Theory of Mind
Beyond the Preschool Years

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Theory of Mind
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To Sylvia, Brielle, and Tavio
## Contents

Preface ix

1 Theory of Mind 1  
   A Little History 2  
   Goals of the Book 5  
   Organization of the Book 7  

2 First-Order Developments 9  
   First-Order False Belief 9  
   Other Epistemic Measures 19  
   Other Mental States 21  
   Developments in Infancy 25  
   Autism 29  
   Neuroimaging of Theory of Mind 30  
   Relations to Other Developments 32  
   Conclusions 36  

3 Second-Order False Belief 41  
   Precursors 41  
   The Second-Order Task 42  
   Developmental Findings 45  
   Antecedents of Second-Order Understanding 58  
   Autism 60  
   Aging 62  
   Conclusions 63  

4 Other Higher-Order Developments: Part 1 69  
   An Overview of Measures 69  
   Developmental Findings 79  
   Executive Function and Language 87  
   Autism 88  
   Aging 90  
   Conclusions 91
5 Other Higher-Order Developments: Part 2
   Interpretive Diversity 93
   Opacity 101
   Origins of Beliefs 104
   Understanding of Mental Activities 109
   Variations of the First-Order Paradigm 115
   Conclusions 121

6 Consequences of Higher-Order Understanding
   Deliberately False Statements 125
   Social Outcomes 133
   Cognitive Outcomes 143
   Other Outcomes 148
   Conclusions 149

7 Historical Connections: What Did We Know Before Theory of Mind?
   Perspective Taking 153
   Metacognition 159
   Epistemological Conceptions 165
   Attribution 171
   Person Perception 177
   Relationships and Groups 181
   Conclusions 185

8 Conclusions 187
   Some Initial Contrasts 187
   Some Contrasts in Theories 190
   Some Contrasts in What Is Studied 192
   So What Does Develop After Age 5? 194

References 203

Author Index 235

Subject Index 245
Preface

Some titles are more informative than others. If you were one of the (not very many) moviegoers who sought out *Snakes on a Plane* or *Cowboys & Aliens*, you knew what you were in for.

My title is not as catchy as those, but it does let you know what you are in for. This book is about developments in theory of mind that occur from about age 5 and on. Much of Chapter 1 presents my reasons for writing such a book, but I can summarize the argument briefly here. Most books about theory of mind concentrate on the preschool period, for the good reason that most research on theory of mind has involved the preschool period. Theory-of-mind development is not complete at age 5, however, and several hundred (mostly quite recent) studies have told us a fair amount about what the further developments are. This recent research joins a larger and more longstanding research literature that addressed mentalistic understanding from a variety of perspectives prior to the advent of theory of mind—a literature that has not been fully integrated with that under the theory-of-mind heading (indeed, many theory-of-mind treatments ignore it entirely). My goal is to bring together new and old in a way that will make clear both what we know and what we still need to know about higher-order theory of mind.

This book has both an immediate and a more long-term predecessor. The immediate predecessor is a review article that I published in *Psychological Bulletin* in 2009 (Miller, 2009). The article dealt with the most often studied development under the higher-order heading: Second-order false belief. This book updates and expands that coverage and adds to it work on several dozen other post-preschool developments, some from the theory-of-mind literature and some from the work that predated theory of mind.

The more long-term predecessor is my immersion—as teacher, author, and researcher—in this earlier, pre—theory-of-mind work. This experience is not quite of the present-at-the-creation sort (for that, one would have had to be in Geneva in the 1920s). Still, it does provide a perspective on the study of social and mental understanding that many authors who write about theory of mind do not possess. And it contributes, I believe, to the two (as we will see, related) ways in which this book attempts to expand the usual age period for writings on theory of mind: in terms of the age of the child, and in terms of the age of the research literature.

Like most authors, I hope that my book will be of use to a wide range of different readers. Because of the breadth of the coverage, even veteran researchers may find things of interest of which they were previously unaware. But I have tried as
well to make the presentation accessible to students just embarking on the study of theory of mind. Parts of the book might serve as a useful supplement in courses on cognitive development.

I am grateful to a number of colleagues for sharing unpublished or pre-publication materials with me. Janet Astington was especially helpful in this regard. I also thank Robin Banerjee, Daniel Bernstein, David Bjorklund, Julie Comay, Melanie Glenwright, Elizabeth Hayward, Nancie Im-Bolter, Ashley King, Jorie Koster-Hale, Lynn Liben, Lauren Myers, and Rebecca Saxe.

Several colleagues at the University of Florida helped in various ways. I am grateful to Shengying Zhang for translation of a key source from Chinese. Thanks also to Jackie Rollins and Jim Yousse for help with word processing issues, to Juliana Vassolo for drawing Figure 2.2, and to Connie Ordaz for drawing Figure 7.1.

It has been a pleasure to work with Debra Riegel, Andrea Zekus, Tara Nieuwesteeg, Jessica Lauffer, and other members of the Psychology Press team. Among their many good services was selection of an outstanding group of reviewers to whom I express my gratitude: Derek Montgomery (Bradley University), John D. Bonvillian (University of Virginia), Manuel Sprung (Harvard University), Martin Doherty (University of Stirling, Scotland), Janet Wilde Astington (University of Toronto), Eric Phillip Charles (The Pennsylvania State University, Altoona), and one anonymous reviewer. A special thanks to Derek, a long-time friend whose opinion I value highly.

Finally, my thanks to Sujata for so many things.
Other Higher-Order Developments

Part 2

As the title indicates, this chapter continues the discussion of higher-order tasks that probe for competencies beyond those found at the preschool level. The distinction between the approaches considered now and those reviewed in Chapter 4 is perhaps at least as much historical as substantive. All of the studies discussed in Chapter 4 were carried out explicitly under the theory-of-mind heading, most had a common starting point in the second-order false belief task, and most had the pragmatic goal of illuminating the condition of autism. The work reviewed in this chapter reflects a diversity of starting points and theoretical orientations, and it clearly falls more in the basic-science than the applied side of the field. The similarity with the work in Chapter 4 is that both help to fill in the later phases of the theory-of-mind developmental story.

Although no one (to my knowledge) has brought together all of the work that I consider here, there have been reviews of portions of this literature. Among the helpful sources are Chandler and Birch (2010), Keenan (2003), Kuhn and Franklin (2006), and Pillow (2008).

INTERPRETIVE DIVERSITY

Chandler’s Work

One theme of this book is that most theorists and researchers of theory of mind have paid relatively little attention to what happens beyond about age 5. There is, however, at least one seminal figure in the theory-of-mind field for whom this indictment clearly does not hold, and that is Michael Chandler (1982; Chandler & Sokol, 1999). Chandler has long argued against the notion that theory-of-mind development is essentially defined by and complete with the mastery of false belief at age 4 or 5, a position he dubs the “one miracle” view of development. His contention, rather, is that many important developments both precede and follow success on the standard false belief tasks. It is the latter that I concentrate on here.
What further developments might there be? As noted, the answer is many—Chandler is certainly not advocating a “two miracle” view in place of the “one miracle” model he decries. Still, one post-preschool development is especially emphasized in his research and writing, and that is mastery of interpretive diversity. Interpretive diversity refers to “the appreciation that one and the same thing can be assigned different meanings by different persons” (Carpendale & Chandler, 1996, p. 1703). This appreciation is seen as part of a more general understanding that the mind is active and constructive in its encounters with the world and not merely a passive recipient of whatever information comes along. Clearly, in anybody’s theory such understanding must be a central component in theory-of-mind development.

Although we can all agree that understanding of interpretive diversity is important, not everyone has seen it as a relatively late developmental achievement. Mastery of false belief, after all, could be argued—and indeed has been argued by many theorists—to demonstrate an appreciation of interpretive diversity. The child who has mastered false belief realizes that Maxi believes one thing about the location of his chocolate while the mother believes something different—thus different meanings for the same aspect of reality. In the false belief case, however, the two thinkers are not dealing with “one and the same thing”; rather, the mother has information that Maxi does not have. False belief, therefore, demonstrates only a limited, albeit important, appreciation of diversity: the understanding that different information can lead to different beliefs. It does not demonstrate the understanding that the same information can lead to different beliefs.

Chandler and Sokol (1999) illustrated the distinction just made with the following example:

Imagine that two couples, the Wimmers and the Perners, both go to a movie. At some disadvantageous moment in the plot line of the film, one of the Wimmers goes out for popcorn. Later they end up arguing over the meaning of what they saw. By contrast, the Perners remained glued to their seats throughout the film, but also exit in sharp disagreement about what they had both seen together from curtain to credits. The Wimmers…are in a situation not unlike that of Maxi and his mother who have access to differing amounts of information, and the basis of any disagreement … that they may have is easily laid at the door of the fact that going out for popcorn at the wrong moment often leads to false beliefs. By contrast, the Perners, who are also in disagreement … closely approximate the kind of ideal test case we are looking for. They both have equivalent access to the “facts,” they sharply disagree about the meaning of their common experience, and their disagreement has real epistemic content—that is, their disagreement is about what they hold out as matters of fact (rather than about some matter of taste or personal preference). (p. 222; reproduced with permission of Taylor & Francis, LLC, a division of Informa plc.)

This example suggests the kind of methodology that is needed to study the form of interpretive diversity emphasized by Chandler and associates: namely, require the child either to predict or to explain different responses to the same stimulus or event. The Chandler group has taken two general approaches to this task.

One approach makes use of ambiguous stimuli, that is, stimuli that lend themselves to at least two equally valid interpretations. In the visual realm reversible

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figures meet this criterion. Figure 5.1 presents two of the most often studied examples. With a bit of concentrated attention you should be able to see a rabbit and a duck in the first case and a rat and an old man in the second. It is doubtful, however, that you were able to do so when you were 3 or 4, for the ability to perceive both versions of a reversible figure is a developmental achievement, and most preschoolers show little success at the task (Gopnik & Rosati, 2001). The research to be considered now is limited to children who themselves can see both interpretations of such pictures.

The auditory realm also presents instances of ambiguous stimuli. Homophones (e.g., pair–pear, the different meanings of ring) are one example. Ambiguous sentences are another—for example, the instruction “Pick the big block” when there are in fact two big blocks in the array. Such would-be communications are undoubtedly the most important real-life form of ambiguity. Most of us spend little time puzzling over reversible pictures, but we have all struggled with messages that lend themselves to more than one possible interpretation.

Figure 5.2 shows an example of the second approach taken by the Chandler group (Lalonde & Chandler, 2002). The drawings are examples of Doodles, a form of cartoon popularized by Roger Price in the 1950s. As can be seen, Doodles are amorphous forms that do not lend themselves to any single, definite interpretation (Rorschach ink blots are another example). On the other hand, once an interpretation is provided—and every Doodle comes with an explanatory caption—it is hard not to see the specified interpretation. The caption for the first Doodle is “ship arriving too late to save a drowning witch.” That for the second is “spider doing a handstand.”
Both ambiguous stimuli and Droodles have been used in two ways in research. In some cases the child participant first receives some disambiguating information about the stimulus. In the case of the Droodles task, for example, the child sees a picture that incorporates the Droolde into a complete and easily interpreted rendering of the full scene. Figure 5.3 shows the picture used in the drowning witch case. The question then is whether the child can predict the response of a target who was not privy to the information that he or she has received—someone, for example, who sees only the original Droolde. Procedurally, this approach is quite similar to the false belief task; in both cases situational cues create an informational
difference between self and other that the child must appreciate to judge correctly. 
Given this similarity, it is not surprising that success on this form of the ambiguity task 
emerges (usually—there is some variation across studies) at about the same 
time as success on false belief, namely, at around age 4 (Perner & Davies, 1991; 
Ruffman, Olson, & Astington, 1991).

The second approach to the study of ambiguity is more relevant to the Chandler 
conceptualization of interpretive diversity. In this case two targets (typically pup-
pets) receive the same insufficient information about the stimulus—thus they see 
the same Droodle or the same ambiguous picture. The question now is whether 
the child realizes that two people can form different beliefs given the same infor-
mation to work with. This realization turns out to be more difficult than the real-
ization that people can form different beliefs given different information. It is only 
at about 7 or 8 that children succeed at tasks that require them either to predict 
or to explain different responses to the same stimulus (Carpendale & Chandler, 
1996; Lalonde & Chandler, 2002). This conclusion is a general one, holding for 
visual ambiguity, lexical ambiguity (i.e., homophones), and ambiguous messages. 
It occurs, moreover, despite the fact that most of the children in these studies 
had succeeded on standard measures of false belief and most had no difficulty in 
acknowledging that two people might have different tastes or preferences. It was 
only different beliefs that gave them difficulty.

A possible caution with respect to this research may have occurred to you. 
Ambiguous pictures and Droodles are obviously rather unusual stimuli, and pup-
pets are not among the real-life targets of interest. If conclusions about interpr e-
tive diversity were confined to such situations they might be of limited interest. 
Research by Ross and colleagues (Ross, Rechia, & Carpendale, 2005), however, 
makes clear that this is not the case. The task for the participants (4- to 9-year-olds) 
in their study was to make sense of conflicts between siblings, conveyed via sce-
narios that provided information about each protagonist’s point of view but left 
the interpretation of the disagreement up to the child. Response to the conflict 
task showed the same developmental pattern as that found in the original diversity 

Figure 5.3 A Droodle disambiguated. (From Lalonde, C. E., & Chandler, M. J., New Ideas 
studies, with the youngest children showing little realization that two defensible positions might exist and older children better able both to identify and to justify different points of view. In addition, children’s reasoning about conflict correlated with their reasoning on the standard measures of diversity.

A recent study by Lagattuta and colleagues (Lagattuta, Sayfan, & Blattman, 2010) provides an interesting addendum to the Chandler research. They presented problems on which two characters first received different but irrelevant information about the identity of an object, followed by a full view that made the identity of the object apparent. Despite the irrelevance of the initial experience, many 6- and 7-year-olds judged that the two characters would form different beliefs about the object. They thus applied their newfound knowledge of diversity too broadly, predicting difference even when no differences would occur. In the authors’ words, they showed an overinterpretive theory of mind.

The Lagattuta et al. (2010) study demonstrates that mastery of interpretive diversity is not complete by age 7. Chandler, in fact, has always been careful to acknowledge that the understanding of diversity demonstrated in his research is an early and simple form. There is still much for children to learn about where beliefs come from and how and why beliefs may differ among different people. In the rest of this chapter we will see what some of these further advances are. Nevertheless, the Chandler research does identify an important early achievement in the move beyond preschool competence: the realization that the mind does not simply copy reality; rather, two minds may impose different interpretations upon the same aspect of the world.

Sources of Diversity

Informative though they are, the Chandler studies leave one basic question about interpretive diversity unanswered, and that is exactly what differences two thinkers might bring to a particular task. Realizing that differences in belief are possible—the achievement focused on by the Chandler group—is a necessary condition for attempting to infer what the differences may be. It is not a sufficient condition, however, and the typical ambiguity study gives the child no basis for attaching particular beliefs to particular targets.

When might there be a basis for predicting how different people will interpret the same situation? The general answer is that prediction becomes possible when the child has prior information about at least one of the targets. Two approaches to the provision of such information have been explored. In some cases (e.g., Barquero, Robinson, & Thomas, 2003; Pillow & Henrichon, 1996) the child is given information about a target’s previous experience with the stimulus in question. The child might watch, for example, as a puppet receives partial views of an object that suggest a plausible but (as the child knows) mistaken interpretation of its identity; the question then is whether the child can use this information to predict the puppet’s response. The answer varies some across different studies and different ways of posing the interpretive question; for the most part, however, it is only at about
TABLE 5.1 Examples of Scenarios Used in the Pillow Research on Understanding of Biased Interpretation

<table>
<thead>
<tr>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann doesn’t like Linda. Ann thinks Linda is mean, and starts fights, and gets into a lot of trouble. Mary likes Linda. Mary and Linda are friends. One day Linda was throwing a ball outside. When Linda threw the ball, it went over the other girl and smashed right through a window. The window broke into pieces. Cathy likes Sarah. Cathy thinks Sarah is nice, and helpful, and always does good things. Joan does not like Sarah. Joan thinks Sarah is mean, gets into trouble a lot, and always does bad things. At Christmas time, the teacher told the class about the poor children who wouldn’t have any toys for Christmas. The teacher asked the children in the class to give toys to the poor children. Then the teacher put a big box at the back of the classroom for them to put toys into for poor children. Some of the children brought toys to school and put them in the box. One morning before school, Cathy and Joan saw Sarah holding a doll in front of the box. The box was open and its top was on the floor.</td>
</tr>
</tbody>
</table>


Age 6 or 7 that children succeed in using a target’s informational history to predict the specific response to an ambiguous stimulus.

The second general approach was touched on in Chapter 3 in the discussion of Brad Pillow’s research. The focus in this case is on the child’s ability to use general characteristics of the target to predict how the target will respond to an ambiguous stimulus or event. In the Pillow studies (Pillow, 1991; Pillow & Weed, 1995) children heard scenarios of the following sort: Character A likes Character C but Character B dislikes C; C then performs some damaging action, in some cases accidentally and in some cases with ambiguous intent. The child’s task is to predict A and B’s interpretation of C’s behavior. Table 5.1 presents two of the scenarios that were used.

As we saw in Chapter 3, preschoolers showed little ability to use the information about the targets to predict their response, and kindergartners were only slightly more successful. By second grade, however, most children were able to make sensible use of the information about bias. They could do so, moreover, whether the bias was positive or negative and whether the response to be predicted was evaluation of the target’s action or judgment of the intent behind the action (see also Mills & Grant, 2009; Mills & Keil, 2005, 2008).

The Pillow studies (Pillow 1991; Pillow & Weed, 1995) extend the Chandler research in three informative ways. The first extension is the one I have already noted. The Chandler studies demonstrate that children realize that diverse views are possible. The Pillow studies demonstrate that children can also use relevant evidence to figure out what the different views are.

A second extension concerns the situations with respect to which children can apply their newfound knowledge. As I noted, most ambiguity studies have focused on the interpretation of limited and somewhat artificial stimuli, typically partial views of two-dimensional pictures. Ross et al. (2005) is one exception to this statement. The Pillow research is another, given its focus on a topic that is clearly of real-life importance: understanding other children’s social behavior (see also Wainryb, Shaw, Langley, Cottam, & Lewis, 2004).
The third extension concerns the types of evidence that children can use to make sense of differences in belief or behavior. I will draw here from a distinction raised by Higgins (1981) in a discussion of the perspective-taking literature. As he noted, the challenges in perspective taking are of two general sorts. In some cases the differences between self and other are situational in origin. This is the case, for example, when the child attempts to describe a referent to a peer who does not share his or her visual perspective. In other cases the differences between self and other reflect what Higgins labels the individual dimension, that is, general status differences that cut across different situations. This would be the case, for example, when an older child attempts to explain the rules of a game to a younger child.

Most studies of ambiguity have focused on the situational dimension. More generally, most theory-of-mind studies have concerned children’s ability to use situational information (Miller, 2000). This is true, for example, of the typical false belief task, as well as most of the other frequently used measures at the preschool level (e.g., appearance-reality, origins of knowledge). The Pillow research adds some relatively rare information about children’s ability to use the individual dimension—specifically, to take into account positive or negative biases that may affect how children evaluate their peers. I return to the situational–individual distinction later in the chapter.

Relations to Other Developments

One issue with respect to any higher-order task is whether it correlates with other higher-order tasks. Of course we never expect a perfect relation; different tasks exist in order to assess abilities that are at least somewhat different. Still, if there is a common underlying core then responses to different higher-order tasks should show some relation.

The limited evidence to date with respect to interpretive diversity is mixed. Two studies provide data. Hayward and Homer (2011) assessed understanding of diversity via both an ambiguous figures task and a Doodles task. Response to the Doodles task correlated significantly, albeit weakly, with second-order false belief; neither the ambiguous figures task nor the Doodles task showed any relation to Strange Stories, Faux Pas, or the Eyes Test. I should add—given that this summary singles out the diversity measure—that an absence of relations was a general finding of the study; only 2 of 15 correlations among the various higher-order measures were significant.

More positive results were reported by Comay and Astington (Comay, 2011; Comay & Astington, 2011). Again, the assessment of diversity was based on both ambiguous pictures and Doodles; first- and second-order false beliefs were also assessed. A composite diversity score correlated .49 with a composite belief score; when age and language were partialled out the correlation remained significant at .31. In Comay and Astington’s analysis the common core that links second-order belief and diversity is that both require an appreciation of two divergent perspectives on the same reality: John’s belief and Mary’s belief, a belief that the picture is a rat and a belief that the picture is an old man.

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OPACITY

The notion of opacity is most easily introduced through example. Imagine that you hear the following pair of sentences (adapted from Kamawar & Olson, 2009):

Jane knows that her cat is in her favorite tree.
Her favorite tree is the oldest tree in town.

You are then asked to evaluate the truth status of this pair of sentences:

The cat is in the oldest tree in town.
Jane knows that her cat is in the oldest tree in town.

The first sentence is true. Favorite tree and oldest tree are coreferential terms; that is, they refer to the same aspect of reality. Any statement about the world that is true of one term is therefore also true of the other. Such contexts are said to be transparent. In contrast, the second sentence is not necessarily true, for we have not been told whether Jane knows that the favorite tree is also the oldest. The context in this case is said to be opaque.

Kamawar and Olson (2009, p. 286) define opacity as follows: “Opaque contexts are linguistic contexts in which one cannot see through a description to the referent itself…; hence the metaphorical name ‘opaque’… Opaque contexts, more formally, are those that contain both a proposition and a mental attitude toward the proposition.” It is the inclusion of the mental attitude (e.g., knows that, thinks that, wishes that) that places opacity in the domain of theory of mind. Children must realize that the truth value of such utterances does not depend on what is true in the world but rather depends on the speaker’s attitude toward what is said about the world.

There is an overlap between work under the heading of opacity and that just discussed under the heading of interpretive diversity. In both instances the core understanding—an understanding that is not present in early childhood but rather must develop—is the realization that the same object or event can be represented in different ways. In the case of opacity, however, the different representations are not imposed by different thinkers. The distinction, rather, is between a representation of reality and a representation of a mental attitude toward reality.

As can be guessed from its inclusion in this chapter, the notion of opacity poses problems for young children. The first demonstration of this point was reported by James Russell (1987). In the Russell study children heard a story in which a man named George saved up money to buy a beautiful watch, only to have the watch stolen by a red-headed thief as he lay sleeping. An initial question verified that the children realized that George did not know that the thief had curly red hair. Two further questions followed: “Can we say that George was thinking: ‘I must find the thief who stole my watch’?” “Can we say that George was thinking: ‘I must find the man with the curly red hair who stole my watch’?” The 5- to 7-year-old participants had no difficulty answering “yes” to the first question. Many, however, also answered “yes” to the second, despite having agreed moments before that George did not know the color of the thief’s hair. They thus treated an opaque context...
as if it were transparent, focusing on the reality in question rather than George's knowledge about the reality.

Research since the Russell (1987) study has had two general goals. One has been to determine whether preschoolers' difficulties with opacity are genuine and not the result of some methodological artifact. The error, after all, is a surprising one—the child has just stated that George does not know what the robber looks like yet seconds later goes on to credit George with knowledge about the robber's looks. Perhaps performance would be better if the vignettes were shorter and simpler or the test question was not so complexly worded. Various attempts at simplification have been explored; examples from different laboratories include Apperly and Robinson (1998); Hulme, Mitchell, and Wood (2003); Kamawar and Olson (2009); and Sprung, Perner, and Mitchell (2007). These studies have led to a clear conclusion. Although the procedural simplifications have sometimes proved helpful, the effects are limited and success prior to age 5 remains rare. Preschoolers' difficulties with opacity are indeed genuine.

This conclusion leads to the second general goal: to determine why preschoolers find the opacity task so difficult. Why, in particular, is opacity more difficult than false belief? The two concepts, after all, would seem to depend on the same basic cognitive advance: the realization that a representation of reality is not necessarily the same thing as reality. Indeed, mastery of false belief could be argued to imply a beginning-level understanding of opacity: The child must realize that Maxi's belief about reality does not reflect reality, that is, is opaque with respect to the true state of the world. Beginning-level, however, is not mature form, and full mastery of opacity requires something more than just false belief.

One possibility is that this something more is linguistic. This was Russell's (1987) explanation for the results in the original opacity study, a position reflected in the title of his article: "Can we say...?" In Russell's view the main difficulty faced by the young child is in handling linguistic descriptions—specifically, in realizing that a description picks out only some and not all aspects of the real-world referent. Kamawar and Olson (1999, 2009) offer a somewhat similar explanation. In their view the key development is metalinguistic awareness, that is, the ability to reflect on language as an object of thought in itself—to "see the description, and not just see through it to the referent" (Kamawar & Olson, 2009, p. 287; italics in original). Such metalinguistic awareness is not sufficient for an understanding of opacity; developments in representational understanding are also required. It may be necessary, however. The Kamawar and Olson (2009) study provides empirical support for this hypothesis: a positive correlation between a measure of metalinguistic awareness and performance on the opacity task. The study also reported a positive correlation between understanding of false belief and performance on opacity, a finding that has emerged in other studies as well (e.g., Kamawar & Olson, 2011).

Other positions, while not necessarily denying a role for metalinguistic awareness, stress the representational advances that make success on opacity tasks possible. Apperly and Robinson (1998, 2003) and Robinson and Apperly (2001) have argued that the main challenge for the young child comes in understanding partial information. Suppose, for example, that Heinz knows that there is a ball in the box but does not know that the ball is a present. When asked, "Does Heinz know that there is a present in the box?" the child must answer not in terms of a full
representation of the situation (i.e., that there is a present in the box) but rather in terms of Heinz’s partial representation, which includes no information about a present. It is true, of course, that on the false belief task the child must also answer in terms of the protagonist’s knowledge rather than the actual situation. With false belief, however, the protagonist is working with outdated information and all that need be represented is his or her ignorance of the current situation. Representing partial information presents a more difficult challenge.

I should add that Hulme et al. (2003) raised doubts about the generality of Apperly and Robinson’s (1998) argument. In their view scenarios such as the one about George and his stolen watch do not entail simply a difference in amount of information; rather there is a qualitative difference between the information available to George and that available to the child participant. Research by Sprung and colleagues (2007) also suggests an addendum to the partial information argument. When they presented stimuli that could be represented in two ways (e.g., an eraser in the shape of a dog) they found what Apperly and Robinson had found: Young children answered in terms of their own knowledge rather than in terms of the information available to the protagonist. Children did much better, however, when the missing information had to do with a property of an object rather than its identity. Told, for example, that Heinz wished to find a red block, they predicted that he would go to the box in which he had seen a red block, rather than to a second box, also containing a red block, for which only the child had seen the color. Children’s difficulties with partial information, therefore, do not seem to be across the board. They are limited to cases of dual identity.

Sprung and colleagues (2007) go on to offer their own explanation for the difficulty of the opacity task, an explanation that is grounded in the more general second-order literature. As we saw, the first question in an opacity task tests the child’s understanding of the protagonist’s knowledge—for example, “Does Heinz know that the dog is an eraser?” Judging someone else’s knowledge is a first-order task, and thus it is not surprising that even 4-year-olds are fairly successful on this question. The opacity test question, however, requires that children recognize the difference between their own perspective on a dual identity situation (e.g., know that the object is both a dog and an eraser) and the protagonist’s perspective on the situation (knows only that the object is a dog). This, according, to Sprung et al., is a second-order task. In their words (Sprung et al., p. 238), “The use of dual identities in … partial knowledge stories requires an understanding of different perspectives created by the dual identities in relation to another person’s … perspective, which is different from the child’s own. This becomes a second-order perspective problem.” And it is because the task is second-order that success is not seen until about 6 or 7.

I have quoted Sprung et al.’s (2007) analysis so that readers can decide for themselves how compelling the argument for second-order competence is. Personally, I believe that the argument needs at the least some further development. I will note also that Sprung et al. attempted to provide some empirical support for their position by relating performance on opacity to performance on a task (taken from Perner & Howes, 1992) that tested understanding of second-order ignorance.
Although the two tasks proved to be at about the same level of difficulty, there was no within-child correlation between the two measures.

Three conclusions follow from the work reviewed in this section. First, mastery of opacity is an important developmental achievement, reflecting a major advance in the child’s understanding of both language and representation. Second, such mastery is not a single developmental achievement but rather takes different forms, and even preschoolers may be capable of simple levels of understanding. Full mastery, however, is a post-preschool developmental achievement. Finally, research and theorizing have identified a number of contributors to this achievement; thus far, however, we do not have a fully satisfactory theory of why young children struggle with opacity and how they eventually overcome their difficulties.

ORIGINS OF BELIEFS

The work to be considered now is addressed to one of the basic issues in theory of mind: the child’s understanding of where beliefs come from. It is part of the more general question of where mental states of any sort (e.g., desires, emotions, intentions) come from. Beliefs, however, have been by far the most often studied mental state, especially beyond the preschool period, and it is therefore beliefs on which I concentrate here.

I begin with some distinctions. Table 5.2 provides an overview of the points to be made.

As a starting point, consider one of the sources mentioned briefly in Chapter 2, a study by Pratt and Bryant (1990). In the Pratt and Bryant study 4-year-olds watched as one adult looked inside a closed box and a second adult merely lifted the box. When subsequently asked who knew what was in the box, most were able to judge that the first adult would know and the second adult would not. Note that both judgments are important. Children need to be able both to attribute knowledge when appropriate and to withhold such attributions when experience is insufficient to support a belief. The children in the Pratt and Bryant study were able to do so, thus demonstrating a basic understanding of how experience leads to belief.

The Pratt and Bryant (1990) task is perhaps the simplest possible test of the experience-belief relation: perception as the source of information, a simple empirical fact as the target for judgment, and either knowledge or ignorance as the outcome to be judged. In a sense, most other research under this heading—in particular, research directed to developments beyond the preschool period—includes various complications of this basic paradigm. The source of the information may vary. Perception is not the only experiential source for beliefs; communication and inference also contribute. The outcome may vary. Knowledge and ignorance are

| Table 5.2 Relevant Dimensions in the Study of Origins of Beliefs |
|---|---|---|---|
| **Source of Information** | **Recipient of Information** | **Nature of Target** | **Outcome** |
| perception, communication, inference, guess | e.g., self or other, adult, child, or baby | e.g., empirical fact, word meaning, conceptual principle | true belief, false belief, ignorance, uncertainty |

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not the only possible outcomes; some kinds of experience result in false beliefs, and other kinds lead to uncertainty. The kind of belief at issue certainly may vary. Simple and arbitrary empirical facts, such as the contents of a box, are not the only beliefs to be formed, and most real-life beliefs of interest are considerably more complex than this maximally simple case. Finally, it may be important to take into account not only what kind of belief is involved but also who it is who is forming the belief. In a simple situation such as the Pratt and Bryant task the recipient of the information really does not matter—anyone looking in the box should come away with the knowledge in question. In more complex situations the nature of the recipient may be a critical determinant of the eventual outcome.

A difficulty in focusing on any of these dimensions in isolation—either in research or in summaries such as the present one—is that the dimensions never occur in isolation. Any belief-forming situation necessarily includes a source of information, a recipient of the information, a content area for the belief, and a particular outcome such as knowledge or ignorance. In what follows I organize the discussion in terms of source of information, beginning with perception and moving on to communication and inference. Each of the other dimensions, however, will also receive consideration.

**Perception**

As Pratt and Bryant (1990) and other studies show, a basic understanding of the relation between perception and belief develops quite early. By age 4 most children can make appropriate judgments of knowledge or ignorance based on the targets’ perceptual access to the relevant information. Most can do so, moreover, for both self and other, although some show a tendency to overrate their own knowledge relative to that of another (Miller, 2000). Children who are 4 years old also typically succeed on the standard false belief tasks, thus demonstrating understanding of a third important outcome of perceptual experience in addition to knowledge or ignorance: namely, false beliefs that result from misleading perceptual information. What they do not yet appreciate, at least usually, is a fourth possible outcome: uncertainty in the face of ambiguous perceptual information. This, as the first section of this chapter indicates, must wait for the early grade-school years.

In studies such as Pratt and Bryant’s (1990) the perceptual information is visual. Children must also come to understand the contribution of other perceptual senses, in particular hearing and touch, as well as the different kinds of information provided by the different senses. As we saw in Chapter 2, preschoolers initially struggle with tasks that require them to differentiate among the senses; they have difficulty reporting the source for things they have just learned (e.g., O’Neill & Chong, 2001), and they are also poor at selecting particular senses when seeking particular kinds of information (e.g., Robinson, Haigh, & Pendle, 2008). These problems, however, are short-lived, and by age 5 performance on such tasks is typically at or close to ceiling.

The gist of the preceding is that many basic forms of understanding with regard to the perception-belief relation are in place by age 5. Tasks with ambiguous information provide an exception. Are there any others?
The situational–individual distinction raised by Higgins (1981) is relevant here. In the tasks considered thus far the relevant information is all situational—what matters is the particular perceptual experience, not who is receiving that experience. It is worth noting that preschoolers seem to appreciate the irrelevance of the particular target in such situations; with rare exceptions they offer the same judgments for self and other, child and adult, friend and stranger, and so forth (Miller, 2000). But what about situations in which the particular target makes a difference?

There is not much relevant work with regard to perception. A study by Taylor, Cartwright, and Bowden (1991) provides the clearest example. They first verified that their participants (4- and 6-year-olds) realized that babies know some things (e.g., what rattles and bottles look like) but not others (e.g., what elephants and bicycles look like). A series of trials followed on which a baby observer received partial views of the objects in question and the children judged whether the baby would know what the object was. Despite having accurately judged babies’ ignorance of the nonbaby items, many 4-year-olds believed that the baby would be able to identify all of the objects; 6-year-olds were better but not yet perfect at making such judgments. The children thus demonstrated an understanding of the situational basis for knowledge formation, namely, adequate perceptual access, but not of the individual basis: a cognitive system capable of utilizing the information. This is a conclusion that we will see again in the work on communication.

Several recent studies (Barrett, Newman, & Richert, 2003; Barrett, Richert, & Driesenga, 2001; Knight, 2008; Makris & Pnevmatikos, 2007) provide a novel approach to the issue of possible differences among targets in response to perceptual input: namely, questions about how God would respond to the typical theory-of-mind tasks. Although the results are not perfectly consistent, the data do suggest an interesting developmental pattern. Three- and 4-year-old children tend to treat God in the same way as any other target. By 5 or 6, however, a view of an omniscient God has emerged; thus God is judged as incapable of forming a false belief or of remaining ignorant even in the face of patently inadequate evidence about an object’s identity. Obviously, determining the accuracy of such judgments is a tricky issue. But they do signal a developmental change in children’s thinking between the preschool and grade-school years.

Communication

As with perception, a basic understanding of communication as a source of information is evident by the preschool period. Such a conclusion emerges from laboratory studies of the issue (e.g., Montgomery, 1993), and it is also implied by various naturally occurring behaviors (question asking, question answering) that are common by the preschool years.

The evidence suggests, however, that children’s initial understanding of communication is probably shakier than their understanding of perception. They have difficulty in particular in recognizing the inadequacy of unclear or ambiguous messages, often overestimating the knowledge that can be gained from such communications (e.g., Sodian, 1988). In addition, within-study comparisons of the two
sources, although not perfectly consistent, generally report better performance on perception than on communication (e.g., Miller et al., 2003; Montgomery, 1993).

Limitations in children’s understanding of communication become more apparent when they must take into account not only the situational dimension (the adequacy of the message) but also the individual dimension (who is receiving the message). As in the Taylor et al. (1991) study, difficulties are especially evident when babies are the target. Montgomery (1993) found that most 4-year-olds and even many 6- and 8-year-olds believed that a baby could acquire knowledge from a verbal communication; this finding occurred despite the fact that the children realized that the babies did not know the words involved in the message. Miller et al. (2003) reported similar results; indeed, in their research the attributions of knowledge for the baby actually increased between ages 4 and 8.

The preceding is based on laboratory study. I should note that children’s adjustments to different targets, including different-aged ones, are often more impressive in the natural setting. Even 2- and 3-year-olds, for example, direct simpler speech to younger siblings than they do to their mothers (Dunn & Kendrick, 1982). Miller (2000) discusses possible explanations for the lab-field discrepancy.

A more positive picture of preschoolers’ ability also emerges from a recent line of research directed to children’s selective learning from different would-be informants (e.g., Birch, Vauthier, & Bloom, 2008; Corriveau, Meints, & Harris, 2009; Robinson & Nurmi, 2009). The basic paradigm for these studies is some version of the following. Children watch as two adults perform some task, one quite well and the other quite poorly. For example (and this has been the most often studied content domain), Adult A might label a series of objects correctly whereas Adult B makes a number of labeling errors. Shortly afterward the children are presented with some novel objects for which they do not yet know a label. Adult A provides one label and Adult B provides a different label, and the question is which adult is more influential. A consistent finding, now reported across two dozen or so such studies, is that children place more credence in the previously reliable adult. This finding has been shown for several different content domains in addition to word learning and for several different ways of establishing informant reliability. And it has been shown in children as young as 2 (Birch, Akmal, & Frampton, 2010).

The findings just summarized provide impressive evidence of preschoolers’ ability to use their knowledge of others to take in information in a selective and adaptive fashion. Also surprising evidence, given that in most settings preschoolers are not at all good at people-reading skills. It should be pointed out, therefore, that the learning situation in these studies is set up to be as simple and as helpful as possible: two simultaneously present adults who offer clearly contrasting responses to some task, followed by an immediate test of the child’s ability to use this information in some closely related setting. The real-life settings in which children observe and learn from others are almost certainly not this helpful. It seems likely that a major developmental change beyond age 4 consists of a progressively improving ability to extract relevant information about others from the hubbub of everyday life. This point is not purely speculative; there is in fact an older research literature under the heading of “information seeking” that documents changes across the grade-school and adolescent years in children’s ability to seek out and utilize...
informational sources differentially (e.g., Bar-Tal, Raviv, Raviv, & Brosh, 1991; Nelson-Le Gall & Gumerman, 1984). So far there has been no attempt to integrate the newer studies with this older literature.

Inference

Conclusions about when children understand inference as a source of knowledge are somewhat controversial. The question, it should be noted, is not whether they can use inference themselves; it is whether they recognize that inference can be a source of knowledge for others. Most examinations of the issue have concluded that children show little such recognition prior to age 6 (e.g., Miller et al., 2003; Pillow, 1999; Sodian & Wimmer, 1987), a phenomenon known as inference neglect (Varouxaki, Freeman, & Peters, 1999). In the within-child comparison in Miller et al., inference proved more difficult than either perception or communication. Studies in which children have to identify the sources of their own knowledge have also generally found inference to be more difficult than perception or communication (Brueell & Woolley, 1996; O’Neill & Gopnik, 1991).

Not everyone agrees with the conclusion that understanding of inference is a post-preschool development. Using simplified procedures (memory aids, heightened salience of the important information), Keenan, Ruffman, and Olson (1994) reported some success in judging inferential knowledge even among 4-year-olds (though see Pillow, 1999, for a critique of their conclusions). In addition, the type of inference may be important. In most studies the inference has been of the logical syllogism sort: All X are Y, this in an X, therefore it is a Y. Rai and Mitchell (2006) explored children’s ability to recognize inferences based on elimination—specifically, if the target knows the names of two out of three characters, then he or she will assume that any new name belongs to the third character (an assumption that children in fact show in their early word learning). Children who were 5 were above chance, although well short of ceiling, in making this attribution.

A reasonable conclusion from the preceding is that inference comes in various forms and various contexts and that some forms and contexts are easier than others. Such, of course, is also the case for perception and, more strongly so, for language. Recall from the Strange Stories measure that children’s understanding of speech forms such as irony or metaphor lags well behind their mastery of more literal, direct messages.

A further question about origins of beliefs cuts across the specific sources of information. It concerns the certainty with which the resulting belief can be held, including the relative certainty of the different informational sources. Do children trust some sources more than others?

One way to study this question is to pit two sources against each other. Suppose that the child sees one thing but is told something else. Not surprisingly, children as young as 3 tend to weight the perceptual information more heavily in such a case (Clement, Koenig, & Harris, 2004; Mitchell, Robinson, Nye, & Isaacs, 1997). They do so, moreover, whether judging for themselves or judging for another.

Another approach to the issue is to teach children to use simple rating scales to express the degree of certainty with which a particular conclusion can be held.
Research adopting this approach by Pillow and colleagues reveals definite developmental changes in feelings of certainty, especially with regard to inference (Pillow, 2002; Pillow, Hill, Boyce, & Stein, 2000; Pillow, Pearson, Hecht, & Bremer, 2010). Although 6-year-olds can recognize inference as a source of information for others, they judge the resulting belief as no more certain than a belief achieved through guessing. It is only at about 8 or 9 that children draw distinctions between the two sources. Children are better at judging the certainty of their own knowledge than that of others; when their own belief is the focus, children as young as 6 realize that inference results in more certain conclusions than does guessing. Finally, by 8 or 9 children recognize that different kinds of inference vary in the certainty of the conclusions that they yield. They rate deductive inferences as more certain than inductive inferences and strong inductive inferences (those with much supportive evidence) more certain than weak inductive inferences (those with less supportive evidence). Such judgments mirror the judgments made by adults.

In summary, three general developmental changes are evident in children’s understanding of informational sources beyond the preschool years. First, although preschoolers understand simple forms of perception, communication, and (perhaps) inference, the variety of forms that they can handle expands with development. Second, developmental changes are especially marked with regard to children’s ability to use the individual dimension in inferring belief. Even preschoolers have a fairly good understanding of the situational bases for belief formation; what they still need to learn is how different people make use of this information. Finally, with development children become capable not only of inferring beliefs accurately but also of reflecting on the nature of the beliefs—in particular, of realizing that some beliefs are more certain than others.

The last point prefires material to be discussed in Chapter 7. As we will see, reflection about beliefs, including differences among beliefs, is a central theme of work in epistemology.

**UNDERSTANDING OF MENTAL ACTIVITIES**

The following passage from Flavell, Green, and Flavell (1995, p. 3) summarizes the kind of knowledge that is at issue now:

> Much of the research in this area has focused on young children’s understanding of mental *states*, such as beliefs, knowledge, desires, emotions, and intentions…. In contrast, there has been little investigation of their knowledge about mental *activities*, that is, mental things that we could be said to *do* rather than just *have*. (italics in original; copyright 1995 by John Wiley & Sons; reprinted with permission)

The preceding section did provide some initial coverage of children’s understanding of mental activities. Inferring, for example, is certainly a mental activity, and we saw that children’s understanding of inference undergoes definite changes as they develop. The present section takes up the topic of mental activity more fully.
**Flavell’s Work**

As is true of many topics in the study of cognitive development, John Flavell and colleagues are responsible for some of the first and the most influential research on children’s understanding of mental activities. I therefore begin with some findings from the Flavell program of research.

The Flavell studies have concentrated primarily on thinking—“broadly and minimally defined as mentally attending to something” (Flavell et al., 1995, p. v). It will be a useful exercise, before reading further, to think about what you know or believe about thinking. Here and in general in cognitive-developmental research, the starting point for work with children is often knowledge of the adult end state—what are the developments that we are attempting to document and explain?

A first finding from the Flavell et al. (1995) studies is that even preschool children demonstrate some understanding of thinking. They realize, for example, that only animate beings think. Indeed, preschoolers, more than older children or adults, tend to deny that animals can think, reserving the ability only for humans. Preschoolers also show some realization that thinking is an internal act, and some are able to localize it in the head or brain. They show some ability as well to distinguish thinking from overt actions to which it is often related, such as seeing or touching something. Although they are not very good at doing so, they can sometimes make some use of available cues to infer when someone is thinking. Finally, they realize that thinking is *about* something, that it has some target, even though they are not very good at figuring out what the target is.

The preceding account should be qualified in several ways. First, “some” understanding is not complete understanding, and all of the developments mentioned show improvement into the grade-school years. Second, although 3-year-olds show some success on some measures, in many instances it is only at age 4 or 5 that above-chance performance emerges. Finally, the assessment procedures throughout the Flavell program of research are designed to be as clear, simple, and undemanding as possible (something that the Flavell group is very good at). The fragile competence elicited by such measures may not be evident very often in the child’s everyday cognitive efforts.

A further point, of course, is that many forms of understanding are not even minimally present in preschoolers but rather emerge only later in development. As a sampling, I discuss two such developments here.

One is an aspect of thinking first identified by William James more than a century ago (James, 1890, p. 239):

> Consciousness, then, does not appear to itself chopped up in bits. Such words as “chain” or “train” do not describe it fitly as it presents itself in the first instance. It is nothing jointed; it flows. A “river” or a “stream” are the metaphors by which it is most naturally described. *In talking of it hereafter, let us call it the stream of thought, of consciousness, or of subjective life.* (italics in original; copyright 1890 by Holt; reprinted with permission)

This passage expresses the famous Jamesean notion of the stream of consciousness—an essentially unending flow of mental activity that characterizes
the mental life of a sentient human being. It is a notion, research reveals, with which most adults agree (Flavell, Green, & Flavell, 1993). What about children? For preschoolers the answer is clear. Preschool children have difficulty identifying thinking even when the clues seem maximally obvious (e.g., a problem to be solved, a pensive look, relevant verbalizations). Most are loath to credit any sort of mental activity to someone who is just sitting silently. In Flavell et al.’s words (1995, p. 32), “4-year-olds are apt to believe that a person who is doing nothing overtly may also be doing nothing covertly.” This judgment extends to their own mental life—preschoolers are no better at introspecting about their own mental activities than they are at judging the mental activities of others.

Although they are not yet at adult level, 6- and 7-year-olds are a good deal more likely than preschoolers to believe that some sort of ongoing mental activity is the norm rather than an exception. They also show some understanding of how one mental activity can lead to another, a phenomenon known as cognitive cuing (Gordon & Flavell, 1977). By 8 or 10 children are also able to withhold attributions of thinking when doing so is relevant; in particular, they realize that someone who is asleep and not dreaming is not thinking or engaging in any other consciousness-requiring mental activity (Flavell, Green, Flavell, & Lin, 1999). Finally, by the grade-school years children begin to show some appreciation of the fact that different thinkers may have diverse trains of thought—that two people looking at the same object, for example, may be thinking quite different things (Eisbach, 2004). Note the convergence of this last conclusion with findings from the Chandler work on understanding of interpretive diversity.

The second development to be discussed is related. One implication of the stream of consciousness is that we have limited ability to control our mental activity. We cannot, for example, simply will ourselves to think of nothing for an extended period of time. Many preschoolers do not realize this. When asked, for example, whether someone can keep her mind free of thoughts for 3 minutes many respond yes (Flavell et al., 1993); indeed, some believe that it is possible to do so for 3 days (Flavell, Green, & Flavell, 1998)! Older children are more likely to share the adult intuition that an extended stretch with no mental content is simply not possible.

Children also come to realize that different mental activities vary in how controllable they are. Table 5.3 shows some of the items used in the Flavell group’s examination of this issue (Flavell & Green, 1999). The first three items (Knowing, Fearing, Wanting) were intended as examples of hard-to-control mental activities; the other entries in this category were Liking and Believing. The last three items (Thinking, Imagining, Changing One’s Mind) were included as examples of relatively easy-to-control mental activities; the other entries in this category were Looking and Paying Attention. The basic question following each scenario was whether it would be easy or hard for the story character to change the mental activity. As with other studies in the Flavell program of research, the results showed a clear age difference. Seven-year-olds (the youngest group tested) did fairly well but not as well as 10-year-olds who in turn were (by some measures) not yet at the level of adults. Interestingly, the main difficulty shown by the youngest children came on the easy-to-control items. Only a third, for example, judged that Clara would be able to change what she was thinking about. These results indicate
TABLE 5.3 Examples of Items From the Flavell and Green Study of the Controllability of Mental Activities

<table>
<thead>
<tr>
<th>Cognitive activity</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowing</td>
<td>“This is about Mary. Mary knows her name. She knows that her name is Mary. Now suppose she doesn’t want to know that her name is Mary any longer. So, she is going to try very hard to forget that her name is Mary. Will it be kind of easy or kind of hard for her to forget that her name is Mary? Why would that be kind of easy (kind of hard)?”</td>
</tr>
<tr>
<td>Fearing</td>
<td>“This is about Julia. Julia was bitten by a big dog one time. Now she is very afraid of big dogs. She is really really afraid of big dogs. Now suppose she doesn’t want to feel afraid of big dogs any longer. She is going to try very hard to stop feeling afraid of big dogs.”</td>
</tr>
<tr>
<td>Wanting</td>
<td>“This is about Jane. Jane doesn’t have a computer at home. She wants very much to have a computer. She has wanted one for a very long time. Now suppose she would like to stop wanting a computer. She is going to try very hard to stop wanting a computer.”</td>
</tr>
<tr>
<td>Thinking</td>
<td>“Now I’ll tell you about Clara. Clara is walking along one morning and suddenly, she starts to think about the cereal she just ate for breakfast. So, she is thinking about that cereal. Now suppose she doesn’t want to think about that cereal any longer. She is going to try very hard to stop thinking about that cereal.”</td>
</tr>
<tr>
<td>Imagining</td>
<td>“This is about Wendy. Wendy is sitting quietly in her room. Suddenly, she starts to imagine that she is someplace else. She is imagining that she is sitting in a tree. Now suppose that she doesn’t want to imagine that she is sitting in a tree any longer. She is going to try very hard to stop imagining that she is sitting in a tree.”</td>
</tr>
<tr>
<td>Changing one's mind</td>
<td>“This is about Hannah. Hannah has decided to take her parrot out of his cage. So, she has made up her mind to take her parrot out of his cage. Now suppose she wants to change her mind about taking her parrot out and decide not to do that after all. She is going to try very hard to change her mind about taking her parrot out of his cage.”</td>
</tr>
</tbody>
</table>


that children face two, related challenges as they develop: coming to realize that mental activities are often uncontrollable but at the same time also developing an appreciation for the exceptions to this rule.

In some instances children’s knowledge about the controllability of mental states may have clinical implications. Some recent research by Sprung and colleagues (Sprung, 2008; Sprung & Harris, 2010; Sprung, Lindner, & Thun-Hohenstein, 2011) provides an example. The primary participants for their research were children who had recently undergone a traumatic experience; some had been exposed a few months earlier to Hurricane Katrina, and some had been hospitalized because of injury or maltreatment. The primary measure was the frequency and nature of intrusive thoughts, defined as when “we start to think about something we don’t really want to think about.” Two main findings emerged. As would be expected, the children who had recently been traumatized reported more negative intrusive thoughts than did a nonexposed control group. In addition, it was children whose theory-of-mind understanding was greatest (as determined primarily by response to a subset of the Flavell questions) who showed the greatest awareness of negative thoughts. If, as many clinicians believe, reflecting about traumatic experience

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is a necessary step in overcoming such experience, then these results suggest that theory-of-mind understanding may play an important role.

Even more than is true for most theory-of-mind research, the preceding summary is based largely on the study of Western, mostly middle-class children. It is worth noting, therefore, that many of the same findings, especially those concerning preschoolers’ difficulties with the concept of thinking, emerged in an independent project with a sample of Filipino children (Liwag, 1999). (For other related work, see Amsterlaw, 2006; Wellman & Hickling, 1994.)

Schwanenflugel and Fabricius’s Work

A helpful review by Pillow (2008) draws a distinction among three kinds of understanding with regard to mental activities. One kind is labeled occurrence knowledge, defined as “knowledge that particular cognitive activities occur” (p. 299). It is this sort of knowledge to which the Flavell studies were directed. The other two forms of understanding are organizational knowledge (“knowledge of relations among cognitive activities”—p. 299) and epistemological thought (“reflection on the nature of knowledge and relation between knowledge and reality”—p. 299). The present section addresses the topic of organizational knowledge. Epistemological thought is one of the topics addressed in Chapter 7.

The main program of research directed to the issue of organization is that of Schwanenflugel, Fabricius, and colleagues (Fabricius, Schwanenflugel, Kyllonen, Barclay, & Denton, 1989; Schwanenflugel, Fabricius, & Alexander, 1994; Schwanenflugel, Fabricius, & Noyes, 1996; Schwanenflugel, Henderson, & Fabricius, 1998). They have taken two, related approaches to the task. One has been to have participants rate the similarity of mental verbs (e.g., “deciding,” “explaining,” “guessing,” “knowing,” “memorizing”) with respect to how they would use their mind for each. The other has been to ask participants to rate the similarity of different cognitive activities. Table 5.4 presents a subset of the items used in one of the latter studies (note that the category labels—for example, List Memory, Prospective Memory—do not appear in the information provided to the participant). The items were presented in pairs, and participants rated their similarity on a seven-point scale ranging from “use your mind in completely the same way” to “use your mind in completely different ways.” With both approaches, the similarity judgments were then subjected to various statistical procedures (e.g., multidimensional scaling) designed to reveal the underlying organization of a set of items.

As with the Flavell research, it will be a useful exercise to think about your own probable response to such an assessment before reading the developmental findings. Each of the studies in the research program does in fact include a sample of adult participants. Several emphases characterize adults’ thinking about mental organization. Perhaps strongest is an emphasis on memory; cognitive activities that involve the use of memory (such as the first three examples in the table) tend to be seen as similar. Adults also distinguish a dimension of inference (including in particular the Inference and Recognition Memory items) and one of attention. Finally—and cutting across the content areas that characterize the first three dimensions—adults identify two more general dimensions. One is information
TABLE 5.4 Examples of Items From the Schwanenflugel et al. Study of Organization of Cognitive Activities

<table>
<thead>
<tr>
<th>Cognitive activity</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>List memory</td>
<td>Telling your friend everything you had to eat today in the school cafeteria. Writing down the names of the states you learned about in social studies last year.</td>
</tr>
<tr>
<td>Prospective memory</td>
<td>Being sure to turn on the TV to watch your teacher on the evening news. Making sure to stop by your classroom after playing to pick up your sweater before you go home.</td>
</tr>
<tr>
<td>Recognition memory</td>
<td>Identifying a song by the first few notes that your teacher plays on the piano. Seeing a mitten in the lost and found and knowing that it’s the one you lost last week.</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Feeling like you know how to do an assignment after the teacher explains it. Investigating a Lego building to see how it is built during recess.</td>
</tr>
<tr>
<td>Inference</td>
<td>Figuring out that your teacher is going to give you a test when she says “Put your books away.” Knowing that your mother baked cookies for your school party by seeing the dirty dishes.</td>
</tr>
<tr>
<td>Planning</td>
<td>Deciding with your mom where she is going to pick you up after school. Choosing what you need to make your costume for the school Christmas play.</td>
</tr>
<tr>
<td>Selective attention</td>
<td>Listening to the announcements being made at lunch time in a noisy cafeteria. Finding where the rabbit is when it’s the same color as the background in a picture in a science class.</td>
</tr>
<tr>
<td>Comparison</td>
<td>Listening to two different songs in music class and deciding if they were sung by the same person. Deciding if two crayons are the same color out of your art box at school.</td>
</tr>
</tbody>
</table>


processing, which encompasses activities at both the input end (e.g., seeing, attending) and the output end (e.g., deciding, inventing) of the decision-making process. The other dimension concerns the certainty with which the resulting knowledge can be held. This means, for example, that “knowing” and “understanding” are seen as highly similar, “guessing” comes at the other end of the certainty continuum, and “thinking” falls somewhere in between. Note the congruence of this last finding with the research by Pillow discussed in the Origins section.

Children’s ratings proved in some ways similar to those of adults and in some ways different. Eight-year-olds (the youngest group tested) did distinguish a memory dimension; they did not do so as strongly or consistently as older children or adults, however, and they showed little differentiation among different types of memory. In addition, 8-year-olds tended to group items along dimensions that from an adult point of view are relatively superficial—whether the activity involved going somewhere or staying where you are, for example, or whether the activity was something that you wanted to do or something someone else wanted you to do (perhaps understandably, a salient dimension for many children). By age 10 the memory dimension was both more firmly established and more differentiated in children’s evaluations, and the more superficial dimensions had begun to recede in importance. At both
ages there was some evidence, as with adults, for both an information-processing dimension and a certainty dimension; the latter, however, figured less importantly in children’s judgments than was the case for the adult participants.

What is the overall message from this work? In the view of Schwanenflugel and colleagues, the most general finding to emerge from their research concerns the movement with development toward a progressively constructivist theory of mind—a conclusion, of course, that is in keeping with other research reviewed in this chapter. As children develop they place less emphasis on the external aspects of problem-solving situations and more emphasis on what the mind does to make sense of those situations. In the researchers’ words (Schwanenflugel et al., 1996, p. 288, italics in original):

A constructive theory of mind is achieved when children consolidate the following insights: (a) that knowledge can be more or less certain, (b) that feelings of uncertainty are important in evaluating information, (c) that things can have multiple meanings, and (d) … that those meanings can derive solely from differences in interpretive mental processes.

VARIATIONS OF THE FIRST-ORDER PARADIGM

We saw in Chapter 2 that the typical pattern of performance on the first-order false belief task is one of the most solidly established, often replicated outcomes in the literature. We saw also that there is general agreement that success on the task marks an important milestone in children’s understanding of belief; questions typically have focused on the possibility that other, simpler measures might reveal success at an earlier point in development.

The work to be discussed now has an opposite emphasis: the possibility that variations in the typical procedures might result in poorer performance and thus provide evidence of aspects of development that are not complete by age 4 or 5. I address this possibility first with respect to children and then with respect to adults. In both cases a variety of different approaches will be considered, but the general message will be the same: Things are more complicated than we might have thought, and there are indeed further developments beyond those that the typical measures reveal.

Studies With Children

In a typical false belief task of the unexpected locations sort the target character has a desire to find a particular object. Thus, Maxi wants to find his chocolate, Sally wants to find her marble, and so forth. Suppose, however, that the desire is just the opposite—to avoid rather than go to a particular location. Perhaps, for example (to take one of the examples used in this literature), Sally does not like frogs and wants therefore to avoid the box that has a frog hiding under it.

Logically, the task for the child participant is the same in an avoidance scenario as it is in the typical approach scenario: namely, infer the belief held by the target character and then predict the behavior that will follow from this belief. Thus if
Sally believes (falsely) that the frog is under the red box, she should avoid the red box and select the green box instead. And she should do so despite the fact that the frog (as the child participant knows) is actually under the green box. It turns out, however, that the two tasks are not of equal difficulty; rather, children find avoidance more difficult than approach (Cassidy, 1998; Friedman & Leslie, 2004, 2005; Keenan & Ellis, 2003; Leslie, German, & Polizzi, 2005). The difference, moreover, is not trivial; only a minority of preschool children who pass the standard task succeed on the avoidance task (the exact percentage varies across studies). Younger children’s difficulty is not in predicting avoidance under all circumstances, for if the character holds a true belief they have no trouble predicting that she will avoid the unwanted location. Nor is their difficulty with the ascription of the false belief, for if the question is “think” rather than “look” they do fine. The difficulty, then, is specific to the behavioral prediction: predicting that the character will go to a location that she actually wishes to avoid.

Why might reasoning about avoidance be more difficult than reasoning about approach? The most general explanation is offered by Friedman and Leslie (2004, 2005). The explanation is part of Leslie’s general theory of modularity, a position touched on in Chapter 2. According to this model, to reason about an agent’s action the child must select a content for the agent’s belief and an action for the agent’s desire. The default assumption for belief is that beliefs are true. In the case of false beliefs this assumption must be inhibited, which is why young children find the false belief task difficult. The default assumption with respect to desire is that action will be directed toward a known location. On the standard task this assumption poses no further problem; on an avoidance task, however, it must be overcome. Avoidance thus requires a double inhibition, which is why children find it more difficult than the standard approach task.

Keenan and Ellis (2003) offer a different, although not necessarily incompatible, explanation for the difficulty of the avoidance paradigm. Their position is narrower in scope than that of Friedman and Leslie, in that it applies to only some kinds of avoidance situations—specifically, to those in which a prey is attempting to avoid a predator. In one of their scenarios a thirsty zebra goes to a pond to get a drink, aware that the lion that she is attempting to avoid is resting behind the trees. While the zebra is drinking, the lion moves to a hiding place behind the tall grass. The question then is what route will the zebra take in going home: past the trees or past the grass? Most 4-year-olds indicate that she will go past the trees, thus ignoring her false belief about the lion’s location; they do so, moreover, even when they are capable of passing a standard version of the location’s task. Some recent research by Ellis and colleagues (Ellis, Bjorklund, & King, 2011) verifies this effect and shows that even 5- and 6-year-olds have difficulty with the avoidance task.

Why is the predator–prey situation so difficult? Keenan and Ellis (2003) argue that the task activates an evolutionarily provided instinctual response system that has evolved to promote survival and that this automatically evoked system, even in vicarious form (for the child, after all, is not the prey), overrides the more deliberate cognitive processing of which the child would otherwise be capable.

Intriguing though the evolutionary argument is, further research is clearly needed to establish both its validity and its generality. This question aside, the
Keenan and Ellis (2003) study does introduce another feature of potential importance: namely, an animate being as the target for the protagonist’s thought and action. Such a focus is rare; in the great majority of false belief studies it is some inanimate object (e.g., chocolate, a marble, a toy) that serves as the object of thought. Again, from a logical point of view the variation should not make a difference; people as well as objects may be in different locations, and beliefs about their whereabouts may be either true or false. Several studies, however, have indicated that the nature of the target does make a difference, with poorer performance for animate (specifically human) targets than for inanimate targets (Rai & Mitchell, 2004; Symons & Clark, 2000; Symons, McLaughlin, Moore, & Morine, 1997). The effect holds, however, only under certain conditions. What turns out to be important is the nature of the human’s movement from the original to the new location. If the movement is involuntary—for example, made in response to someone else’s command—then the task is no more difficult than the standard object displacement problem. If the movement is voluntary, however, then keeping track of a human is more difficult than keeping track of an object.

Why should this be? The explanation offered by Symons and colleagues (1997) is that voluntary movement by an animate object introduces a second set of mental states for children to consider—not only the belief of the target for the false belief question but also the thoughts and intentions of the self-moving agent. Even though only the former belief is relevant in this context, children who are in the process of mastering false belief apparently find the inclusion of additional mental states confusing and thus perform more poorly. (Not always, I should add—Ahn and Miller, in press, failed to confirm the voluntary-movement effect.)

Nguyen and Frye (1999) provide some further evidence that reasoning about the actions of others may be more difficult than reasoning about inanimate objects. Their study contrasted a standard unexpected locations scenario with scenarios that involved a change in activities rather than a change in locations. Thus in an initial scene Child A and Child B were shown to be engaged in activity X; B then left for a while, and in his absence A switched to activity Y; Child B prepared to return; and the question for the participant was what B believed that A was now doing. The correct answer, of course, is activity X—having no knowledge of the change, B should have a false belief about A’s activity. This question turned out to be more difficult than the standard change-of-location question, with a substantial number of misses even among 5-year-olds. (Again, however, I must note that the research evidence is not perfectly consistent—cf. Garner, Curenton, & Taylor, 2005.)

The procedural variations discussed to this point have all retained a focus on false belief; what has varied from the standard task has been either the content of the belief or the action that follows from it. Zhang et al. (2010) add a different emphasis: children’s ability to reason about uncertain beliefs. Their participants heard a story in which a dog placed his toy in a red house and left the scene; in his absence a rabbit moved the toy to a blue house. The dog then returned, and the question was where he would search for the toy. So far we have standard false belief, and all of the participants who continued to the next phase of the study answered the search question correctly. The next phase introduced the novel element. The dog was shown to search unsuccessfully in the red house, and the
question was where he would look next. This was a question because there were three other houses: not only the blue one but a green and yellow one as well.

If your own answer to the look-next question was some version of “any of the other three,” then you responded in the same way as the adult participants included in Zhang et al.’s (2010) study. Also the 8-year-olds. Not the younger children, however. Most 4-year-olds and a substantial number of 6-year-olds indicated that the dog would search in the blue house—that is, in what they themselves knew to be the true location. Note that all of the children had been able to set aside their own knowledge in the false belief case; many, however, proved unable to do so when judging an uncertain belief. As Zhang et al. noted, their results show some similarity to findings from the opacity literature, in which children also have difficulty realizing that someone may share some but not all of their knowledge. There is also an obvious overlap with work on ambiguity, in that in both cases a key development is the realization that not all problems have a single correct answer. Each of the three paradigms leads to the same general conclusion: Reasoning about uncertainty is a more difficult, later developing ability than is reasoning about false belief.

Studies With Adults

As we saw in Chapter 4, advanced theory-of-mind tasks such as Strange Stories or the Eyes Test are sometimes used with adult samples. For adults with clinical impairments first-order tasks may also be informative, and such tasks have in fact been applied across a range of clinical conditions (see Apperly, Samson, & Humphreys, 2009, for an excellent summary of such work). Presumably, however, there is no point in administering first-order measures to a sample of normal adults. What could be the point of asking adults to respond to a task that they had all mastered by age 4 or 5?

If standard tasks with standard measures are used then there is in fact no point. Suppose, however, that we introduce some change in the typical approach, perhaps a variation in the usual experimental procedure, or perhaps a change in the response required of the participant, or perhaps both. In this case we may pick up some variability in how even normal, unimpaired adults respond, some way in which performance, at least for some, is not yet at ceiling.

Figure 5.4, taken from Birch and Bloom (2007), shows one example. As can be seen, the task introduces three changes from the usual unexpected locations problem. First, there are four possible locations rather than the usual two. Second, the containers themselves and not just the object of interest are moved in the protagonist’s absence. Finally, the response is not a simple choice between the alternatives; rather the task is to assign a probability to each of the possible search locations.

Not shown in the figure is a final feature: an experimental condition comparison. Some of the participants heard the wording shown in the figure: “moves the violin to the red container.” Others heard simply “moves the violin to another container.” Thus, the former but not the latter knew the true location.

This manipulation proved to be important. Those who were ignorant of the true location assigned an average probability of 71% to the original location of the blue container; thus they regarded the typical false belief error as Vicki’s most likely
This is Vicki. She finishes playing her violin and puts it in the blue container. Then she goes outside to play.

While Vicki is outside playing, her sister, Denise, moves the violin to the red container.

Then, Denise rearranges the containers in the room until the room looks like the picture below.

When Vicki returns, she wants to play her violin. What are the chances Vicki will first look for her violin in each of the above containers? Write your answers in percentages in the spaces provided under each container.

**Figure 5.4** False belief task used to test the curse-of-knowledge effect in adult participants. (From Birch, S. A. J., & Bloom, P., *Psychological Science, 18*, 2007, p. 384. Copyright 2007 by SAGE Publications. Reprinted by permission of SAGE.)

response. The only other container to receive an appreciable probability rating (23%) was the red one, the container that now occupied the spatial position where the violin had been left. Participants who knew the true location also rated these two outcomes as most likely, but their ratings differed significantly from those in the ignorance condition: 59% for the original container and 34% for the red container. Why the higher ratings for the red container? The only possible explanation is that these participants knew that this container actually held the violin, and they allowed their own knowledge to color their predictions of Vicki’s response.

Birch and Bloom (2007) refer to the biasing effects of one’s own knowledge as “the curse of knowledge,” defined as the “difficulty appreciating a more naïve
perspective as a result of being biased by one’s own knowledge” (Birch, 2005, p. 25). As they note, this concept overlaps with the notion of egocentrism; indeed, most commentators would probably classify their findings as an example of egocentrism. The curse of knowledge, however, is a more specific and directional bias, in that it applies only to judgments of a more naïve perspective. As their research shows, both children and adults can often (although of course not always) appreciate a more knowledgeable perspective; the more difficult task is to realize that someone knows less than the self. (For another curse-of-knowledge effect on adults’ first-order performance, see Bernstein, Thornton, & Sommerville, 2011.)

The Birch and Bloom study illustrates two of the possible ways to pick up some variability in adults’ theory-of-mind performance: modify the task (four locations rather than two) and modify the response (probability ratings rather than a categorical judgment). A third possible approach is to give adults something else to do in addition to the theory-of-mind task. Newton and de Villiers (2007) provided an example of such a “dual task” approach. Their adult participants responded to a nonverbal false belief task of the unexpected contents sort while simultaneously performing either a verbal (shadowing sentences) or a nonverbal (rhythmic tapping) interference task. The nonverbal task had little effect on false belief performance, and neither interference task affected performance on a true-belief trial that was included for comparison. False belief performance, however, was markedly impaired by the imposition of the sentence-shadowing task; fewer than half of the participants were successful on the locations task, a task, recall, that most 4- and 5-year-olds have mastered.

Most of us, of course, do not engage very often in sentence-shadowing or rhythmic tapping tasks. Still, it is a common experience to have two or more cognitive activities in play at the same time, and it is in this respect that dual-task studies are informative. What the Newton and de Villiers (2007) study and others like it (e.g., McKinnon & Moscovitch, 2007) suggest is that theory-of-mind reasoning, even in adults, is not so effortless and automatic that it can proceed unimpeded and error-free when there are other demands on cognitive resources. A further, more specific conclusion from the Newton and de Villiers study follows from the differential effects of the two interference tasks. The fact that only the verbal task disrupted performance suggests that language is important not only for mastery of theory-of-mind skills; it remains important for mature theory-of-mind performance (though see Apperly, 2011, for a dissenting view).

Let us return to the curse-of-knowledge effect. The false belief task is by no means the only context in which such effects have been demonstrated in adults. Epley and colleagues provide an example from the domain of communication (Epley, Morewedge, & Keysar, 2004). The task for the participants in their study was to move a set of objects to various places in a spatial array in response to instructions from a “Director.” Participant and Director were seated on opposite sides of the array, and the Director (as the participant knew) could see only some of the objects that were visible to the participant. One contrast, for example, was that the participant could see a small, a medium-sized, and a large truck, whereas the Director could see only the medium and large trucks. One of the Director’s instructions was to “move the small truck.” To respond nonnegocentrically, the
participant must realize that “small” from the director’s perspective corresponds
to the medium-sized of the three trucks that he or she sees. The adults proved
fairly, although not perfectly, successful at directing their reach toward the appro-
piate object; reaching errors were considerably more common in the children
(mean age = 6) included for comparison. Reaches, however, were not the only
dependent variable in the study; eye movement data were also recorded. In this
case there were no adult–child differences; the adults were just as likely as the
children to direct their first look toward the object that only they could see—thus
the small truck in the example. Adults, then, were just as prone to an initial
curse-of-knowledge bias as the children; where the two groups differed was in the
speed with which they were able to correct the error and respond appropriately.

The studies just discussed are just a few examples from a growing literature
devoted to theory-of-mind performance in adulthood. No one, of course, suggests
that adults no longer possess the first-order knowledge that they developed as pre-
schoolers. What this research shows, however, is that applying this knowledge is
not always as easy or as certain as we might have expected. Apperly (2011) is a good
source for this work.

It may seem strange to spend a section on adult shortcomings in a book devoted
to the positive developments that occur beyond the preschool period. But of course
any shortcomings shown by adults are simply the lingering and relatively minor
vestiges of problems that are much more marked earlier in development. Part of
development beyond preschool consists of the acquisition of new knowledge. Part,
however, is a matter of getting better at using the knowledge one already has.

CONCLUSIONS

This chapter, much more than the preceding two chapters, has dealt with a wide
range of different topics. For each, significant advances in understanding occur
beyond the preschool years, which, of course, is the reason for their inclusion in
this book. But is it possible to extract any further, more specific themes that cut
across the diversity of approaches? In this final section I attempt to identify several
such themes.

One theme concerns children’s growing ability to free themselves from their
own knowledge and perspective. Some such ability, of course, is present in the
preschool period; it is a necessary contributor to mastery of first-order false belief.
As we saw in this chapter, however, the same child who easily handles first-order
false belief may respond in terms of his or her own knowledge on an ambiguity or
opacity task. Indeed, under some procedural variations the child may respond ego-
centrically to a first-order belief task. And not just children—adults also may strug-
gle to overcome their own perspective. We can see here a message that emerged in
the earlier Piagetian research: Breaking away from egocentrism is not a one-time
process but a continual, perhaps lifelong challenge.

A second theme concerns understanding of cognitive activities—thus the
processes and not simply the products of the cognitive system. Preschoolers are
fairly good at judging various mental states. In simple situations, they are also
good at figuring out where those states come from. As we have seen, however,
a full appreciation of the constructive nature of the mind is a later developmental achievement. Understanding of thinking (the most thoroughly studied cognitive activity) is rudimentary at best in early childhood and continues to develop into the adult years. Finally, children’s understanding of how others form beliefs shows one of the most general and important developmental changes. Even preschoolers are fairly successful at recognizing the situational determinants of belief formation, such as informative perceptual input or an adequate verbal message. What they struggle with—and what accounts for most developmental change beyond age 5—is the individual dimension: the contribution of the cognitive system to formation of beliefs.

A third theme concerns the expansion in the range of beliefs that are targets for children’s thinking. The great majority of studies at the preschool level have examined understanding of beliefs of two sorts: where is an object located, or what is in a closed container. There are exceptions, some of which were discussed in Chapter 2 and some of which appeared in this chapter (in particular, the work on learning from different sources). The exceptions, however, are limited. It is no accident that the label for the most often studied concept in this literature is “false belief,” not “false beliefs.” The attempt has been to identify what children know about belief in general, not about particular beliefs. And as part of this attempt, most studies have presented the simplest sort of belief possible.

Each of the lines of research discussed in this chapter goes beyond beliefs about simple and arbitrary empirical facts. The work on thinking, for example, encompasses beliefs of a wide range of different sorts. The research discussed in the preceding section adds beliefs about people to the usual focus on beliefs about objects. We will see a further expansion in the kinds of beliefs that are the targets for thought with the work on epistemology discussed in Chapter 7. Together, these various research literatures broaden the traditional theory-of-mind focus on children’s understanding of belief to a focus on children’s understanding of beliefs.

A final theme that emerges from the work reviewed here is diversity, in two senses. Each of the paradigms reviewed here documents children’s growing awareness that people may differ in their mental contents. Even preschoolers realize that people with different information may form different beliefs. The Chandler research identifies an important next step: the realization that people with the same information may form different beliefs. The work on understanding of the origins of beliefs reveals further developments. Young children have limited understanding of the ways in which differences among people may lead to differences in what they take from experience. And even when they are aware of relevant cognitive differences (e.g., babies can’t talk), they may at first fail to apply their knowledge.

The first sense of diversity, then, concerns children’s appreciation of diversity. The second sense concerns ways in which children themselves differ. Of course work on first-order theory of mind demonstrates individual differences among children. Furthermore—and as discussed in Chapter 2—much productive research has been directed to the question of where these differences come from and what implications they have for other aspects of children’s development. Nevertheless, the differences studied at the first-order level are almost all of one sort: differences in the rate of development. Except in clinical cases, first-order developments
are universal developments; children vary in how quickly they develop such skills, not in whether they develop them. Furthermore, most first-order assessments are dichotomous; the child either passes or fails and thus either possesses the knowledge or does not yet possess it. Work on advanced forms of theory of mind offers the possibility for, and in fact demonstrates, a much wider range of individual differences. This is a point to which I return in the concluding chapter.