Inquiry*, 6, 267-285.
- Estes, D. (1998). Young children's awareness of their mental activity: The case of mental rotation. *Child Development*, 69, 1345-1360.
- Fabricius, W.V., & Imbens-Bailey, A.L. (2000). False belief about false beliefs. In P. Mitchell & K. Riggs (Eds.), *Children's reasoning and the mind*. Hove, UK: Psychology Press.
- Fabricius, W.V., & Schwanenflugel, P.J. (1994). The older child's theory of mind. In A. Demetriou & A. Efklides (Eds.), *Intelligence, mind, and reasoning: Structure and development* (pp. 111-132). Amsterdam: Elsevier.
- Feinfield, K.A., Lee, P.P., Flavell, E.R., Green, F.L., & Flavell, J.H. (in press). Young children's understanding of intention. *Cognitive Development*.
- Flavell, J.H. (1992). Perspectives on perspective taking. In H. Beilin & P. Pufall (Eds.), *Piaget's theory: Prospects and possibilities* (pp. 107-139). Hillsdale, NJ: Erlbaum.
- Flavell, J.H. (1999). Cognitive development: Children's knowledge about the mind. *Annual Review of Psychology*, 50, 21-45.
- Flavell, J.H., Flavell, E.R., & Green, F.L. (1983). Development of the appearance-reality distinction. *Cognitive Psychology*, 15, 95-120.
- Flavell, J.H., Flavell, E.R., Green, F.L., & Wilcox, S.A. (1980). Young children's knowledge about visual perception. Effect of observer's distance from target on perceptual clarity of target. *Developmental Psychology*, 16, 10-12.
- Flavell, J.H., Green, F.L., & Flavell, E.R. (1995a). The development of children's knowledge about attentional focus. *Developmental Psychology*, 31, 706-712.
- Flavell, J.H., Green, F.L., & Flavell, E.R. (1995b). Young children's knowledge about thinking. *Monographs of the Society for Research in Child Development*, 60 (1, Serial No. 243).
- Flavell, J.H., Green, F.L., & Flavell, E.R. (2000). Development of children's awareness of their own thoughts. *Journal of Cognitive Development*, 1, 97-112.
- Flavell, J.H., Green, F.L., Flavell, E.R., & Lin, N.T. (1999). Development of children's knowledge about unconsciousness. *Child Development*, 70, 396-412.
- Flavell, J.H., & Miller, P.H. (1998). Social cognition. In D. Kuhn & R.S. Siegler (Eds.), W. Damon (Series Ed.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 851-898). New York: Wiley.
- Flavell, J.H., Miller, P.H., & Miller, S.A. (1993). *Cognitive development* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Flavell, J.H., & O'Donnell, A.K. (1999). Le développement de savoirs intuitifs à propos des expériences mentales. *Enfance*, 51, 267-276.
- Gopnik, A., & Meltzoff, A.N. (1997). *Words, thoughts, and theories*. Cambridge, MA: MIT Press.
- Gopnik, A., & Wellman, H.M. (1994). The 'theory' theory. In L.A. Hirschfeld & S.A. Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 257-293). Cambridge, UK: Cambridge University Press.
- Haith, M.M., & Benson, J.B. (1998). Infant cognition. In D. Kuhn & R.S. Siegler (Eds.), W. Damon (Series Ed.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 199-254). New York: Wiley.
- Hala, S. (Ed.) (1997). *The development of social cognition*. Hove, UK: Psychology Press.
- Harman, G. (1978). Studying the chimpanzee's theory of mind. *Behavioral and Brain Sciences*, 1, 576-577.
- Harris, P.L. (1992). From simulation to folk psychology: The case for development. *Mind and Language*, 7, 120-144.
- Hughes, C. (1998). Finding your marbles: Does preschoolers' strategic behavior predict later understanding of mind? *Developmental Psychology*, 34, 1326-1339.
- Jenkins, J.M., & Astington, J.W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology*, 32, 70-78.
- Johnson, C.N., & Wellman, H.M. (1980). Children's developing understanding of mental verbs: Remember, know, and guess. *Child Development*, 51, 1095-1102.
- Jost, J.T., Kruglanski, A.W. & Nelson, T.O. (1998). Social metacognition: An expansionist review. *Personality and Social Psychology Review*, 2, 137-154.
- Kuhn, D. (1999). Metacognitive development. In C. Tamis Le-Monda (Ed.), *Child psychology: A handbook of contemporary issues*. Philadelphia, PA: Psychology Press.
- Leslie, A.M. (1987). Pretense and representation: The origins of "theory of mind". *Psychological Review*, 94, 412-426.
- Leslie, A.M. (1994). ToMM, ToBy, and agency: Core architecture and domain specificity. In L.A. Hirschfeld & S.A. Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 119-148). Cambridge, UK: Cambridge University Press.
- Lillard, A.S. (1998a). Wanting to be it: Children's understanding of intentions underlying pretense. *Child Development*, 69, 979-991.
- Lillard, A.S. (1998b). Ethnopsychologies: Cultural variations in theories of mind. *Psychological Bulletin*, 123, 3-33.
- Meltzoff, A.N. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Developmental Psychology*, 31, 838-850.
- Metcalfe, J., & Shimamura, A.P. (Eds.) (1994). *Metacognition*. Cambridge, MA: MIT Press.
- Mitchell, P. (1997). *Introduction to theory of mind: Children, autism and apes*. London: Arnold.
- Moore, C. (1996). Theories of mind in infancy. *British Journal of Developmental Psychology*, 14, 19-40.
- Moses, L.J., Baldwin, D.A., Rosicky, J.G., & Tidball, G. (in press). Evidence for referential understanding in the emotions domain at 12 and 18 months. *Child Development*.
- Moshman, D. (1998). Cognitive development beyond childhood. In D. Kuhn & R.S. Siegler (Eds.), W. Damon (Series Ed.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 947-978). New York: Wiley.
- Perner, J. (1991). *Understanding the representational mind*. Cambridge, MA: MIT Press.
- Perner, J., Ruffman, T., & Leekam, S.R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development*, 65, 1228-1238.
- Peterson, C.C., & Siegal, M. (1997). Psychological, physical, and biological thinking in normal, autistic, and deaf children. In H.M. Wellman & K. Inagaki (Eds.), *The emergence of core domains of thought: Children's reasoning about physical psychological, and biological phenomena*. (New Directions for Child Development), (No. 75, pp. 55-70). San Francisco, CA: Jossey-Bass.
- Pillow, B.H. (1995). Two trends in the development of conceptual perspective-taking: An elaboration of the passive-active hypothesis. *International Journal of Behavioral Development*, 18, 649-676.
- Pillow, B.H., & Henrichon, A.J. (1996). There's more to the picture than meets the eye: Young children's difficulty understanding biased interpretation. *Child Development*, 67, 803-819.

- Poulin-Dubois, D. (1999). Infants' distinction between animate and inanimate objects: The origins of naive psychology. In P. Rochat (Ed.), *Early social cognition* (pp. 257-280). Mahwah, NJ: Erlbaum.
- Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, *1*, 515-526.
- Reaux, J.E., Theall, L.A., & Povinelli, D.J. (1999). A longitudinal investigation of chimpanzees' understanding of visual perception. *Child Development*, *70*, 275-290.
- Repacholi, B.M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14- and 18-month olds. *Developmental Psychology*, *33*, 12-21.
- Shantz, C.U. (1983). Social cognition. In P.H. Mussen (Series Ed.), J.H. Flavell & E.M. Markman (Eds.), *Handbook of child psychology: Vol. 3. Cognitive development* (pp. 495-555). New York: Wiley.
- Shatz, M., Wellman, H.M., & Silber, S. (1983). The acquisition of mental verbs: A systematic investigation of first references to mental state. *Cognition*, *14*, 301-321.
- Schneider, W., & Bjorklund, D.F. (1998). In D. Kuhn & R.S. Siegler (Eds.), W. Damon (Series Ed.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 467-521). New York: Wiley.
- Stone, V.E., Baron-Cohen, S., & Knight, R.T. (1998). Frontal lobe contributions to theory of mind. *Journal of Cognitive Neuroscience*, *10*, 640-656.
- Taylor, M. (1996). A theory of mind perspective on social cognitive development. In R. Gelman & T. Au (Eds.), E.C. Carterette & M.P. Friedman (Gen Eds.), *Handbook of perception and cognition: Vol. 13, Perceptual and cognitive development* (pp. 283-329). New York: Academic Press.
- Taylor, M., Esbensen, B.M., & Bennett, R.T. (1994). Children's understanding of knowledge acquisition: The tendency for children to report they have always known what they have just learned. *Child Development*, *65*, 1581-1604.
- Watson, A.C., Nixon, C.L., Wilson, A., & Capage, L. (1999). Social interaction skills and theory of mind in young children. *Developmental Psychology*, *35*, 386-391.
- Wellman, H.M. (1983). Metamemory revisited. In M.T.H. Chi (Ed.), *Trends in memory development research* (pp. 31-51). Basel: Karger.
- Wellman, H.M. (1985). The child's theory of mind: The development of conceptions of cognition. In S.R. Yussen (Ed.), *The growth of reflection in children* (pp. 169-206). San Diego, CA: Academic Press.
- Wellman, H.M. (1993). Early understanding of mind: The normal case. In S. Baron-Cohen, H. Tager-Flusberg, & D. Cohen (Eds.), *Understanding other minds: Perspectives from autism* (pp. 10-39). Oxford, UK: Oxford University Press.
- Wellman, H.M. (1998). Culture, variation, and levels of analysis in our folk psychologies. *Psychological Bulletin*, *123*, 33-36.
- Wellman, H.M., Baron-Cohen, S., Gomez, J.C., Swettenham, J., & Toye, E. Using thought-bubbles helps children with autism acquire an alternative for theory of mind. Manuscript in preparation.
- Wellman, H.M., Cross, D., & Watson, J.K. (1999, April). *A meta-analysis of theory of mind development: The truth about false belief*. Poster presented at the meeting of the Society for Research in Child Development, Albuquerque, NM.
- Wellman, H.M., & Gelman, S.A. (1998). Knowledge acquisition in functional domains. In D. Kuhn and R.S. Siegler (Eds.), W. Damon (Series Ed.), *Handbook of Child Psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 523-573). New York: Wiley.
- Wellman, H.M., Harris, P.L., Banerjee, M., & Sinclair, A. (1995). Early understandings of emotion: Evidence from natural language. *Cognition and Emotion*, *9*, 117-149.
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*, 103-128.
- Woolley, J.D. (1995). The fictional mind: Young children's understanding of imagination, pretense, and dreams. *Developmental Review*, *15*, 172-211.
- Woolley, J.D., & Wellman, H.M. (1992). Children's conceptions of dreams. *Cognitive Development*, *7*, 365-380.
- Woodward, A.L. (1998). Infants selectively encode the goal object of an actor's reach. *Cognition*, *69*, 1-34.
- Woodward, A.L., & Markman, E.M. (1998). Early word learning. In D. Kuhn & R.S. Siegler (Eds.), W. Damon (Series Ed.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 371-420). New York: Wiley.