CHILD DEVELOPMENT

Principles & Perspectives

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Chapter 5

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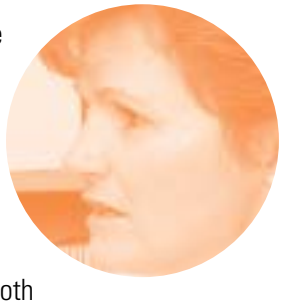
A PERSPECTIVE TO think ABOUT

"Maria wants to pick the best school for her sons, so she plans to observe and interview teachers."

Maria is the mother of two boys, ages 4½ and 12, and she and her children recently moved into a new community. The new community has a school-choice program that allows families to place their children in any school in the district. Maria wants to pick the best school for her sons, so she plans to observe and interview teachers and school officials at several schools. She's heard a lot about the importance of starting children in school early, but her younger son will have just turned 5 when the school year begins. Maria is concerned that he may not really be ready for formal schooling. What should Maria look for when visiting schools and teachers? What kinds of classroom activities and teaching methods would best foster both of her sons' cognitive development? How can she decide whether her younger son is ready for kindergarten?



After studying this chapter, you should be able to identify several important factors that Maria should look for. You will know the kinds of educational philosophy and practices that can support and stimulate the cognitive growth of Maria's children. As you work through this chapter, create a list of at least 12 concepts that might relate to Maria's situation. Explain how Maria could use each concept to identify the best educational environment for her sons.

As you read this chapter, look for the questions that ask you to think about what you're learning from Maria's perspective.

The situation Maria faces is not uncommon. All of us who work with children need to understand cognitive development so that we can be good advocates for children, recognize their strengths and limitations, and provide stimulating academic and intellectual environments. As you learned in Chapter 4, children experience tremendous physical changes from birth through adolescence. Less visible but just as important are the enormous changes in children's thinking during these years. The vast differences between younger and older children's thinking are evident in every aspect of their lives, from the kinds of questions children ask to the kinds of explanations they can understand or offer—and even in the kinds of events and information they will pay attention to. These changes in thinking, in which children's thought gradually becomes more organized and complex, are called *cognitive development.*

In this chapter we explore two of the most influential theories of cognitive development: the stage theory of Jean Piaget, and the sociocultural theory of Lev Vygotsky. Recently, researchers asked 1,500 child development experts to name the "most revolutionary" work published in the last half century (Dixon, 2002). According to the experts, Jean Piaget's 1952 book *The Origins of Intelligence in Children* remained the most revolutionary and influential work published since 1950! The second most important work was Lev Vygotsky's *Mind in Society: The Development of Higher Psychological Processes* (1978). This chapter highlights the central themes of both of these important works as well as newer sociocultural views. As you read, you will see that these theories have had a tremendous impact on how we think about the development of cognition in children.

Piaget's Constructivist View of Cognitive Development

The most influential theorist in the study of cognitive development was Jean Piaget, who was born in 1896 and died in 1980. His prolific career in psychology spanned an astonishing 7 decades. One anonymous writer surmised that

> assessing the impact of Piaget on developmental psychology is like assessing the impact of Shakespeare on English literature or Aristotle on philosophy—impossible. The impact is too monumental to embrace and at the same time too omnipresent to detect. (cited in Beilin, 1994)

After reading this section you should be able to answer the following questions:

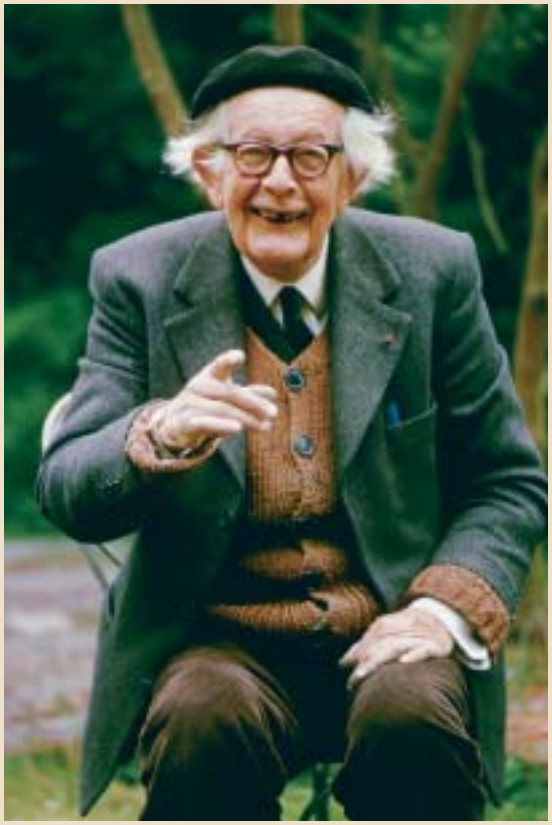
- What influence did Piaget's background in biology have on his theory? What are some specific examples of this biological influence?
- What is constructivism, and why is Piaget considered a constructivist?
- According to Piaget, what processes guide children's interaction with the environment? How do they affect cognitive development?

Piaget as a Child Prodigy

Jean Piaget was no ordinary child. From a very early age, he showed tremendous intellectual talent. Born in Neuchâtel, Switzerland, a small university town, Piaget showed an early interest in nature, particularly in observing wildlife in its natural setting. His observations

led to the first of his many scientific publications. He was only 10 years old when he published his first article, a one-page report on an albino sparrow he observed in a park. At the Museum of Natural History in Neuchâtel, Piaget began working with a zoologist who specialized in mollusks (clams, oysters, snails, etc.). Piaget "catalogued and studied adaptation" (Bringuier, 1980, p. 8), detailing how mollusks' shells changed in relation to the movement of the water in which they lived. As you will see, the idea of adaptation came to play a central role in Piaget's later theory of cognitive development. From age 15 to age 18, Piaget published a series of articles on the mollusk research. His work was so noteworthy that a natural history museum in Geneva offered him a position as curator of their mollusk collection. Fortunately for psychology, he had to decline—he hadn't graduated from high school yet!

After earning a Ph.D. degree at 21, Piaget became interested in psychology. He worked for a time at a psychiatric clinic in Zurich, where he learned about Freudian psychoanalysis and how to conduct a clinical interview. Later he moved to Paris to work with Theophile Simon in the Binet Laboratory. Theophile Simon and Alfred Binet were known for their work on intelligence testing, and Piaget's job in the laboratory was to help develop a standardized French version of some reasoning tasks. Piaget later wrote that



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Jean Piaget was a pioneer in child development research. His theory revolutionized how we view children's thinking.

> Simon wasn't living in Paris and couldn't oversee what I did—luckily! . . . Simon wanted me to standardize in French the tests that had been devised in English. . . . I became interested immediately in the way the child reasoned and the difficulties he encountered, the mistakes he made, his reasons for making them, and the methods he came up with in order to get to the right answers. From the outset, I did what I've been doing ever since: I made qualitative analyses instead of preparing statistics about right and wrong answers. (cited in Bringuier, 1980, p. 9)

The years in the Binet Laboratory were important in several ways for Piaget and the development of his theory and methods. First, he realized that children were *active* in their thinking, not passive. He found that even very young children made admirable attempts to understand and answer questions, although their reasoning was far from what an adult would see as logical. Drawing on his biological background, he interpreted these attempts as children's efforts to cognitively adapt to the situations they were in, to understand and succeed in their situations. Second, Piaget began to see that children's thinking showed a striking *regularity and consistency,* even though it was often incorrect. Piaget noticed that children of the same age tended to give the same wrong answers, whereas children of a different age tended to give different wrong answers. There seemed to be age-related patterns in the children's thinking. These may not seem to be groundbreaking insights today—but at that time most experts believed that children were passive recipients of information (simply memorizing information without interpreting or modifying it) and did not have coherent or regular ways of thinking. Piaget challenged these well-established views. Finally, Piaget realized that a *clinical method,* in which children are asked to explain the reasons for their answers rather than simply to give an answer, could be an invaluable tool in his efforts to understand children's thinking.

Constructivism and Interaction with the Environment

Piaget combined his background in biology with his interest in understanding how logic and knowledge develop and spent the rest of his career observing children and articulating his theory of cognitive development. He applied several concepts from biology and used them to explain how knowledge develops.

Piaget's theory is often described as a **constructivist view.** According to *constructivists,* people interpret their environments and experiences in light of the knowledge and experiences they already have. People do not simply take in an external reality and develop an unchanged, exact mental copy of objects or events. Instead, they build (or "construct") their own individual understandings and knowledge. For Piaget, the essential building block for cognition is the *scheme.* A **scheme** is an organized pattern of action or thought. It is a broad concept and can refer to organized patterns of physical action (such as an infant reaching to grasp an object), or mental action (such as a high school student thinking about how to solve an algebra problem).

constructivist view
The view that people construct their own knowledge and understanding of the world by using what they already know and understand to interpret new experiences.

scheme
An organized pattern of physical action (motor scheme) or mental action (mental scheme).

As children interact with the environment, individual schemes become modified, combined, and reorganized to form more complex cognitive structures. As children mature, these structures allow more complex and sophisticated ways of thinking. These, in turn, allow children to interact in qualitatively different ways with their environment. For example, a little girl develops a scheme for noticing similarities between objects (we'll call this a "compare" scheme) and a separate one for noticing differences (a "contrast" scheme). Gradually, she coordinates and combines the two into a single cognitive structure that allows her to compare and contrast objects at the same time. When she encounters a new object, she uses this coordinated cognitive structure to develop a fuller understanding of the object. The first time she encounters an avocado, for example, she can compare and contrast it to other foods. This process will help her determine what kind of food it is and will increase her understanding of the overall category (similar in size to an orange, similar in color to a lime, different in texture from an apple). Cognitive structures not only organize existing knowledge but also serve as filters for all new experiences. That is, we interpret new experiences in light of our already existing cognitive structures. Because no two people ever have exactly the same experiences, no two cognitive structures ever are exactly the same, and no two people ever interpret events in exactly the same way. The way you interpret and understand the information you're learning about Piaget is different (at least slightly) from the way your classmates understand it, because each of you filters and interprets the information through a different cognitive structure.

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How is this child constructing her own understanding of science concepts?

Piaget believed that extensive interaction with the environment is absolutely essential for each person's cognitive development. Though Piaget acknowledged that biological maturation sets the general limits within which cognitive development occurs, he placed much more emphasis on the role of the environment. Children who have severely limited interactions with their environments simply will not have the opportunities to develop and reorganize their cognitive structures so as to achieve mature ways of thinking. The way

we interact with the environment is not random, however. Three common processes guide our interactions: *organization, adaptation,* and *reflective abstraction.* If you have studied biology, you will recognize the influence of Piaget's biology background in the first two of these processes. Both concepts originate in the physical sciences, and Piaget used them in his theory of psychological development.

Organization is the tendency of all species to form increasingly coherent and integrated entities. For example, consider the human body. Cells themselves are organized systems of subcellular material. And cells organize into tissues, tissues into organs, organs into organ systems, and organ systems into the body. Piaget believed that the tendency to organize also occurs on the psychological level—that people try to organize their knowledge into coherent systems. In fact, Piaget believed that the tendency to organize is so basic that people cannot keep from trying to organize their knowledge. This explains why you may find yourself thinking about something that didn't make sense to you when you encountered it, even when you don't intend or want to spend time thinking about it! The advantage of this organizational tendency is that it gives us a way to understand and interpret events and objects we encounter; in short, it helps us function more successfully in our psychological environments. The disadvantage is, of course, that the particular way we may organize our knowledge may be completely wrong. If enough mistakes and misinterpretations occur, however, we may reexamine our cognitive organization and perhaps make adjustments. Piaget called this later process adaptation.

In biology the term **adaptation** refers to every species' tendency to make modifications in order to survive and succeed in the environment. (Remember how the mollusks' shells adapted to the water currents?) Applied to cognitive development, *adaptation* means changing one's cognitive structure or one's environment (or both to some degree) in order to better understand the environment. Figure 5.1 diagrams the steps involved in adaptation: A child moves from assimilation through cognitive disequilibrium, accommodation, and cognitive equilibrium, then back to a new assimilation.

Let's explore this process using the example of Lily, a 2-year-old who is learning to name animals, shown in Figure 5.1. Lily has a dog at home, and according to her "doggie scheme," "doggies" are animals that have four feet and fur and that bark and fetch balls. One day, riding in the car with her mother, Lily points to a field with several cows and exclaims, "Look, Mommy, doggies!" She is excited to see so many "doggies," especially ones so large! We can see that Lily is trying to understand these new animals by thinking about them as something she already understands: "doggies." This is an example of **assimilation,** the process of bringing new objects or information into a scheme that already exists.

Thinking of these new animals as "doggies," Lily fully expects that they will also bark and fetch balls. Such misunderstandings are common when we try to force new objects into ill-fitting schemes. Her mother, however, comments, "No, those are cows. They are bigger than dogs. And see the udders underneath? Cows give us milk." These comments place Lily into cognitive disequilibrium—she is confused. Lily realizes that she has never seen udders under dogs and also has never seen dogs that large. To resolve her cognitive conflict, Lily adjusts her understanding of animals. She adds new information about dogs (they are smaller and don't give us milk), and she learns a new animal (cows are like dogs but larger, and they give milk). These adjustments are examples of **accommodation,** the process of modifying old schemes, or creating new ones, to fit better with assimilated information. Now Lily can properly identify dogs and cows, and her new success in naming the animals moves her into cognitive equilibrium. Lily remains in cognitive equilibrium until she visits the zoo and encounters a new animal: an elephant. How will she assimilate this animal?

Piaget, then, claimed that we try to understand new experiences by assimilating them into the schemes or cognitive structures that we already have. If the assimilation does not

YOUR PERSPECTIVE NOTES

Can you think of a time when you found yourself wondering about an event, a fact, or a concept that you didn't quite understand, even though you didn't intend to think about it? As you continued to think about it, did it finally "fall into place" as you were able to integrate it into your cognitive structures?

YOUR PERSPECTIVE NOTES

Think back over your day so far. Can you identify an example of assimilation in your daily activities? Can you think of an example of accommodation?

organization
The tendency to form increasingly coherent and integrated structures.

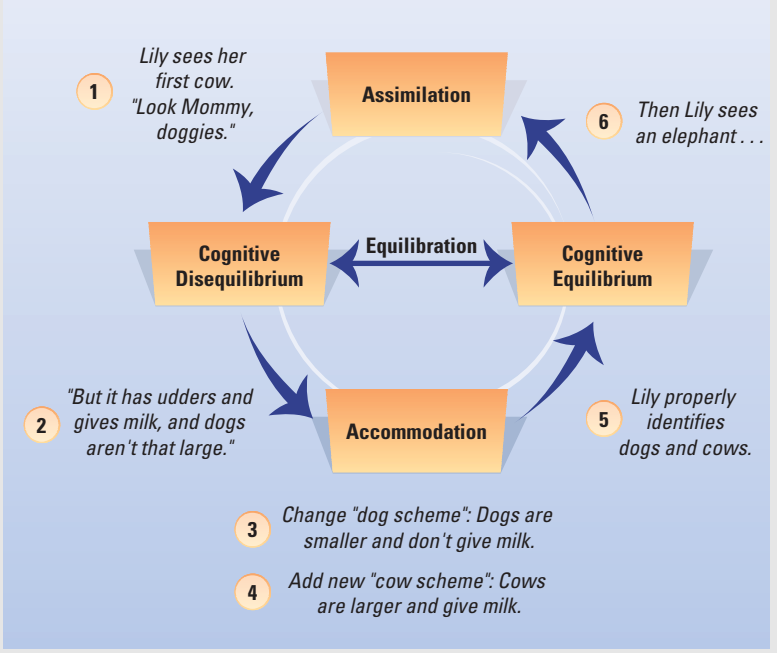
adaptation
In cognitive development, the process of changing a cognitive structure or the environment (or both) in order to understand the environment.

assimilation
The process of bringing new objects or information into a scheme that already exists.

accommodation
The process of modifying old schemes or creating new ones to better fit assimilated information.

FIGURE 5.1 Adaptation and Equilibration

In the cycle of adaptation and equilibration, a new experience is first assimilated into an existing scheme. If it doesn't fit properly, cognitive disequilibrium results. Accommodating (adjusting) the scheme brings the child to cognitive equilibrium, until a new assimilation challenges the scheme again.



work completely, there is an imbalance between the new experience and the old scheme. Piaget described this imbalance as a state of *cognitive disequilibrium*. To resolve the disequilibrium, we accommodate, or adjust, our schemes to provide a better fit for the new experience. If we are successful, we achieve *cognitive equilibrium*. **Equilibration** therefore is the dynamic process of moving between states of cognitive disequilibrium and equilibrium as we assimilate new experiences and accommodate schemes.

Because of the process of organization, we are never satisfied with equilibrium. We stretch and extend our cognitive structures by assimilating new and challenging information. According to Piaget, the tendency to seek equilibrium is always present—we are constantly seeking to understand—but equilibration is a dynamic process and is never fully achieved. In other words, although we certainly have periods when we understand and deal effectively with the environment, we never attain perfect, complete, and permanent understanding of everything. Piaget believed that "the normal state of mind is one of disequilibrium—or rather a state of 'moving equilibrium' " (Beilin, 1994, p. 263). There are always new things to learn!

A final process that guides our thinking is reflective abstraction. In **reflective abstraction** we notice something in the environment (e.g., some specific property of an object or action), then reflect on it (Ginsburg & Opper, 1988; Piaget, 1971). That is, we try to relate it to our current cognitive structures. As a result of reflection, we modify our current cognitive structures. For example, a boy playing on the beach may notice that the number of rocks he has is the same regardless of whether he arranges them in a line or a circle or piles them on top of one another. Reflective abstraction in this case involves the child's *noticing* that he has the same number of rocks, then *thinking about the implication* of this fact—that number is not affected by how they are arranged. According to Piaget, we must engage in reflective abstraction in order to learn from our interactions with the environment. The process enables us to isolate and think about specific properties, compare and contrast them, and think about how we understand them. In this way reflective abstraction *leads to* the accommodation of cognitive structures. A child can notice something in the environment, but if he does not think about its meaning or its relation to what he already knows, no cognitive reorganization

YOUR PERSPECTIVE NOTES

Engage in some reflective abstraction. What do you *notice* about Piaget's background in biology, and what do you *think about* how this background relates to his theory of cognitive development?

equilibration
The dynamic process of moving between states of cognitive disequilibrium and equilibrium.

reflective abstraction
The process of thinking about information and experiences.

will occur. In our earlier example, Lily would not have accommodated her understanding of "doggies" if she had not (1) *noticed* that the cows were much larger than dogs (and had udders), and (2) reflected or *thought about* what this meant.

The processes of organization, adaptation, and reflective abstraction play important roles in children's development. First, children are naturally curious. They are constantly probing and exploring their environments, looking for ways to challenge their existing schemes, and reflecting on whether the things they encounter make sense to them. But without opportunities for exploration and stimulating experiences, there would be nothing new to assimilate. Second, cognitive disequilibrium is a precursor to learning. When children are confused and perplexed, they are ready to make adjustments—they are ready to make accommodations in their schemes. Although it may be tempting to think of confusion as a sign of failure or as something to avoid, in Piaget's system it is a necessary step toward success. Finally, the concept of constructivism is embedded in the cycle. Faced with disequilibrium, children will accommodate their own schemes, engage in reflective abstraction, and improve and reorganize their cognitive structures. In short, children do not passively absorb structures from the adults and other people around them. They actively create their own accommodations and so construct their own understandings.

thinking OF MARIA

What kinds of teaching practices could Maria look for that would help her find a teacher who uses Piaget's concepts of constructivism, adaptation, organization, and reflective abstraction?

LET'S REVIEW . . .

1. Adaptation is an important concept in Piaget's theory of cognitive development, and this concept can be traced back to Piaget's early work in:
   a. psychology. b. biology. c. philosophy. d. physics.
2. In Piaget's theory, an organized pattern of action or thought is called a(n):
   a. scheme. b. adaptation. c. assimilation. d. organization.
3. Two-year-old David points to a pickup truck and says, "Look, Mommy, a red car!" Calling the truck a car is an example of what Piaget would call:
   a. equilibration. b. accommodation. c. abstraction. d. assimilation.
4. When you consider Piaget's cycle of adaptation, what condition comes immediately before accommodation?
   a. assimilation b. cognitive equilibrium c. cognitive disequilibrium d. organization
5. True or False: Piaget is referred to as a "constructivist" because he believed that children learn primarily by copying the cognitive structures that have been constructed by the adults and other more mature people around them.
6. True or False: In Piaget's theory, cognitive equilibrium is achieved when children accommodate their schemes so they provide a better fit with new experiences.

Answers: 1. b, 2. a, 3. d, 4. c, 5. F, 6. T

Piaget's Stages of Cognitive Development

We have seen that children adapt individual schemes (like "doggie" and "cow") through equilibration. We might refer to this type of equilibration as *microequilibration*—the equilibration of individual schemes. Piaget also described a process that we might call *macroequilibration,* or the equilibration of larger and more comprehensive cognitive structures. Remember that in biology cells organize into tissues, and tissues form the body. When enough individual cells change or adapt to their environment, the effects can be seen in the tissues and in the body as

TABLE 5.1 Piaget's Four Stages of Cognitive Development

COGNITIVE STAGE	LIMITATIONS	ACHIEVEMENTS
Sensorimotor Thought: Birth to 2 years (p. 5-10)	• No representational thought; infants cannot form internal symbols early in this stage. • Object permanence is lacking early in this stage.	• Representational, symbolic thought gradually emerges as the stage progresses. • Object permanence develops as the stage progresses.
Preoperational Thought: 2 to 7 years (p. 5-13)	• Intuitive logic leads to egocentrism, animism, artificialism, and an inability to use more objective forms of logic. • Schemes are not reversible, not operational. • Children fail conservation tasks because of centration, focus on static endpoints, and lack of reversibility.	• Flourishing mental representations and symbols are seen in language, art, and play.
Concrete Operational Thought: 7 to 12 years (p. 5-18)	• Logic is limited to concrete, tangible materials and experiences.	• Logical thought is more objective, allows skills like class inclusion and transitivity. • Schemes can be reversible, operational. • Children pass conservation problems due to decentration, focus on dynamic transformations, reversibility.
Formal Operational Thought: 12 years and up (p. 5-19)	• Adolescent egocentrism is seen in the imaginary audience and personal fable.	• Hypothetico-deductive reasoning emerges. • Abstract thought emerges.

a whole. In cognitive development, as individual schemes adapt, larger cognitive structures emerge and change. The microequilibrations eventually lead to macroequilibrations. When these larger structures are modified and reorganized, new and more powerful ways of thinking become possible. According to Piaget, children grow through four *stages* of cognitive development. Each stage involves certain skills and limitations, as summarized in Table 5.1.

After reading this section you should be able to answer the following questions:

- What are the main limitations in cognitive processing at each of the stages?
- What new cognitive structures, forms of logical thought, or other cognitive advances emerge during each stage?
- What is the practical usefulness of understanding Piaget's stages of cognitive development?

Stage 1: Sensorimotor Thought (Birth to 2 Years)

According to Piaget, infants can engage only in **sensorimotor thought.** That is, they know the world only in terms of their own sensory input (what they can see, smell, taste, touch, and hear) and their physical or motor actions on it (e.g., sucking, reaching, and grasping). They do not have internal mental representations of the objects and events that exist outside their own body. For example, consider what happens when you give 3-month-old Latoya a plastic rattle. Latoya grasps the rattle tightly in her hand, shakes it back and forth, and rubs it against her cheek. Then Latoya brings the rattle to her mouth to explore it in detail by sucking and biting on it. Finally, she flings the rattle to the floor and stares brightly back at you. Now, what does Latoya "know" about the rattle?

sensorimotor thought
Thought that is based only on sensory input and physical (motor) actions.

According to Piaget, Latoya doesn't know anything about the rattle unless she is having direct sensory or motor contact with it. At the time that she is grasping and shaking the rattle, she knows how it feels in her hand and how it moves and sounds when she shakes it. She can

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What does this infant understand about her rattle? If she drops the rattle out of sight, will she know that it still exists?

feel its smooth surface against her cheek. She knows more about the detailed bumps, curves, and textures when she has it in her mouth. After she flings it to the floor, however, she has no way of maintaining an internalized representation of the rattle. She therefore cannot "think" about the rattle, and she doesn't know or remember anything about it.

Most adults take mental representation for granted. When we study an object, we form a mental code or image that represents what we know, and we can access this image later when the object is no longer physically available. We are capable of **symbolic (representational) thought**—the ability to form symbols in our mind that represent (or stand for) objects or events in the world. Piaget claimed that young infants cannot form symbols and are therefore stuck in the here-and-now world of their immediate sensory and motor actions. Piaget believed that representational thought gradually emerges as babies develop the ability to form mental symbols. This represents an important achievement, because the emergence of representational thought frees children from the here and now. With representational thought, children can think about past events and anticipate future interactions. Mental representation also allows children to communicate with others using language. By definition, language of any type requires that arbitrary symbols (words) represent actual things. Without mental representation, it is impossible to learn words and understand what they stand for.

Piaget proposed six substages of sensorimotor thought that describe how representational thought emerges during infancy. These substages are summarized in Table 5.2. If you look carefully across the substages, you will notice a general trend in babies' thinking. Infants begin in the early stages as simply *reflexive*—that is, reacting to environmental stimuli via inborn reflexes. They have no voluntary control over objects or events in their environment but can only react to whatever takes place. Gradually, however, infants begin to take more control. These first attempts occur because infants accidentally notice the effects of certain random actions. They begin trying to understand events by using *trial and error,* taking actions and simply observing what happens, then slightly modifying the actions, observing, and so on. Initially these trial-and-error interactions are observations of effects with no anticipation of what the outcomes might be. Eventually, however, babies show evidence of *intentionality.*

symbolic (representational) thought

The ability to form symbols (or mental representations) that stand for objects or events in the world.

TABLE 5.2 Piaget's Six Substages of Sensorimotor Thought

SENSORIMOTOR SUBSTAGE	AGE	CHARACTERISTIC	EXAMPLES
1. Basic Reflexes	Birth to 1 month	The first schemes are inborn reflexes.	Rooting, sucking, grasping reflexes.
2. Primary Circular Reactions	1 to 4 months	Infants discover actions involving their own bodies by accident, then learn by trial and error to repeat them until they become habits (schemes).	At first thumb comes to mouth by accident. Through trial and error infants learn to reproduce the event until a thumb-sucking scheme becomes established.
3. Secondary Circular Reactions	4 to 10 months	Infants discover actions involving objects in the environment by accident, then learn by trial and error to repeat them until they become habits (schemes).	Holding a rattle, an infant may accidentally shake the rattle and enjoy the noise. Through trial and error the infant learns to reproduce the event until a shaking scheme becomes established.
4. Coordination of Secondary Schemes	10 to 12 months	Infants intentionally put two schemes together to solve a problem or reach a goal. Intentionality is a new feature—these new behaviors are no longer discovered by accident.	An infant sees a toy behind a box, pushes the box aside, then reaches for the toy. The infant intentionally combined pushing and reaching schemes to reach the goal (the toy).
5. Tertiary Circular Reactions	12 to 18 months	Babies are curious about objects in the world and explore them in a trial-and-error fashion, trying to produce novel reactions.	A baby drops a ball from shoulder height and watches what happens. The baby then explores the "dropping scheme" by dropping the ball from hip height, then from head height, then from knee height, observing each new result.
6. Transition to Symbolic Thought	18 to 24 months	Toddlers begin to form symbolic representations of events, showing the beginnings of mental thought. Representations still tend to be physical (rather than purely mental), as when toddlers use their own body movements to represent movements of objects in the world.	A 1½-year-old girl would like to open the lid of a box, and to think about this she opens and closes her hand repeatedly. Rather than work directly on the box, she first uses her hand motion as a way to "think" about how to open it. She is thinking about the box using a symbolic representation (her hand).

That is, they begin to take actions that they expect to have specific outcomes. Intentionality represents an effort to exert control over the environment because it involves taking actions that are *intended* to produce specific results.

Evidence of Representational Thought. How do we know when an infant has achieved representational thought? One line of evidence, as we've seen, is the use of language, starting at about one year—because in order to use language, the child must have mental representations to attach labels to. Another line of evidence can be seen in babies' grasp of the concept Piaget called *object permanence*. Piaget made the provocative claim that young infants do not understand **object permanence**—the fact that objects, events, or even people continue to exist when they are not in the infant's direct line of sensory or motor action. Recall Latoya and her rattle. Once Latoya flung the rattle to the floor, Piaget would say that she had no way to think or know about the rattle. Because she couldn't form a mental representation of it, she couldn't consider its continued existence. She couldn't want it or wonder about it. For Latoya, "out of sight" was literally "out of mind."

object permanence
The fact that objects, events, and people continue to exist even when they are out of a child's direct line of sensory input or motor action.

Piaget traced understanding of object permanence through the substages of sensorimotor thought, from nonexistence at birth to its full achievement at about age 2 (Ginsburg & Opper, 1988; Piaget, 1952a, 1954). In the earliest substages, infants simply do not look for an object once it is out of their immediate experience. They make no attempt to get the object

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This infant is looking under the blanket for a hidden toy. What does this search behavior tell us about the mental representations formed by infants?

back, though they may continue looking at the place where they last saw the object. Later, they may actively try to retrieve an object, but only if part of it is still visible (e.g., reaching for a toy that is partially hidden under a blanket). By about 1 year, babies will attempt to retrieve an object that is completely hidden. Interestingly, however, if babies watch the object being hidden in one location, then watch as a researcher moves the object to a different location (this is called a visible displacement problem), they will look in the first location rather than the second even though they witnessed the whole sequence. By about 18 months, babies are able to solve these visible displacement problems, but they still cannot find the object when the displacements are invisible. That is, if they watch as the object is hidden in one location, but when the researcher secretly moves the object to a different location, babies look only in the first spot. They don't check other possible places nearby. Finally, by 2 years of age, the child is able to solve invisible displacement problems. Piaget described this ability as evidence of full mental representation.

In summary, there are two major developmental trends as an infant moves through the sensorimotor stage. First, the infant progresses from interacting reflexively with the environment, through a trial-and-error phase, to deliberate and intentional actions on the environment. Second, the child develops the ability to mentally represent objects, events, and concepts. Infants' early thought processes involve reflexes and immediate sensations and motor actions, but toddlers leave the sensorimotor stage with the ability to internalize their thought processes into a purely "mental" form. Internal and intentional thought provides the building blocks for the next stage of cognitive development.

Stage 2: Preoperational Thought (2 to 7 Years)

Piaget's second stage, **preoperational thought,** features the flourishing use of mental representations and the beginnings of logic (intuitive thought). Although logic is emerging, it is based only on personal experience (Piaget called it intuitive). Also, as you will see shortly, children still do not recognize that some logical processes can be reversed.

preoperational thought
Thought characterized by the use of mental representations (symbols) and intuitive thought.

Flourishing Mental Representations. During the preoperational stage children will practice, and even playfully exaggerate, their new symbolic or mental representation abilities. Let's look at the symbols they use in language, artwork, and play.

Symbols in Language. Talk to a child who is just turning 2, and the conversation will be pretty simple and limited to objects and events currently present. Talk to a 4-year-old, however, and you'll find yourself engaged in a real conversation! As we discuss in Chapter 8, there is an explosive increase in children's vocabulary and grammar (rules for putting words together) after the age of about 18 months. At 18 months, the average vocabulary is about 22 words. By 2 years children use more than 250 words on average, and by 5 years their vocabulary is more than 2,000 words (Anglin, 1993). What makes this rapid escalation of linguistic skill possible? According to Piaget, language development is based on children's mental representational ability—their ability to let a symbol (e.g., a word) stand for an object in the environment. This ability gives children a way to communicate about the objects in the environment, even when the objects are not actually present. Children's use of symbols also allows their thought to become faster and more efficient, because it no longer depends on the actual physical manipulation of objects in the environment. If a child is upset, for example, the child can name the problem, thereby increasing the likelihood that a parent or caregiver can help. The process of construction is also evident in language, as children actively filter what they hear and create their own inventive versions of words and phrases. A young child may call a blanket a "winkie," describe a person with short hair as having "little hair," or say that a criminal is "under arrested."

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The ability to form mental representations allows these children to use fantasy and symbolism in their play. Using mental symbols, children can escape the reality of the here and now and pretend to be superheroes on exciting adventures in far-off places.

Symbols in Artwork. Preoperational children's increasing ability to use mental representation is also seen clearly in the artwork they produce. When one of our daughters was 3 years old, she drew a heavy black horizontal line above a bright red horizontal line. "Look, Mom, I made a picture of you!" she said. "See, there's your head, and your hair on top, and that's your favorite red shirt!" What parent has not admired their own child's evidences of mental representation?

To produce such artwork, the child must have mental representations—not only of the mother's face and hair, for example, but also of her favorite red shirt. Though the initial scribbles of 3-year-olds may not resemble any real object to an adult, they are evidence that the child has developed mental representation. In Figure 5.2 are drawings made by children of various ages; you can easily trace the development of more accurate and more complex mental representations.

Symbols in Play. Watch children engaged in play, and you will soon see clear evidence of symbol use. In *symbolic play* children use one object to stand for another, such as when they pretend that a blanket is a magic carpet or a banana is a telephone. Children of 18 months seldom show such symbolic play; for example, they'll pretend to talk on a telephone only when they have in hand a quite realistic-looking toy telephone. By the age of 2, children will use objects far less similar to the real item (such as using a banana for a tele-

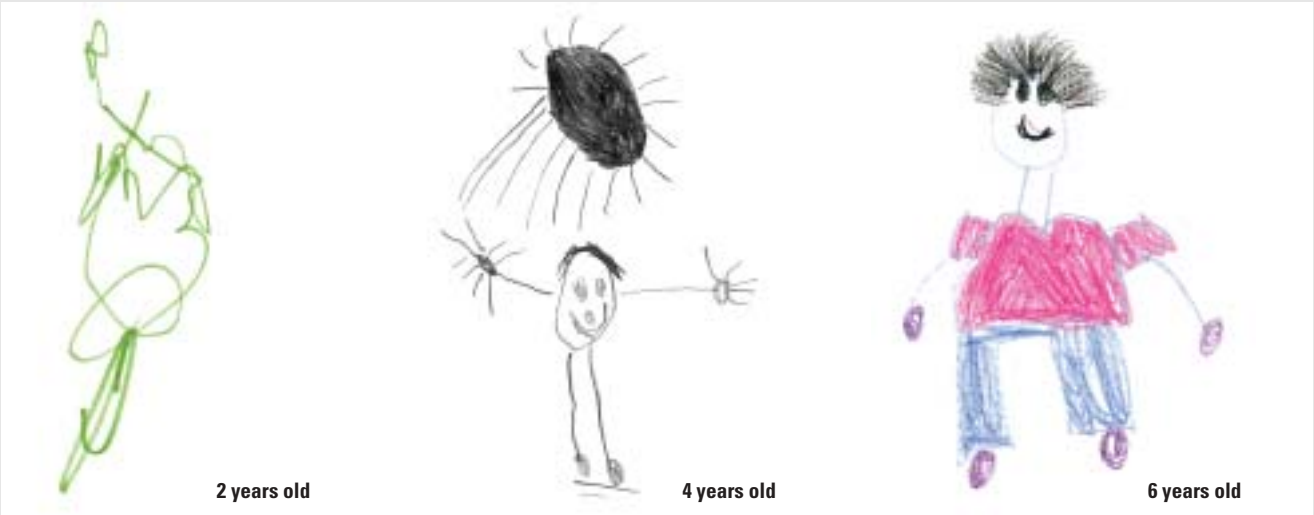

FIGURE 5.2 Artwork Showing the Development of Mental Representation

The 2-year-old's drawing of a person is just a scribble. At age 4 the child draws the person as a happy head with arms and legs. By age 6, the body is represented more fully, including the neck and torso. What do these drawings tell us about the developing mental representation of what a person is?

phone). Finally, by 5 years children are capable of using practically anything as a pretend "telephone." Their ability to mentally represent objects has progressed to the point that the symbol no longer has to bear any resemblance to the real thing (Corrigan, 1987; O'Reilly, 1995).

Preoperational children also use symbols in *fantasy play*, in which they pretend to be something they are not (like a tiger or a superhero) or to engage in activities that are impossible (like having their teddy bear read them a story). And in *make-believe play* children use toys as props to carry out some procedure, such as using a kitchen set and dishes to pretend to cook dinner, or using a doll to pretend to feed and rock a baby. All these kinds of play require that the child be able to allow one thing to represent another. For Piaget, these types of play indicate children's degree of mental representation. It also allows them to practice and become more skillful in mental representation. We have a lot more to say about the development of play in Chapter 11.

thinking OF MARIA

For Maria's 4½-year-old son, how would language, art, and play activities be important in his cognitive development? Would art and play be important in his preschool and kindergarten classrooms?

Emergence of Intuitive Thought: "It *Seems* That. . . ." Another important development during the preoperational stage is the emergence of **intuitive thought,** or reasoning based on personal experience rather than on any formal logical system. Children reason according to what things "seem like," according to their personal experience with the objects and events involved. For example, on the way to preschool one foggy morning, our son, who was about 3½ years old, said, "Better turn your lights on—it's really *froggy* out." When asked what he meant, he explained that he had noticed a lot of this cloudy stuff in the air whenever we drove by ponds. "I know that frogs live in water, so when all the frogs breathe out, they make the air froggy." An admirable attempt, to be sure, but our son's intuitive explanation would not pass the objective tests of true logic. Evidence of intuitive thought can be seen in several characteristics of thinking that are common during the preoperational period, including egocentrism, animism, and artificialism.

intuitive thought

Thought and logic that is based on the child's personal experience rather than on a formal system of rules.

Piaget used the term *egocentrism* to refer to the young child's inability to take another person's perspective. To young children it does seem that they are the center of the universe, and it seems that everyone must think about things just the way they do. Preoperational children are not able to understand that other people's perspectives might be different from

FIGURE 5.3 The Three-Mountains Task

What would the doll see? Can children describe the perspective that would be seen from a different location?

Source: H. Bee & D. Boyd. (2002). *Lifespan development,* 3rd ed. Boston: Allyn & Bacon, p. 158.

their own. The classic demonstration of egocentrism is the three-mountain task. As pictured in Figure 5.3, experimenters show children a model of three mountains that have landmarks placed among them. A child sits at one location in relation to the mountains, and a doll sits at another location. The experimenter then asks the child to describe what the doll would see from its location. Preschool children typically describe the scene as they view it from their own location. Further, when given photographs depicting the views from each location around the table, children select the photos showing the view from their own locations, not the doll's (Piaget & Inhelder, 1948/1956). In other words, children select views based on their own personal and intuitive experience with the scene. They don't yet take into account the logical necessity that someone viewing the scene from a different place will have a different perspective.

Animism—the idea that inanimate objects have conscious life and feelings—is typical of the preoperational stage (Piaget, 1929, 1930, 1951). For example, children may say that the sun is shining brightly because it is happy, or they may put their pencil down because "it is tired." *Artificialism* is the notion that natural events or objects (e.g., the sun, moon, hurricanes, droughts) are under the control of people or of superhuman agents. A child might say that the sun went down because someone switched it off, or that the moon isn't shining because someone blew it out. As children's cognitive structures encounter more and more instances in which animism and artificialism do not satisfactorily explain events, they begin to move away from these modes of intuitive thought and gradually move toward explanations based on physical facts and on a more objective logic.

YOUR PERSPECTIVE NOTES

Identify examples of egocentrism, animism, or artificialism from your own past, or from your experiences with children you know. What prompted your/their thinking to change?

Conservation Problems. The most famous examples of preoperational thought come from children's answers to Piaget's *conservation problems.* Piaget used the term **conservation** to refer to the concept that certain basic properties of an object (e.g., volume, mass, and weight) remain the same even if its physical appearance changes (Ginsburg & Opper, 1988; Piaget, 1952b, 1969, 1970; Piaget & Inhelder, 1974). For example, look at the liquid conservation problem shown in Figure 5.4. An experimenter fills two identical beakers with liquid to the same level, as shown on the left. The experimenter asks the child, "Do these two have the same amount of liquid, or does one have more?" The child says that they have the same amount. Then, with the child watching, the experimenter pours the contents of one beaker into a taller and skinnier beaker. When asked if the two beakers "have the same amount, or does one have more?" younger children typically claim that the taller beaker has more liquid than the shorter beaker. When asked why, they usually point to the height of the liquid surface: "See, this one is taller, so it has more." Children using preoperational thought don't seem to understand that the volume of liquid is conserved (remains the same) even though the shape of the container changes. Children give similar responses for tasks involving number and mass (see Figure 5.4).

By looking at Figure 5.4, you can see why preoperational children's tendency to use intuitive thought would lead them astray. At a quick glance, it does "seem that" the taller beaker has more. Piaget, however, analyzed children's responses further and was able to pinpoint other important limitations of preoperational thought. First, young children show marked

conservation
The understanding that some basic properties of objects remain the same even when a transformation changes the physical appearance.

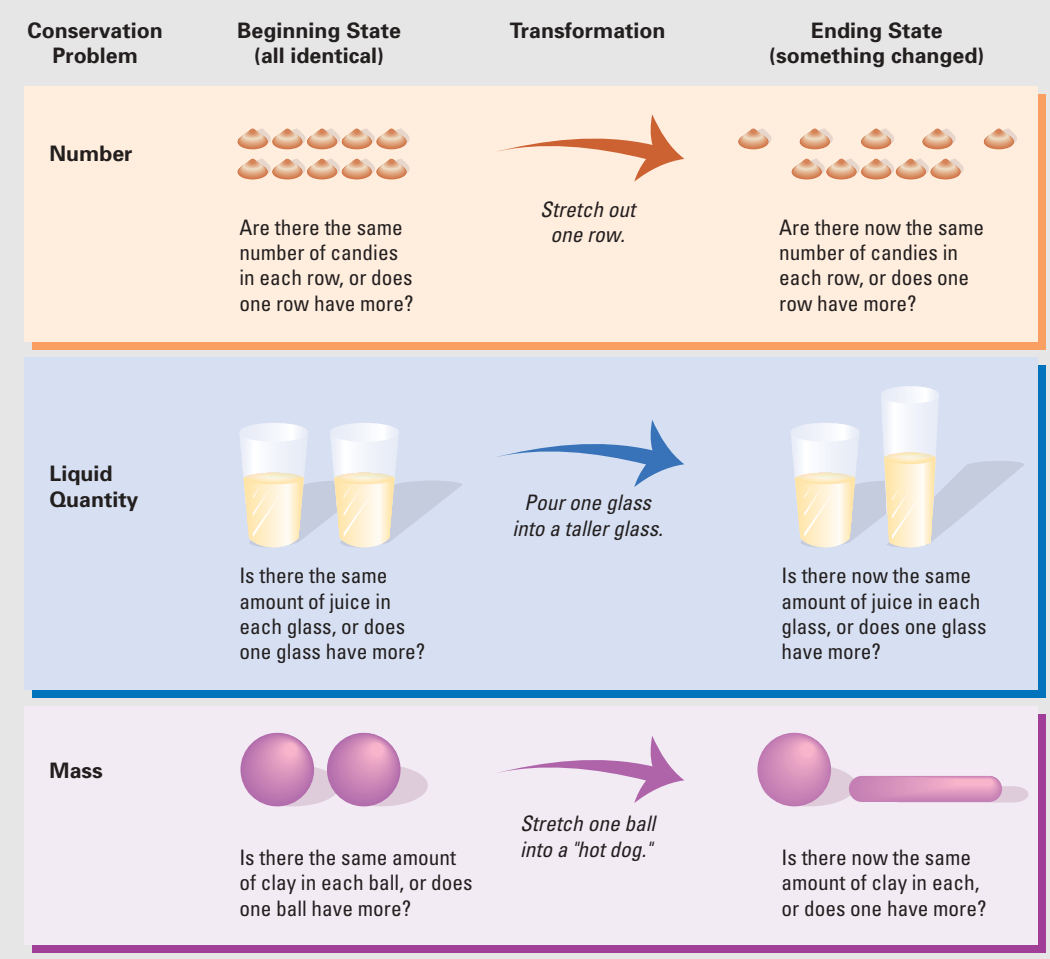

FIGURE 5.4 Conservation Problems
Three well-known conservation problems involve number (top), liquid quantity (middle), and mass (bottom).

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This child thinks the taller container has more liquid in it. What can her answer tell us about the thinking processes of young children?

centration in their thinking. *Centration* is the tendency to focus on only one aspect of a situation at a time instead of taking several aspects into consideration. In the liquid problem, for example, children tend to focus on the height of the liquid, instead of considering that the greater width of one beaker compensates for the taller height of the other. Second, young children focus on the *static endpoints* of the transformation (how things look before and after) rather than considering what happened in the transformation itself. Children look at the beginning state (both levels are equal on the left side of Figure 5.4), then at the ending state (one level is higher on the right side), and they conclude that the higher level must have more. They fail to consider the transformation itself—the act of pouring could show that the amount of liquid did not change. And finally, children at this stage lack a grasp of *reversibility.* That is, they do not imagine what would happen if they reversed the transformation; they don't visualize pouring the liquid back into its original container to demonstrate that the amount would still be the same. When children focus on the height of the liquid, pay attention only to the static endpoints of the problem, and don't imagine pouring the liquid back, you can see why they usually obtain such an intuitive answer as "this one is taller, so it has more."

Piaget saw the lack of mental reversibility as an important hallmark of preoperational thought. To be fully logical, our cognitive structures need to be reversible. Think about the logic of math, for example. If we have 4 and take 2 away, we need to understand that we can return to 4 by adding 2 back. Piaget gave a special name to cognitive structures that are reversible. He called them **operations**—actions performed mentally that are reversible (Ginsburg & Opper, 1988). Piaget believed that these dynamic mental operations were necessary for true logical thought. This is why he called the second stage *pre*operational thought—it is thought that is *not yet reversible,* not yet truly *operational.* With continued experience with the environment, children realize that their intuitive thought does not adequately explain the events around them. As they realize the reversibility of many transformations and their thought structures become operational, we have the beginnings of the next stage of cognitive development.

Stage 3: Concrete Operational Thought (7 to 11 Years)

To an older child the conservation problems shown in Figure 5.4 are trivial. With the liquid problem, a typical 10-year-old would say, "Of course they both still have the same amount; all you did was pour it over here. If you pour the taller one back into the short beaker, you'll see that it's just the same." Or "Sure, the taller one looks like it has more, but it is also skinnier, so it's really just the same." Children in this third stage, **concrete operational thought,** show thinking that is *decentered*—they consider multiple aspects of the problem (understanding the importance of both height and width). They focus on the *dynamic transformation* in the problem (realizing that the true answer lies in the pouring). And, most importantly, they show the *reversibility* of true mental *operations* (just pour it back, and it's the same). In this third stage children's cognitive structures are operational—hence the name, concrete *operational* thought. This development allows them to think about the world using objective rules of logic, freeing them from the misconceptions of intuitive thought.

operations
Mental schemes (actions) that are reversible.

concrete operational thought
Stage of cognitive development in which children are able to think about two or more dimensions of a problem (decentered thought), dynamic transformations, and reversible operations.

Children in the concrete operational stage also show their logical abilities when they solve *class inclusion* and *transitive inference* problems. For example, show a child a set of five dolls and three teddy bears, then ask this question: "Are there more dolls or more toys?" Children in the preoperational stage will typically answer "more dolls," because they tend to focus on only one part of the problem (dolls versus bears) and ignore the fact that all of the objects belong to the general class of toys. Most children in the concrete operational stage, however, understand that both dolls and bears are also toys. To them this is a silly question—of course there are more toys than dolls! In other words, older children understand *class inclusion*—the fact that objects can be classified in different ways and at different levels. Younger children don't understand this. When he was about 4, our younger son heard his mother referred to as "Doctor." He immediately spoke up: "She's not a doctor, she's my mommy!" Our older son just rolled his eyes. To young children, grandmothers can't also be mothers, and firemen can't also be fathers.

Older children also understand *transitive inference*—the process of drawing inferences by comparing relations among objects. Consider the following example. Sue is taller than Jean, and Jean is taller than Lexi. Who is taller, Sue or Lexi? We can draw the inference that Sue is taller than Lexi by comparing the relationships from Sue and Jean to Jean and Lexi. Children in the preoperational stage have trouble following these transitivity problems; they may comment that they can't tell who is taller (after all, they can't see them!) or may just take a guess. With true operational logic, however, children in the concrete operational stage can represent the logical relationships and arrive at the correct answer.

By age 7 most children are capable of using logical thought structures that are increasingly objective and reversible, and they can solve problems that involve class inclusion and transitivity. However, there is still one major limitation in their thinking: Their use of mental operations is still closely tied to *concrete* materials, contexts, and situations. In other words, if children have not had direct experience with the context or situation, or if the material is not tangible, they are not successful in using their mental operations. This is why the stage is called *concrete* operational thought.

thinking OF MARIA

Would Piaget predict that Maria's 4½-year-old would be able to solve class inclusion and transitivity problems? Would teachers be able to teach such skills to a child this young?

Stage 4: Formal Operational Thought (Approximately Age 12 and Above)

According to Piaget, it is during adolescence that cognitive development reaches its fullest potential—**formal operational thought.** Two major changes occur in this stage: Adolescents gradually develop the ability to use hypothetico-deductive reasoning, and they extend their logical thinking to concepts that are abstract (no longer solely to materials that are concrete and tangible).

formal operational thought
Piaget's final stage of cognitive development, when an adolescent gradually learns to use hypothetico-deductive reasoning and to extend logical thinking to concepts that are abstract.

hypothetico-deductive reasoning
The ability to use deductive reasoning (reasoning from general to specific facts) to systematically manipulate several variables, test the effects in a systematic way, and reach correct conclusions in complex problems; scientific reasoning.

Hypothetico-Deductive Reasoning. For Piaget the culminating achievement of cognitive development is the ability to use hypothetico-deductive reasoning. **Hypothetico-deductive reasoning** is the use of deductive reasoning (reasoning from general principles to particular conclusions) to systematically manipulate several variables, test their effects in a systematic way, and reach correct conclusions. Piaget tested adolescents' developing use of hypothetico-deductive reasoning by using several tasks, many of which involved physics or chemistry (Ginsburg & Opper, 1988; Inhelder & Piaget, 1958). In his famous *pendulum problem,* children and adolescents of different ages were given a set of weights and strings of different lengths. As you can see in Figure 5.5, the weights could be hung from the strings and swung like pendulums. The investigators asked the children and adolescents to determine what caused the pendulums to swing at different rates. Was it the length of the string, the amount of weight, or how high the weight was held before it was released? Children in the

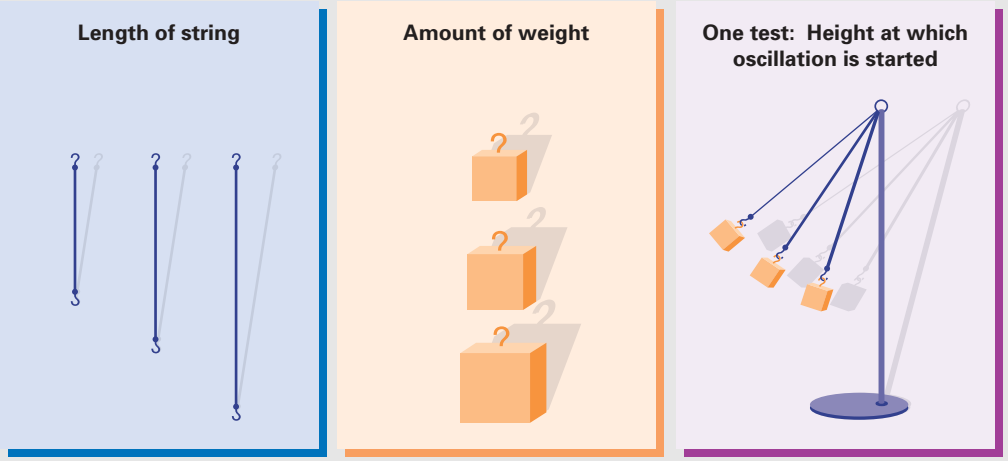

FIGURE 5.5 Piaget's Pendulum Problem

The pendulum problem asks you to figure out what causes the rate of the swing to vary. Is it the length of the string, the amount of weight at the end, or the height from which the weight is dropped? What tests would you conduct to isolate the relevant factor?

thinking OF MARIA

What kinds of topics and activities could Maria look for in schools that would demonstrate that the schools support hypothetico-deductive reasoning in their teaching?

concrete operational stage are not good at systematically testing all of the factors; they tend to report whatever answer seems to be correct after conducting only a few tests. Adolescents using formal operations, however, start by considering all of the variables and all of their possible combinations, reasoning that any one factor could be responsible for the pendulum's rate of oscillation. They then systematically test each factor one at a time, holding the other factors constant, until they arrive at the correct solution. The adolescent shows hypothetico-deductive reasoning, or formal scientific reasoning—the ability to plan systematic tests to explore multiple variables.

■ **Abstract Thought.** The second major development that takes place during the formal operational stage is the adolescent's growing ability to engage in abstract thought. **Abstract thought** is thought about things that are not real or tangible, or things that are only possibilities. You saw an example of this in the pendulum problem. When solving the problem, adolescents took as their starting point *all possible solutions;* this allowed them to reach an accurate solution efficiently. Abstract thought, however, also leads adolescents to spend extraordinary amounts of time speculating on all the possible outcomes of seemingly simple actions—as when they spend 4 hours discussing whether to wear *this* dress or *that* dress to a school social event. Although this behavior may drive parents crazy, it really is a sign of increasing cognitive maturity!

During the stage of formal operations, the adolescent also learns to think logically about such abstract concepts as truth, justice, fairness, and morality. Such concepts are at the heart of many important social, political, and ethical issues faced the world over. Not only are adolescents beginning to comprehend these concepts; they also develop the ability to reason flexibly about them and understand their relativity. For example, adolescents gradually become able to understand that *justice* may mean very different things to different people, depending on the context and intent of an action. They learn that it can be difficult to assess the justness of any particular action without considering these complex factors. The black-and-white meanings of childhood have given way to the grays of adulthood.

Although adolescents are learning formal logical thought and abstract reasoning, Piaget observed that adolescents still show a level of immaturity. He defined **adolescent egocentrism**

abstract thought
Thought about things that are not real or things that are only possibilities.

adolescent egocentrism
A cognitive immaturity seen in adolescents—their inability to distinguish between their own abstract reasoning and thoughts and those of others.

as a young person's inability to distinguish between his or her own abstract reasoning and thoughts and those of others (Inhelder & Piaget, 1958). Piaget described two particular forms of adolescent egocentrism. The first is the *imaginary audience.* Adolescents believe that other people are just as concerned with their behavior, feelings, and thoughts as they are themselves. This leads to a sometimes excruciating degree of self-consciousness. Many adolescents feel "on stage," as if everyone else were noticing every embarrassing thing they do. The second adolescent egocentrism is the facet of *personal fable.* Adolescents tend to believe that they and their newly abstract thoughts are unique and that they are invulnerable. Often they believe that no one has ever thought about issues in the same way they do, and that no one else (especially parents!) could ever understand the way they feel. Unfortunately, feelings of invulnerability can lead adolescents to feel that nothing bad will happen to them—even when they engage in very risky behavior, like unprotected sexual activity or drinking and driving.

With the achievement of hypothetico-deductive reasoning and abstract thought, and with the eventual decline of adolescent egocentrism, young adults gradually attain what Piaget considered mature cognition. They become able to reason about anything, real or imagined, and have the capability to use scientific reasoning to solve complex problems. But this does not mean that no further changes in cognition occur. On the contrary, Piaget claimed that we never reach a permanent state of equilibrium. He believed that we are forever adapting and reorganizing our cognitive structures and working "toward *better* equilibrium" (Piaget, 1985, p. 26). Piaget did not, however, envision further major reorganizations of cognitive structure or the development of qualitatively more advanced or different kinds of thought.

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Adolescents are fond of discussing deep thoughts and abstract ideas. What kinds of discussions do you remember having with your friends during adolescence?

YOUR PERSPECTIVE NOTES

Do you recall having an imaginary audience? What examples of personal fable can you think of from your own adolescent experiences or from the experiences of other adolescents you have known?

Evaluation of Piaget's Theory

Cognitive psychologists have done an astounding amount of research to evaluate Piaget's theory. We will not attempt to cover all of this work. Instead, we will discuss the general conclusions about Piaget's most important and well-known claims, and we'll give you an overview of Piaget's legacy today.

Piaget was right about many important aspects of cognitive development. In general, children do seem to move from being more egocentric to less egocentric. They also move from being less systematic and less able to reason logically to being more able to think in these ways. And many studies over many years have replicated Piaget's results on tasks such as object permanence and conservation, if the experimenters conduct the tasks in the same ways as Piaget conducted them. Finally, studies from different cultures indicate that children seem to pass through Piaget's four stages in the same order—although the age brackets of the stages show great variability. Also, whether children ever achieve the formal operational stage depends on several different factors such as educational levels and the kinds of cognitive skills valued in a given culture (Gelman & Baillergeon, 1983; Ginsburg & Opper, 1988; Harris, 1983; Opper, 1977).

Research studies have also, however, highlighted two important weaknesses in Piaget's theory. First, Piaget underestimated the abilities of children, especially during infancy (Gelman & Baillargeon, 1983; Haith & Benson, 1998; Wellman & Gelman, 1998). Research conducted since the 1970s, using techniques and technologies not available back when Piaget was forming his theory, has demonstrated impressive cognitive abilities during infancy. Under the proper conditions, infants as young as 3½ months demonstrate a grasp of object permanence (Baillargeon, 1993; Spelke, 1991). Also, research demonstrates that young infants do code information and store mental representations in the form of memories, as we'll discuss in Chapter 6. Other research shows that preschool children can handle conservation and other problems when the tasks are simple enough and the children have appropriate training (Au, Sidle, & Rollins, 1993; Beilin, 1978; Donaldson, 1982; Gelman, 1972; McCabe & Siegel, 1987). At the same time, it turns out that Piaget may have *overestimated* the abilities of most adolescents and adults. Researchers now believe that only 50 to 60 percent of 18- to 20-year-olds in industrialized countries use formal operations and that the rates are even lower in nonindustrialized countries (Commons, Miller, & Kuhn, 1982; Keating, 1980). Recent research also questions how consistently adolescent egocentrism is found, and they have suggested that it may indicate more about young adolescents' attempts to develop an identity and psychologically separate from their family than a general cognitive immaturity (Vartanian, 2000, 2001).

A second general criticism addresses the notion of developmental stages. Piaget's theory implies that as children reorganize their cognitive structures, they rise to a higher level of logical thought. Once achieved, these new structures and organizations presumably apply across all contexts. In real life, however, this is not what happens (Gelman, 2000; Gelman & Baillargeon, 1983; Harris, 1983; Larivée, Normandeau, & Parent, 2000). Let's take conservation problems as an example. Research shows that most children pass tests on number conservation problems by age 6 or 7; they pass weight conservation problems by age 9 or 10; but they don't pass volume conservation problems until about age 11 or 12 (Ginsburg & Opper, 1988). If children understand the concept of conservation (showing decentered and reversible thought) in the number problem, why don't they transfer this understanding to the weight and volume problems until years later? And how do we mark the transition from preoperational to concrete operational thought? Does it occur when a child passes the number conservation problem, or do we wait until the child comprehends conservation in all its forms? Not only is it difficult to define these transitions, but children also frequently show evidence of being in two or more stages at once. For these and other reasons, most modern-day researchers reject the concept of broad cognitive developmental stages (Flavell, Miller, & Miller, 1993).

What is least criticized is Piaget's constructivist view of development. Children do seem to be active participants in their own learning and development, assimilating new information into their existing cognitive structures, and modifying or reorganizing their structures when necessary to fit new information. The process of adaptation that Piaget observed in sea mollusks seems a fitting analogy for the adaptive processes children engage in as they achieve cognitive maturity.

Piaget's Legacy

Piaget's theory of cognitive development has left a legacy that no other theory in developmental psychology has even approached. His contributions can be summarized as follows:

- Piaget changed *psychology's view of young children.* Before, theorists saw children as passive organisms capable only of reacting to events. After Piaget, they realized that children actively seek to understand their environment and actively initiate events simply to see how things work.

- Piaget gave to posterity a *vast store of facts about children* and child development. This knowledge came both directly—from Piaget's own research, observations, and writings—and indirectly, from the research that others conducted attempting to either support or refute his theory.

A Professional PERSPECTIVE...

Career Focus: Constructivist Teacher

Stacie Anderson
Donnelsville, Ohio
First grade teacher at Donnelsville Elementary School

How do you use Piagetian concepts in your teaching?
It is critical to have an idea of the preexisting schemes that students already have on a topic or skill area—it sets the stage for how I introduce a lesson. Next, I observe children's thought processes as a new concept, or a new layer of the concept, is introduced. How is it fitting (assimilating) into what they already know? I check to see how the new information is fitting by asking questions and having children evaluate their own thinking and each other's responses.

What specific activities do you use to help children construct knowledge?
Hands-on activities are critical in first grade, and all grades in my estimation. When teaching geometric shapes I have children sort out squares, circles, and triangles and list what they know about each shape (the square has four sides, four corners, etc.). Then I show a rectangle and ask, "How many sides and angles does it have?" "Is it a square?" Some children will say "Yes." As we take a closer look, they recognize that the sides are different lengths. Now they understand that squares have four equal sides, but rectangles have two side lengths. Then we introduce a parallelogram, rhombus, trapezoid. . . . With counting, students build towers with Unifix cubes to represent each numeral (1 to 10). They observe that "It looks like stairs!" and "Every tower is one taller." They can visually see that each tower is one greater than the other, and this smoothly leads into the concept of adding one.

How do you use Piaget's stages as guidelines for your curriculum or classroom activities?
At the district level, we created benchmarks and indicators of success in critical skill areas. However, based on my experience, it is important to know that a child can exhibit various behaviors that are indicative of several of these stages. Still, first graders do think more concretely and have difficulty thinking beyond their home, family, and friends. It would be unrealistic to tackle national abstract issues with six-year-olds!

What education and training is required to work in your area?
To be a licensed teacher, you need to have a degree or courses in education, and you need to be supervised as a student teacher for one year. The requirements differ in each state. Many states require teachers to get a master's degree to have a permanent teaching license, and others require an advanced degree to teach above the third grade. A praxis exam is required in most states. ■

thinking OF MARIA

How could a constructivist teacher help Maria's youngest son if he were to start kindergarten early? In what ways might his schemes be different from the older children in his class?

Piaget's theory has had important *applications in the field of education.* First, the notion of the child as an active and curious organism led to the design of interactive and hands-on curricula in schools. These teaching materials encourage children to make use of their natural curiosity to explore concepts in science, mathematics, and other domains. Second, Piaget's four stages and his concept of cognitive readiness (i.e., the idea that children cannot skip stages but must move from one to another as they are maturationally and cognitively ready) have shaped many guidelines for when to introduce different topics. Third, educators have learned to make use of the notion of cognitive disequilibrium. They do this by deliberately presenting students with puzzles, debates, and conflicting opinions to intentionally upset students' existing cognitive structures and encourage students to grow in understanding. Finally, educators explicitly urge reflective abstraction; they encourage students to think about the implications, usefulness, and limitations of their existing cognitive structures. To learn more about how teachers use Piaget's theory to help children learn, read the Professional Perspective box called "Career Focus: Constructivist Teacher."

Piaget's work and writing stimulated *vast amounts of research* in a variety of areas of child development. In doing this work, researchers developed new methodologies, tested new ideas of how children think, and opened and pursued new areas of inquiry. There is an old saying in scientific circles that the clear sign of a good theory is not whether the theory is ultimately shown to be right or wrong, but how much research and knowledge it stimulates. Whether or not any aspects of Piaget's theory are ultimately shown to be true, the theory can be considered great by this standard alone.

LET'S REVIEW . . .

1. According to Piaget, infants in the sensorimotor thought stage *cannot:*
   a. use sensory impressions to understand the world.
   b. use motor actions to understand the world.
   c. form symbolic representations to understand the world.
   d. display reflexes during the first month after birth.
2. A major characteristic of preoperational thought is that children tend to use:
   a. reflexes rather than mental symbols.
   b. intuitive thought.
   c. abstract . reasoning
   d. hypothetico-deductive reasoning.
3. Jimmy watches as you take two identical clay balls and roll one into the shape of a hot dog. You then ask him if both pieces of clay now have the same amount, or if one piece has more clay. Jimmy responds, "Of course they have the same amount; all you have to do is roll the hot dog back up into a ball to see that it has the same amount." Jimmy's answer shows that he understands:
   a. reversibility.
   b. decentration.
   c. static endpoints.
   d. transitivity.
4. According to Piaget, the imaginary audience and the personal fable are both parts of:
   a. intuitive thought.
   b. object permanence.
   c. conservation problems.
   d. adolescent egocentrism.
5. True or False: When a child gives the correct answer to conservation problems, it is a sign that the child is now in the stage of preoperational thought.
6. True or False: One criticism of Piaget's theory is that he overestimated the cognitive abilities of infants.

Answers: 1. c, 2. b, 3. a, 4. d, 5. F, 6. F

Answer to the pendulum problem in Figure 5.5: Length of the string is the factor that determines how fast the pendulum swings.

Vygotsky's Sociocultural View of Cognitive Development

Of course, not everyone was satisfied with Piaget's account of cognitive development. Aside from the evidence against grand stages in cognitive development, some theorists and practitioners have long felt that Piaget's account does not adequately consider one very important influence on cognition: the child's social environment. Lev Semenovich Vygotsky is one theorist who gave the role of social interaction and culture a central place in his account of cognitive development.

After reading this section you should be able to answer the following questions:

- What influence did Vygotsky's own cultural background have on his theory? What historical events were taking place during his time, and how did they affect his theory?
- Why is Vygotsky's theory called a "sociocultural" view? According to this theory, what roles do culture and social interaction play in cognitive development?
- What role does language play in cognitive development, and how can adults facilitate children's development?

Vygotsky's Background: The Sociocultural Context for a New Theory

Vygotsky was born in 1896, the same year as Piaget but in Belorussia (later part of the Soviet Union). Vygotsky's family was Jewish, and they shared a rich cultural background with most of their fellow townspeople. Being Jewish, they also experienced prejudice, discrimination, and strict governmental restrictions. Vygotsky received his early education from a private tutor who taught by means of Socratic dialogue. In this method, the tutor poses questions and helps the student reason through and figure out answers, rather than simply giving the student facts and information. At the University of Moscow, Vygotsky studied law, history, and philosophy. He graduated in 1917, the year of the Russian Revolution, in which the centuries-old tsarist government fell and Lenin came to power at the head of a Marxist government. Vygotsky was a committed Marxist. The new Soviet government seemed to promise an end to ethnic and religious discrimination, promising that everyone would be considered an equal Soviet citizen. Vygotsky also was a firm believer in Marx's emphasis on the importance of social history as an influence on people's behavior and development (Kozulin, 1990; Wertsch, 1985).

In 1924 Vygotsky took a position at Moscow's prestigious Psychological Institute to help restructure the institute and develop a Marxist psychology. Over the next decade this so-called "Mozart of psychology" (Toulmin, 1978) attracted many top Soviet scholars as students and colleagues to assist in developing and testing his theoretical ideas. Unfortunately, in 1934 Vygotsky died from tuberculosis. Although he was only 38, he had already written several important books and other articles, and his brilliance was recognized by all of those who worked around him (Kozulin, 1990; Wertsch, 1985).

It might seem that such a popular figure as Vygotsky would have had an immediate impact on psychology worldwide. He did not. Much of his writing was not published, even in the Soviet Union, until decades after his death. In part this was because the research to support Vygotsky's ideas had to be completed by his students after his death. Also, even as his followers completed the work, the Soviet regime banned much of it. Vygotsky often referenced foreign scientists, philosophers, and literary works. But under Josef Stalin the regime saw the influence of foreigners as undesirable. For 2 decades, therefore, few Soviet psychologists had access to Vygotsky's work. In addition, the cold war meant that there was little hope for dissemination to European and American psychologists. After Stalin's death in 1953, Vygotsky's work again began to be published, and ever since the end of the cold war Vygotsky's influence on psychology has been steadily increasing (Kozulin, 1990; Wertsch, 1985).

Dr. Michael Cole/Laboratory of Comparative Human Cognition

Soviet psychologist Lev Vygotsky proposed a sociocultural theory of cognitive development that continues to gain prominence. Can you see the influence of Vygotsky's own cultural background in his theory?

The Role of Speech and Language

thinking OF MARIA

According to Vygotsky's theory, why would it be important for Maria to spend time in schools and classrooms listening to the verbal messages being conveyed? What kinds of messages, or cognitive structures, would she want to hear?

The central theme in Vygotsky's theory is that children acquire cognitive structures from their culture and from their social interactions, primarily by listening to the language they hear around them. **Social speech** is the speech that we hear as people talk around us or to us. According to Vygotsky, children adopt important parts of social speech and make it their own **private speech**—the speech children say aloud to themselves. It is the language (speech) that carries the concepts and cognitive structures to the child, and these concepts become the "psychological tools" that the child will use (Vygotsky, 1962).

Consider the simple example of a little girl learning to draw a circle. At first the child has no concept of "circle," so the adult uses social speech to talk her through the process. "Start your mark going around, like this [demonstrating an arc], then bring it all the way around until the marks meet each other." As the child tries to draw her own circle, she repeats the instructions aloud to herself, "I make the mark go 'round, like this, then I bring it 'round until it meets." The concept of "circle" was carried from the social speech (of the adult directing the child) to the private speech of the child. As Vygotsky put it,

> Any function in the child's . . . development appears twice, or on two planes. First it appears on the social plane, and then on the psychological plane. First it appears between people as an interpsychological category, and then within the child as an intrapsychological category. (Vygotsky, 1981, p. 163)

YOUR PERSPECTIVE NOTES

Try to remember the last time that you mumbled or talked aloud to yourself when you were trying to do something difficult or challenging. How did your private speech help?

When children are learning new concepts or difficult tasks, they often rely on the support of private speech. "I'll bring the mark around. Oops! I went too far up. Now back down, and around this way. Not too far. Now the marks don't meet. I'll draw it over. There, a circle!" **Internalization** is the process by which external activity and speech become internal and come to be executed mentally. As children master a concept, they need private speech less and less. Eventually they internalize it completely as silent, inner speech.

Private speech is midway between the social interactions in which it originated and the completely internal thought that it will become. Research on the development of private speech shows the progression you might expect: Children go from talking out loud to whispering softly to silently moving their lips before ceasing to show private speech (Bivens & Berk, 1990; Winsler & Naglieri, in press). Private speech does not simply disappear forever, however. We all revert to some level of private speech when we encounter a difficult problem, or if we make a mistake when working on a task, or when we are confused about a task. Private speech seems to help us focus our attention, regulate our strategies, and plan our problem-solving efforts (Behrend, Rosengren, & Perlmutter, 1992; Berk, 1992; Berk & Spuhl, 1995; Emerson & Miyake, 2003; Schneider, 2002). A considerable body of research indicates that private speech both serves as a step in the internalization process and functions to help people think through problems.

social speech
Speech that we hear as people talk around us or to us.

private speech
Speech that children say aloud to themselves; later internalized to form inner speech and mental activity.

internalization
The process of taking external speech and activity and making it internal and mental.

mediation
The process adults and more skilled peers use to introduce concepts and cognitive structures to less skilled children.

Mediation: With a Little Help from Your Friends

In Vygotsky's theory interpersonal interactions with adults or more skilled peers teach, or *mediate,* the cognitive structures created by the larger culture. **Mediation** is the process of introducing concepts, knowledge, skills, and strategies to the child (Karpov & Haywood, 1998; Vygotsky, 1981). For the mediating adult (or older peer), mediation involves choosing which structures to introduce to the child, deciding when and how to teach them, and helping the child understand their usefulness. For example, think about helping a young child put together a jigsaw puzzle. Many adults encourage specific puzzle-making strategies such as starting with the corners, doing the borders first, or looking for clues (e.g., matching colors,

matching shapes). In addition, adults often help children think about more general skills, such as being careful when matching shapes and colors or being systematic when trying a piece in different locations. However, most adults do not try to introduce all of these things at the same time. They mediate by selecting specific strategies and highlighting them; they help the child learn a few skills, then move on to others as the child gains expertise. Gradually the child internalizes all of the strategies, along with the verbal labels for them. In the end the child can use this information as a structure and tackle jigsaw puzzles independently.

Mediation can take place in structured settings (such as during formal schooling) or in informal day-to-day activities (such as when a parent talks about ecology while putting out the trash and recyclables). The key to making mediation effective is to tailor it to an appropriate level for the individual child. The structures being explained should be neither so easy that the child has already internalized them nor so difficult that the child cannot understand them. This optimal level of difficulty lies within what Vygotsky called the child's *zone of proximal development.*

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How do adults provide mediation for children's learning?

The Zone of Proximal Development

Vygotsky defined the **zone of proximal development (ZPD)** as the distance between a child's "actual developmental level as determined by independent problem solving" and the child's level of "potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). The ZPD refers to the range of problems a child can solve if given some assistance. As shown in Figure 5.6, the bottom boundary of the ZPD consists of the most challenging problems a child can already solve independently. The top boundary of the ZPD consists of problems that the child cannot solve, no matter how much support others may offer. These tasks require higher mental functions that the child has not yet begun to internalize, so even very explicit assistance does not help. The ZPD is the zone between these two boundaries. The tasks within this zone require mental functions that the child is in the process of internalizing but has not yet completely internalized.

An important point to remember about the ZPD is that it is dynamic—the top and bottom boundaries change as the child internalizes more and more mental functions (see Figure 5.6). The boundaries move up as the natural result of effective mediation within the ZPD. An adult interacts with a child, presenting problems that challenge the child. The adult helps the child work through the solution, sometimes needing to offer a great deal of assistance at first. The child gradually learns how to solve these challenging problems. Now the problems that used to be within the child's ZPD are below it.

There is an important implication here for instruction—can you see what it is? According to Vygotsky the most effective instruction involves giving children *challenging material, along with help in mastering it.* Although children may need extensive help at first, Vygotsky said that challenging tasks promote cognitive development, as long as a given task is not beyond the top boundary of a given child's ZPD. And there is a related implication for assessment, or testing. That is, the most informative assessments are not tests of

zone of proximal development (ZPD)

The distance between the current maximum independent performance level of a child and the tasks the child can perform if guided by adults or more capable peers.

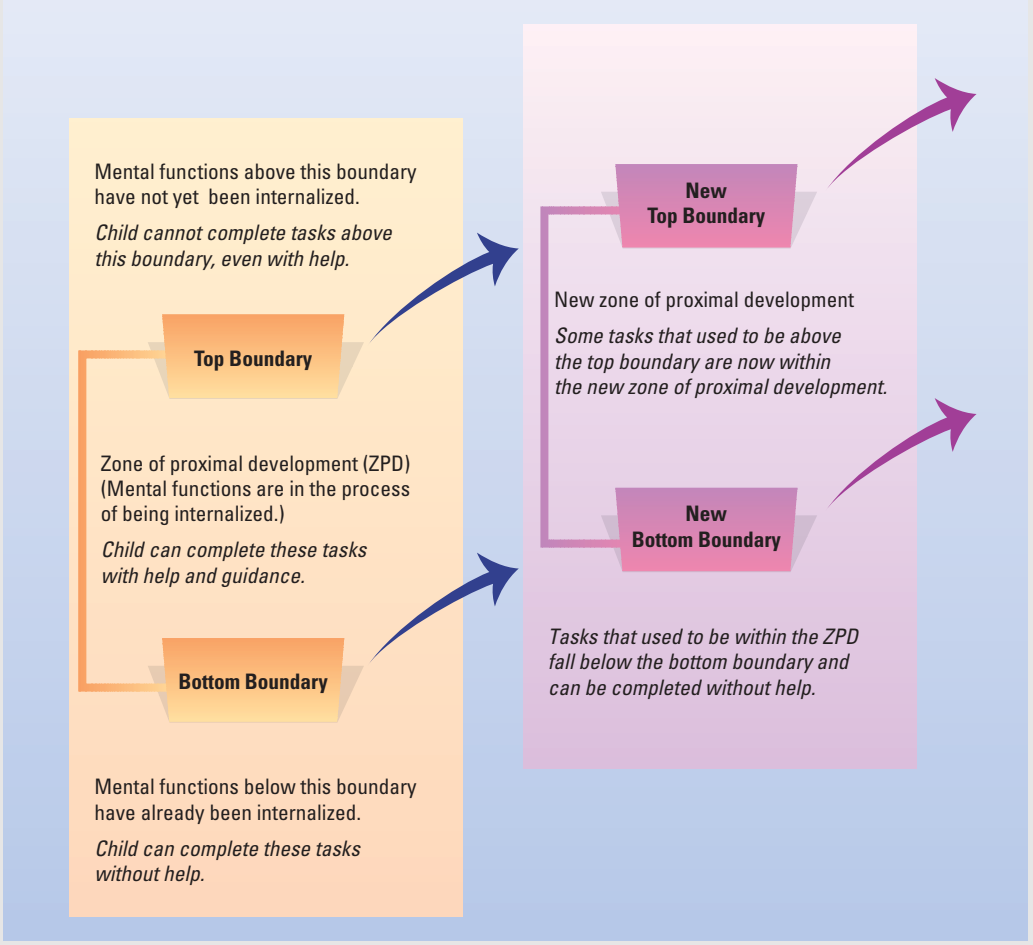

FIGURE 5.6 The Zone of Proximal Development

The range of tasks a child is capable of completing with help and guidance defines the zone of proximal development. The bottom boundary is defined by tasks the child already can complete independently. The top is defined by tasks the child cannot complete even with help. The zone changes with development, and both boundaries move up as more mental functions are internalized. As a result, tasks that used to be above the top boundary are within the child's zone; tasks that used to be within the zone become too easy and fall below the bottom boundary.

thinking OF MARIA

What could Maria look for in schools that would indicate that her sons would be appropriately challenged within their own zones of proximal development? What kinds of mediation might teachers provide?

independent performance but tests of assisted performance. Such tests "take stock not only of . . . the processes of maturation that are completed" but also of "processes that are now in the state of coming into being, that are only ripening, or only developing" (Vygotsky, 1956, p. 448).

The contrast between Vygotsky's and Piaget's views of cognitive development is at the heart of a controversy over when children should be allowed to enter school. To learn more about the implications of these theories for thinking about school readiness, read the Social Policy Perspectives box called "When Should Children Start School?"

Scaffolding: Support during Learning

If mediation within the ZPD is so important, how do adults and other helpers do it? Scaffolding, a concept that has grown from Vygotsky's theory, helps answer this question. **Scaffolding** is providing supportive help when a child is developing a mental function or learning to do a particular task (Wood, Bruner, & Ross, 1976; Wood & Middleton, 1975; Wood, Wood, & Middleton, 1978). Think about a building being constructed, and picture the supports that the builders set up during the construction process. These scaffolds support the workers until they complete the building. Cognitive scaffolds do exactly the same thing—they provide support for children as they develop the cognitive processes

scaffolding

Support given to a child as he or she develops a new mental function or learns to perform a particular task.

A Social Policy PERSPECTIVE...

When Should Children Start School?

When a child is younger than most of her classmates-to-be, which is better: To delay her entry into school and give her another year to mature and become "ready" for schooling? Or to enroll her, assuming that she will benefit from the activities and interactions and learn just as much as the older children? Most children in the United States today enter kindergarten at 5 years of age, but many states are considering increasing the age of school entry. Schools face increasing pressure to be accountable for their students' performance, so they are looking for ways to increase children's achievement. If older children benefit more from schooling, they should show higher achievement test scores, which often translate into better funding and resources. Parents are increasingly holding their "younger" children (particularly boys) back from entering school for fear that these children may not learn as well or as quickly as their classmates, perhaps might be retained, and then might have behavioral problems.

Those who support older entry ages argue that older children are biologically, cognitively, and socially more mature, and therefore that they are better able to take advantage of formal instruction. There is also the implicit assumption that the "'gift of time' and general (out of school) experience outweigh the benefits of a school setting" for increasing readiness (Stipek, 2002, p. 4). Others disagree, arguing that there is no single age at which all children will achieve "readiness" across all the biological, cognitive, and social skills involved in schooling. No matter what the cutoff age is, some children will be more and some less ready. More fundamentally, critics argue that holding children back from schooling will only put them *farther behind,* because the school environment is precisely what children need to further their development. Keeping children out of school will only increase the gap between their skills and those of their peers, and it will put them at even higher risk for poor academic achievement. Finally, critics argue that it is not the child's responsibility to be ready for school, but schools' responsibility to be ready for children—no matter what their level of skills and abilities when they begin.

The research evidence does not argue strongly for older entry ages. Some studies indicate a small advantage for some skills for older children, but the difference fades within the first few years of schooling. For most skills studied, schooling has a significantly stronger effect than age, and younger children at a grade level benefit from schooling as much as older children (Stipek, 2002). There also may be some risks for children who are older than their classmates because of delayed entry. These children show more behavior problems than younger children at the same grade level, with the difference increasing over time (Byrd, Weitzman, & Auinger, 1997; Mayer & Knutson, 1999).

Which sides of this debate would Piaget and Vygotsky likely take, and why? Given the theoretical views and research evidence, how would you advise parents and your local school system to think about the issue of school entry age? And where does the responsibility for readiness lie—with the children being taught, or with the system doing the instruction?

needed for a particular task. Cognitive scaffolding can take many different forms. It might include such things as initially doing part of a task for the child, simplifying difficult parts, talking the child through the task, or giving reminders. Any of these actions can help children complete the task and therefore assist them as they develop the necessary processes. Just as with a physical scaffold on a building, however, a cognitive scaffold is not meant to be permanent. It is a *temporary supportive structure,* meant to be gradually removed as the child's mental functions mature. To learn more about how adults provide scaffolds for children's learning, read the Personal Perspective box called "How Did I Help My Children Learn?"

The full impact of Vygotsky's ideas cannot be assessed yet, because some of his writings are only now being translated and made widely available. Many aspects of the theory have already proved useful, however—especially in the field of education (Kozulin, 1998). For example, because thought and cognitive development *follow from* language, it is

A Personal PERSPECTIVE...

Kelly Welch
Manhattan, Kansas
Mother of four sons (ages 14, 16, 18, and 20)

How Did I Help My Children Learn?

What kinds of scaffolds did you provide for your children as they learned new things?
Examples of scaffolds are limitless, from helping them learn to make beds, potty training, and even making a bowl of cereal or a peanut butter and jelly sandwich. Typically I would model the behavior and both verbally and physically guide them until I felt they could handle different pieces on their own. For example, I might hold the milk carton while they "poured" the milk, until I eventually let them do it on their own regardless of the spills and messes.

How did you reduce or remove the scaffolds as your child learned?
It's a stepwise process. As I sensed their independence and confidence, I let them do more on their own. I had to refrain from correcting them so I didn't send the message, "Yes, you did it, but not good enough."

Did you use scaffolding differently for your different children? Were the scaffolds removed at a different rate for each child?
Every one of our sons was different. The oldest was a perfectionist, so we had to leave scaffolds in place longer or he would be heartbroken when things didn't work correctly. Our third son became frustrated more easily than the other boys, so we had to remove scaffolds more slowly for him also. He was a hands-on learner. The other two boys learned better from books, so they didn't need as much scaffolding from us.

How do you help your children without doing the work for them?
By making it fun! We modeled the task to the point they wanted to do it. Putting food coloring in the dishwater was a sure way to have them argue over who got to wash the dishes. We also dished up praise whenever we could. We always let them know that it didn't matter what others could do, that they are perfect just the way they are. ■

thinking OF MARIA

What activities could Maria provide at home to encourage her sons' knowledge construction?

important to engage children in tasks they cannot yet handle independently, help them work through the tasks, and talk about the process. With mediation more experienced people help children master the cognitive structures they need to succeed in their environment. The role of the parent or teacher shifts from that of an interested observer to that of a fully active participant in a child's development. It is not enough to provide a stimulating environment for the child. We must also make decisions about which aspects of the larger culture to introduce to the child and when to introduce them. We also must find ways to structure these aspects, explain them, and provide scaffolding as the child struggles to master them.

Collaborative learning is a natural outgrowth of Vygotsky's theory. Remember that Vygotsky emphasized that cognitive development is driven by social interaction and that a more capable peer can be an effective mediator. Accordingly, parents and teachers can foster cognitive development by encouraging children to help one another solve problems, share their knowledge and skills, and discuss their strategies and knowledge (Gillies, 2003; Slavin, 1995; Wentzel & Watkins, 2002; Zimbardo, Butler, & Wolfe, 2003). As with any other form of mediation, however, collaborative learning experiences must help each child master the cognitive structures of the larger culture. Also, the mediation must take place within each individual child's ZPD if it is to be effective.

thinking OF MARIA

If Maria observed children working together in groups, with teachers guiding and advising the groups, would this be a sign that the learning environment was conducive to cognitive development?

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Can you see Vygotsky's sociocultural theory at work in this collaborative learning group? Use the concepts of social speech, mediation, ZPD, and scaffolding to explain why peer collaboration can be an effective way for children to learn.

One lesson to be learned from Vygotsky's theory is the importance of considering the impact of larger cultural systems and experiences on individual cognitive development. For example, in Chapter 1 we described the ecological systems theory developed by Urie Bronfenbrenner, which describes the influence of different systems on development. One recent approach to understanding the development of African American youth builds on both Vygotsky and systems theory. The *phenomenological variant of systems theory* emphasizes the importance of identifying relationships between broader cultural influences and development, but also asks how these influences affect the thinking and cognitive perspectives of the individual. The "focus [is] on the meaning-making processes" (Spencer, 1995, p. 39). For example, experiences of discrimination, racism, and stereotyping affect how minority youth think. The result is that children in minority groups often develop a unique and adaptive set of psychological tools for dealing with the challenges of their specific cultural setting (Spencer, Noll, Stoltzfus, & Harpalani, 2001).

Vygotsky would surely be delighted that his ideas have influenced the way we view cognitive development. And he would be especially glad that his ideas have made a difference in educational practice. Remember that he lived in a tumultuous time, experiencing extraordinary social and intellectual upheavals. He saw firsthand how cultures and societies change over time, and he believed that such changes have a powerful influence on cognitive development. We can see that influence when we compare Vygotsky to Piaget. Piaget grew up in Switzerland, a country that prides itself on autonomy and independence; he theorized that children construct their own cognitive structures as they learn to adapt to the environment. For Piaget the child's own experiences are primary. For Vygotsky, however, the words of the community are primary. Vygotsky believed in the collectivist philosophy of the communist Soviet Union; he proposed that children learn by adopting the cognitive structures offered by the important people—and the larger community—around the child.

YOUR PERSPECTIVE NOTES

Identify some of the scaffolds you have been offered in this textbook or in this class. List them and think about how they have supported your learning.

LET'S REVIEW . . .

1. In contrast to Piaget, Vygotsky placed a greater emphasis on the role of _____ in children's cognitive development.
   a. the child's own subjective interpretation
   b. math and logic
   c. biology and genetics
   d. social interaction and language
2. When Jeremy was doing his math homework, he could be heard mumbling aloud: "I carry the six, so that makes this six plus three equals nine." According to Vygotsky, Jeremy just gave us an example of:
   a. social speech.
   b. private speech.
   c. inner speech.
   d. internalized speech.
3. According to Vygotsky's theory, it is best if teachers design educational programs that work:
   a. just below a child's zone of proximal development.
   b. just above a child's zone of proximal development.
   c. within a child's zone of proximal development.
   d. against a child's zone of proximal development.
4. According to Vygotsky, children's thought structures develop from:
   a. the language they hear around them.
   b. their attempts to modify their own internal schemes.
   c. their own experimentation with characteristics in the environment.
   d. the biological maturation of their nervous system.
5. True or False: Vygotsky's emphasis on the social transmission of thought and knowledge follows from his belief in Marxist philosophy.
6. True or False: In Vygotsky's theory, scaffolds are the support structures that adults and other people provide to help a child learn a difficult task.

Answers: 1. d, 2. b, 3. c, 4. a, 5. T, 6. T

Recent Sociocultural Views of Cognitive Development

Vygotsky's theory served as the foundation for several more recent views of cognitive development. These views emphasize the important influence of social interaction and the larger cultural context on children's cognitive development, and they reveal how Vygotsky's theory has stimulated many researchers to think about cognitive development in new ways.

After reading this section you should be able to answer the following questions:

- What influence did Vygotsky have on the development of the newer sociocultural views of cognitive development?
- According to these newer views, how do the social context, groups, and the larger culture influence cognitive development?
- What specific ideas can we take from these newer sociocultural views that would help us facilitate children's cognitive development?

Situated Cognition

"If you were selling candy, would you make more profit by selling one piece for 200 cruzeiros or by selling three pieces for 500 cruzeiros?" When Geoffrey Saxe (1988) asked Brazilian schoolchildren questions like this, he found that most were not able to answer correctly. But when he went into city streets in Brazil and asked children who were not attending school at all, he got accurate answers. Why the difference? The children he interviewed in the streets were vendors, children who sold things to support themselves and their families. Although they lacked formal education in mathematics, they had developed their own strategies for solving complicated problems. The street vendors probably would not have succeeded in school math tests, as these tests tend to use problems that are rather abstract and taken out of context. Within their familiar context, however, the vendors were quite adept. Similar results have been found in other cultures, such as Beirut (Jurdak & Shahin, 1999). Their mathematical skills were situation-specific—an example of *situated cognition.*

The **situated cognition** view of cognitive development holds that thinking always takes place within a specific context, and always in relation to a particular problem, situation, or interaction. According to this view you cannot really understand thought or its quality or level without also examining the context in which the thought takes place. For example, suppose you ask a first grader, "What is 4 divided by 2?" He will probably be unable to answer, maybe saying he hasn't "had division yet." But give him four cookies and tell him to make sure that he and his brother both get the same number, and watch how quickly the boy solves the problem. Embedding questions in concrete and meaningful contexts enables children to solve problems that they cannot otherwise understand. The situated cognition view emphasizes that the particular kinds of thinking that occur in different cultures result from adaptations to the particular contexts in which the members of the cultures find themselves. The key factors are the kinds of problems people encounter frequently and the cognitive structures that they find to be effective. In sum, this view reminds us that to properly understand cognitive development, we need also to consider its context. In keeping with this view, many educators strive to teach cognitive skills within contexts—drawing on the types of situations most important within their students' cultures.

Guided Participation

Another recent sociocultural view emphasizes **guided participation.** The central idea here is that development consists of children's gradually increasing participation in sociocultural activity—with gradually decreasing guidance and support from those around them (Lave & Wenger, 1991; Rogoff, 1998, 2003; Rogoff, Mistry, Göncü, & Mosier, 1993). For example, think about a girl learning to read. Initially, she cannot decipher the symbols on the page, so her participation is marginal. But she is a *legitimate peripheral participant* (Lave & Wenger, 1991, 1996), which means that she is involved in the activity to the degree that her current skill allows. She can select the book to be read, listen attentively, ask and answer questions, and examine any pictures that go along with the story. As the child begins to decipher letters and to remember the sounds of different letters, her degree of participation increases and its nature changes. She can now point out specific letters, even recognize and read simple words such as *a* or *an.* Her participation continues to change as she gradually becomes more of a *central participant,* able to do a great deal of the reading herself and even reading simple books to other, less central participants.

The guided participation view is similar to Vygotsky's in that more central participants initially guide the activity, and the child gradually takes on increasing responsibility. But whereas Vygotsky emphasized how children internalize the psychological tools represented in their culture, the guided participation view instead emphasizes how the child's social roles or shared interactions with other people change as the child develops. Also, whereas Vygotsky

YOUR PERSPECTIVE NOTES

Identify an activity in which you have moved from being a legitimate peripheral participant to being a more central participant. What skills and knowledge did you learn as a legitimate peripheral participant, and how did they help you become more of a central participant?

situated cognition
The idea that we cannot fully understand children's thinking and cognition without considering the context within which it occurs.

guided participation
The idea that children are involved in sociocultural activities to the degree that their level of cognitive development allows.

tended to focus on the internalization of such things as a culture's language or number system, the guided participation view emphasizes participation in more routine, day-to-day activities.

thinking OF MARIA

What kinds of classroom activities might Maria look for that would indicate that her sons would have opportunities to contribute to socially shared cognition?

Thinking as Socially Shared Cognition: Two Heads Are Better than One

Vygotsky claimed that even after children internalize cognitive structures, thought is still a social phenomenon, because its roots are in social interaction. Recent work emphasizes this point, describing cognition as a socially shared activity rather than an individual one (Resnick, Levine, & Teasley, 1991; Wertsch, Tulviste, & Hagstrom, 1993). In this view, cognition does not involve an individual's activities alone, or even an individual's contributions to a social interaction. This view holds that thinking extends "beyond the skin" of the individual and includes the "thinking" of pairs and groups of people (Wertsch, Tulviste, & Hagstrom, 1993, p. 337). It does not make sense to ask, "Whose idea is that?" because thought takes place across the members of a group—it is **socially shared cognition.** This theory does not deny that an individual can think independently. But it argues that even "independent" thought is the culmination of many others' input. Thinking resides in the dynamic interactions between individuals within the group, not solely inside the head of any individual.

socially shared cognition

The idea that thought is a shared group activity and that the thoughts of any individual child are derived at least in part from dynamic interactions occurring between people and in groups.

The three views we have summarized here all draw on different aspects of Vygotsky's theory. These modern sociocultural views of cognition are still in the formative stages. But the key point is that today's sociocultural cognition theorists no longer see thought as something that takes place inside one individual's head and consists of abstract skills applied across many different problems and contexts. Instead, they view cognition as much more complex. They suggest that cognition makes use of specific features and contexts and involves individuals collaborating to create ideas and think in ways that no individual could accomplish alone. In short, they see cognition as a very dynamic, social, and interactive process.

LET'S REVIEW . . .

1. Children show more advanced cognitive processing when they are tested within contexts that are familiar and well practiced. This is one of the main points of the:
   a. socially shared cognition view.
   b. guided participation view.
   c. social speech view.
   d. situated cognition view.
2. Which of the following would be an example of development in the guided participation view?
   a. John moves from watching children play basketball to playing in the game himself.
   b. Sue and Lisa work together to solve a problem that neither could solve alone.
   c. Henri can read his favorite books at home but has trouble reading the practice sheets in school.
   d. Tonya needs social scaffolds to help her understand algebra problems.
3. True or False: The sociocultural theories are a reaction against Vygotsky's view of cognitive development.
4. True or False: According to the sociocultural view, cognition is the product of social interaction more than the private construction of individual thinkers.

Answers: 1. d, 2. a, 3. F, 4. T

thinking

BACK TO MARIA

Now that you have studied this chapter, you should be able to explain how Maria could use concepts from the constructivist and sociocultural theories to identify schools and teachers that would facilitate the cognitive development of her sons, ages 4½ and 12. You should be able to list at least a dozen specific concepts and explain how each would relate to Maria's situation.

Using Piaget's constructivist theory, Maria would want to find classroom environments that promote active learning and look for teachers who use rich hands-on activities. By providing novel materials and concepts in class, teachers provide the environment where children can try to assimilate new information into their existing schemes. If their schemes cannot handle the new information, then children may be puzzled or perplexed. This is not failure; Piaget referred to it as cognitive disequilibrium, and it signals readiness to learn or accommodate schemes. Teachers should encourage reflective abstraction by asking children to look for connections and interrelationships among concepts.

Using Vygotsky's sociocultural theory, Maria should understand that children also learn by adopting the cognitive structures embedded in the language and culture of the classroom and the school. She should spend time observing and listening for the messages contained in the school culture. Are the messages predominantly positive—as in "All students can learn," "Math and science have practical importance," and "Celebrate diversity"? Social speech becomes private speech. Would Maria be proud to see her sons internalize the messages heard in the schools and classrooms she visits? What kinds of mediation and scaffolding do teachers provide? Do teachers properly challenge students within their own zones of proximal development? Maria might observe whether schools offer collaborative learning activities in which less advanced students can learn from their more advanced peers. To decide when to enroll her son in kindergarten, Maria might be interested in finding out the local schools' philosophies on the issue of school readiness: Do they follow Piaget on the need for children to be ready for school? Or, as Vygotsky argued, do they see schools as responsible for mediating within each child's ZPD?

Finally, Maria can consider the newer sociocultural theories. Do schools teach and assess concepts within the context of important real-life situations? Do teachers guide students as they move from being "legitimate peripheral participants" to "central participants"? Do students have opportunities to work collaboratively on projects, creating shared cognitions?

CHAPTER SUMMARY

How does Piaget's theory of cognitive development reflect his background in biology and IQ testing?

Piaget was a young scholar in biology, producing his first scientific publication at the age of 10. In his teens he studied how sea mollusks adapt their shells to changes in water currents, and this image of adaptation formed the core of his theory of cognitive development. Piaget theorized that children create and adapt their own cognitive structures in response to their changing experiences with the world. When he worked in Binet's lab developing IQ tests, Piaget observed that young children's incorrect answers fell into patterns—they were not haphazard. Children of about the same age tended to give the same kinds of wrong answers. Piaget believed that this indicated that young children use a different logic than do older children and adults. His theory proposes four stages of cognitive development that represent changes in the forms of logic and thought children use as they mature.

Why is Piaget's theory considered a constructivist view? What are the main concepts in Piaget's theory about how children develop cognitive structures?

Piaget's is considered a constructivist view because he emphasized that children learn primarily by interpreting their environment and experiences in light of the knowledge and experiences they already have, thus constructing their own schemes and cognitive structures. Adaptation is the process through which children modify their schemes and cognitive structures. In adaptation new experiences are assimilated into existing schemes; if they do not fit adequately, cognitive disequilibrium results. Children can accommodate, or modify, their schemes to provide a better fit with the environment, restoring cognitive equilibrium. Organization is children's tendency to arrange cognitive structures into larger coherent systems. Reflective abstraction is the ability to notice patterns and connections among related schemes.

What are Piaget's stages of cognitive development, and what basic changes occur as children progress through these stages?

In the sensorimotor thought stage (birth to 2 years), infants begin by understanding the world through inborn reflexes and through their own direct sensory and motor actions. The ability to represent knowledge internally, in symbolic, mental form, develops gradually. In the preoperational thought stage (2 to 7 years), children can form internal mental representations, and they practice using symbols in their language, art, and play. Thought in this stage is intuitive, based more on personal observation than on objective logic. Egocentrism, animism, and artificialism are prominent features. Children fail conservation problems because their cognitive schemes are not reversible (not "operational"), they center their thought on only one dimension of the problem, and they focus on the static endpoints of the problem. In the concrete operational stage (7 to 11 years), children can solve conservation problems: Schemes are reversible ("operational"), and children represent multiple dimensions of the problems and the dynamic transformations. Logic is more objective and allows the child to understand class inclusion and transitivity. Logic still requires tangible or concrete material or experience, however. In formal operations (12 years and above), adolescents learn hypothetico-deductive reasoning and abstract thought. They can work systematically through all possible solutions to complex problems. Adolescents maintain a form of adolescent egocentrism, reflected in the imaginary audience and the personal fable.

What are the main criticisms of Piaget's theory? What was Piaget's main contribution to child development?

The two major criticisms are that Piaget underestimated children's abilities, especially during infancy, and that there does not seem to be evidence for the unified stages he proposed. More recent research has demonstrated that infants can form mental representations and demonstrate object permanence at a much earlier age than Piaget predicted. Also, they often show performance indicative of several stages at once, as when a child passes the number conservation task but fails the liquid task. It seems that progress through the stages is not unified: It is not shown simultaneously across tasks and contexts. Still, Piaget left a tremendous legacy for child development. He emphasized the active, constructive nature of children's learning, and many of the cognitive developmental trends he observed have been verified by research. Egocentrism and intuitive thought decline with development as the use of objective logic and abstract thought emerge. Piaget's impact on educational practice, especially his emphasis on active learning processes, has been especially important.

What are the main ideas in Vygotsky's sociocultural view of cognitive development?

Vygotsky proposed that children learn primarily by adopting the cognitive structures embedded in the language and the larger culture around them. As adults and others speak, children adopt their social speech and transform it into their own private speech. Children then internalize their private speech to form internal thought structures. Adults and others mediate cognitive structures for children, often providing scaffolds or supports as children attempt more difficult tasks. The zone of proximal development represents those tasks that the child can perform with mediation or support from more skilled mentors.

What are the more recent sociocultural views stimulated by Vygotsky's theory?

The situated cognition view emphasizes that development involves adaptation to the contexts or situations that are prominent in each child's culture. We cannot properly understand or measure development without considering the situation. The guided participation view stresses how other social agents guide children from being peripheral participants to central participants in important cognitive activities. With socially shared cognition, two heads are better than one: Working together, children can construct more advanced cognitive products than when working alone. All of these views stress the importance of understanding the larger social context when considering children's cognitive development.

KEY TERMS

abstract thought (5-20)
accommodation (5-7)
adaptation (5-7)
adolescent egocentrism (5-20)
assimilation (5-7)
concrete operational thought (5-18)
conservation (5-17)
constructivist view (5-6)
equilibration (5-8)
formal operational thought (5-19)
guided participation (5-33)
hypothetico-deductive reasoning (5-19)
internalization (5-26)
intuitive thought (5-15)
mediation (5-26)
object permanence (5-12)
operations (5-18)
organization (5-7)
preoperational thought (5-13)
private speech (5-26)
reflective abstraction (5-8)
scaffolding (5-28)
scheme (5-6)
sensorimotor thought (5-10)
situated cognition (5-33)
social speech (5-26)
socially shared cognition (5-34)
symbolic (representational) thought (5-11)
zone of proximal development (ZPD) (5-27)