HOW DID PIAGET VIEW COGNITIVE DEVELOPMENT?

Jean Piaget, born in Switzerland in 1896, is the most influential developmental psychologist in the history of psychology (see Wadsworth, 2004). After receiving his doctorate in biology, he became more interested in psychology, basing his earliest theories on careful observation of his own three children. Piaget thought of himself as applying biological principles and methods to the study of human development, and many of the terms he introduced to psychology were drawn directly from biology.

Piaget explored both why and how mental abilities change over time. For Piaget, development depends in large part on the child's manipulation of and active interaction with the environment. In Piaget's view, knowledge comes from action (see DeVries, 2008; Wadsworth, 2004). Piaget's theory of cognitive development proposes that a child's intellect, or cognitive ability, progresses through four distinct stages. Each stage is characterized by the emergence of new abilities and ways of processing information. Many of the specifics of Piaget's theories have been challenged in later research. In particular, many of the changes in cognitive functioning that he described are now known to take place earlier than he stated, at least under certain circumstances. Nevertheless, Piaget's work forms an essential basis for understanding child development.

How Development Occurs

SCHEMES Piaget believed that all children are born with an innate tendency to interact with and make sense of their environments. Young children demonstrate patterns of behavior or thinking, called **schemes**, that older children and adults also use in dealing with objects in the world. We use schemes to find out about and act in the world; each scheme treats all objects and events in the same way. When babies encounter a new object, how are they to know what this object is all about? According to Piaget, they will use the schemes they have developed and will find out

whether the object makes a loud or a soft sound when banged, what it tastes like, whether it gives milk, and whether it goes thud when dropped (see Figure 2.1).

ASSIMILATION AND ACCOMMODATION According to Piaget, **adaptation** is the process of adjusting schemes in response to the environment by means of assimilation and

a. Banging is a favorite **scheme** used by babies to explore their world.

b. **Assimilation** occurs when they incorporate new objects into the scheme.

c. **Accommodation** occurs when a new object does not fit the existing scheme.

accommodation. **Assimilation** is the process of understanding a new object or event in terms of an existing scheme. If you give young infants small objects that they have never seen before but that resemble familiar objects, they are likely to grasp them, bite them, and bang them. In other words, they will try to use existing schemes to learn about these unknown things (see Figure 2.1b). Similarly, a high school student may have a studying scheme that involves putting information on cards and memorizing the cards' contents. She may have had success with this in one subject and then applied the same scheme to many subjects.

Sometimes, when old ways of dealing with the world simply don't work, a child might modify an existing scheme in light of new information or a new experience, a process called **accommodation**. For example, if you give an egg to a baby who has a banging scheme for small objects, what will happen to the egg is obvious (Figure 2.1c). Less obvious, however, is what will happen to the baby's banging scheme. Because of the unexpected consequences of banging the egg, the baby may change the scheme. In the future the baby might bang some objects hard and others softly. The high school student who studies only by means of memorization might learn to use a different strategy, such as discussing difficult concepts with a friend, to study subjects or topics in which memorization does not work very well.

The baby who banged the egg and the student who tried to memorize rather than comprehend had to deal with situations that could not be fully handled by existing schemes. This, in Piaget's theory, creates a state of disequilibrium, or an imbalance between what is understood and what is encountered. People naturally try to reduce such imbalances by focusing on the stimuli that cause the disequilibrium and developing new schemes, or adapting old ones, until equilibrium is restored. This process of restoring balance is called **equilibration**. According to Piaget, learning depends on this process. When equilibrium is upset, children have the opportunity to grow and develop. Eventually, qualitatively new ways of thinking about the world emerge, and children advance to a new stage of development. Piaget believed that physical experiences and manipulation of the environment are critical for developmental change to occur. However, he also believed that social interaction with peers, especially arguments and discussions, helps to clarify thinking and, eventually, to make it more logical. Research has stressed the importance of confronting students with experiences or data that do not fit into their current theories of how the world works as a means of advancing their cognitive development. Having students resolve disequilibrium working with peers is particularly effective (Slavin, 2014).

Piaget's theory of development represents **constructivism**, a view of cognitive development as a process in which children actively build systems of meaning and understandings of reality through their experiences and interactions (Berk, 2013; Schunk, 2016). In this view, children actively construct knowledge by continuously assimilating and accommodating new information.

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Piaget's Stages of Development

Piaget divided the cognitive development of children and adolescents into four stages: sensorimotor, preoperational, concrete operational, and formal operational. He believed that all children pass through these stages in this order and that no child can skip a stage, although different children pass through the stages at somewhat different rates. The same individuals may perform tasks associated with different stages at the same time, particularly at points of transition into a new stage. Table 2.1 summarizes the approximate ages at which children and adolescents pass through Piaget's four stages. It also shows the major accomplishments of each stage.

SENSORIMOTOR STAGE (BIRTH TO AGE 2) The earliest stage is called **sensorimotor** because during this stage, babies and young children explore the world by using their senses and motor skills. Dramatic changes occur as infants progress through the sensorimotor period. Initially, all infants have inborn behaviors called **reflexes**. Touch a newborn's lips, and the baby will begin to suck; place your finger in the palm of an infant's hand, and the infant will grasp it. These and other innate behaviors are the building blocks from which the infant's first schemes form.

TABLE 2.1 t Piaget's Stages of Cognitive Development

People progress through four stages of cognitive development between birth and adulthood, according to Jean Piaget. Each stage is marked by the emergence of new intellectual abilities that enable people to understand the world in increasingly complex ways.

STAGE	APPROXIMATE AGES	MAJOR ACCOMPLISHMENTS
Sensorimotor	Birth to 2 years	Formation of concept of "object permanence" and gradual progression from reflexive behavior to goal-directed behavior.
Preoperational	2 to 7 years	Development of the ability to use symbols to represent objects in the world. Thinking remains egocentric and centered.
Concrete operational	7 to 11 years	Improvement in ability to think logically. New abilities include the use of operations that are reversible. Thinking is decentered, and problem solving is less restricted by egocentrism. Abstract thinking is not yet possible.
Formal operational	11 years to adulthood	Abstract and purely symbolic thinking is possible. Problems can be solved through the use of systematic experimentation.

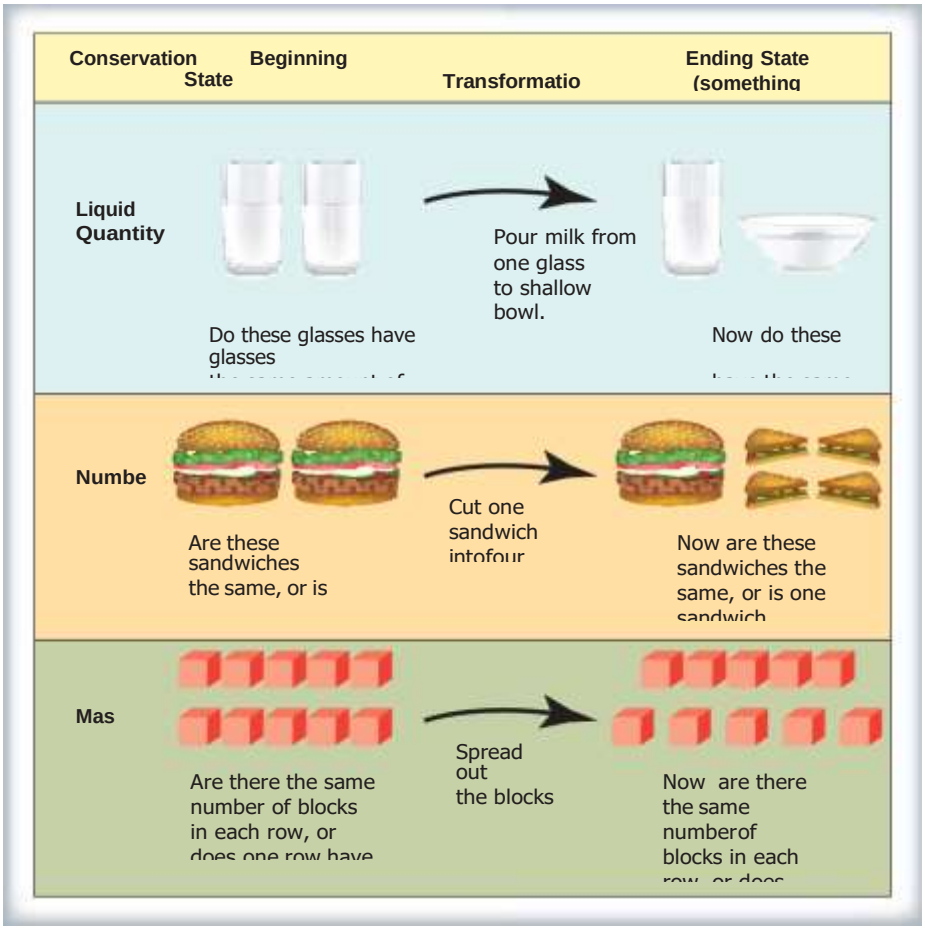
Infants soon learn to use these reflexes to produce more interesting and intentional patterns of behavior. This learning occurs initially through accident and then through more intentional trial-and-error efforts. According to Piaget, by the end of the sensorimotor stage, children have progressed from their earlier trial-and-error approach to a more planned approach to problem solving. For the first time they can mentally represent objects and events. What most of us would call "thinking" appears now. This is a major advance because it means that the child can think through and plan behavior. For example, suppose a 2-year-old is in the kitchen watching his mother prepare dinner. If the child knows where the step stool is kept, he may ask to have it set up to afford a better view of the counter and a better chance for a nibble. The child did not stumble on this solution accidentally. Instead, he thought about the problem, figured out a possible solution that used the step stool, tried out the solution mentally, and only then tried the solution in practice (Trawick-Smith, 2014).

Another hallmark development of the sensorimotor period is the ability to grasp **object permanence**. Piaget argued that children must learn that objects are physically stable and exist even when the objects are not in the child's physical presence. For example, if you cover an infant's bottle with a towel, the child may not remove it, believing that the bottle is gone. By 2 years of age, children understand that objects exist even when they cannot be seen. Once they realize that things exist out of sight, children can start using symbols to represent these things in their minds so that they can think about them (Cohen & Cashon, 2003).

PREOPERATIONAL STAGE (AGES 2 TO 7) During the **preoperational stage**, children have greater ability to think about things and can use symbols to mentally represent objects (Massey, 2008; Ostroff, 2012). Their language and concepts develop at an incredible rate. Yet much of their thinking remains surprisingly primitive. One of Piaget's earliest and most important discoveries was that young children lack an understanding of the principle of **conservation**. For example, if you pour milk from a tall, narrow container into a shallow, wide one, and back again, in the presence of a preoperational child, the child will firmly believe that the tall glass has more milk (see Figure 2.2). Similarly, a preoperational child is likely to believe that a sandwich cut in four pieces is more sandwich or that a line of blocks that is spread out contains more blocks than a line that is compressed, even after being shown that the number of blocks is identical.

Several aspects of preoperational thinking help to explain the error on conservation tasks. One characteristic is **centration**: paying attention to only one aspect of a situation. In the example illustrated in Figure 2.2, children might have claimed that there was less milk after it was poured into the wide container because they centered on the height of the milk, ignoring its width. At the bottom of Figure 2.2, children focused on the length of the line of blocks and ignored its density (or the actual number of blocks).

Reversibility, the ability to change direction in one's thinking to return to a starting point, is another facet of thinking that is not yet developed in preoperational children. As adults, for



example, we know that if $7 + 5 = 12$, then $12 - 5 = 7$. If we add 5 items to 7 items and then take the 5 items away (reverse what we've done), we are left with 7 items again. If preoperational children could think this way, then they could mentally reverse the process of pouring the milk and realize that if the milk were poured back into the tall beaker, its quantity would not change.

Finally, preoperational children are **egocentric** in their thinking. Children at this stage believe that everyone sees the world exactly as they do. For example, Piaget and Inhelder (1956) seated children on one side of a display of three mountains and asked them to describe how the scene looked to a doll seated on the other side. Children below the age of 6 or 7 described the doll's view as identical to their own, even though it was apparent to adults that this could not be so. Because preoperational children are unable to take the perspective of others, they often interpret events entirely in reference to themselves.

CONCRETE OPERATIONAL STAGE (AGES 7 TO 11) Although the differences between the mental abilities of preoperational preschoolers and concrete operational elementary school students are dramatic, concrete operational children still do not think like adults (Davis, 2008). They are very much rooted in the world as it is and have difficulty with abstract thought. Flavell describes the concrete operational child as taking "an earthbound, concrete, practical-minded sort of problem-solving approach, one that persistently fixates on the perceptible and inferable reality right there in front of him. A theorist the elementary-school child is not" (1986, p. 103). The term **concrete operational stage** reflects this earthbound approach. Children at this stage can form concepts, see relationships, and solve problems, but only as long as they involve objects and situations that are familiar.

One important task that children learn during the concrete operational stage is **seriation**, or arranging things in a logical progression—for example, lining up sticks from smallest to largest. To do this, they must be able to order or classify objects according to some criterion or dimension, in this case length. Once this ability is acquired, children can master a related skill known as **transitivity**, the ability to infer a relationship between two objects on the basis of knowledge of their respective relationships with a third object. For example, if you tell preoperational preschoolers that Tom is taller than Becky and that Becky is taller than Fred, they will not see that Tom is taller than Fred.

Children in the elementary grades also are moving from egocentric thought to decentered or objective thought. Decentered thought enables children to see that others can have different perceptions than they do. For example, children with decentered thought will be able to understand that different children may see different patterns in clouds. Children whose thought processes are decentered are able to learn that events can be governed by physical laws, such as the laws of gravity. These changes do not all happen at the same time. Rather, they occur gradually during the concrete operational stage.

FORMAL OPERATIONAL STAGE (AGE 11 TO ADULTHOOD) Sometime around the onset of puberty, children's thinking begins to develop into the form that is characteristic of adults (Horn, Drill, Hochberg, Heinze, & Frank, 2008; Packard & Babineau, 2008). The preadolescent begins to be able to think abstractly and to see possibilities beyond the here and now. These abilities continue to develop into adulthood. With the **formal operational stage** comes the ability to deal with potential or hypothetical situations; the form is now separate from the content.

HYPOTHETICAL CONDITIONS Another ability that Piaget and others recognized in the young adolescent is an aptitude to reason about situations and conditions that have not been experienced. The adolescent can accept, for the sake of argument or discussion, conditions that are arbitrary, that are not known to exist, or even that are known to be contrary to fact.