

One small example indicating that this has happened is a story Harlow told in his own words about a woman who, after hearing Harlow present his research, came up to him and said, "Now I know what's wrong with me! I'm just a wire mother" (p. 677).

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Reading 18: OUT OF SIGHT, BUT NOT OUT OF MIND

Piaget, J. (1954). The development of object concept. In J. Piaget, *The construction of reality in the child* (pp. 3-96). New York: Basic Books.

How did you develop from an infant, with a few elementary thinking skills, to the adult you are now, with the ability to reason and analyze the world in many complex ways involving language, symbols, and logic? Your first reaction to this question may very likely be to say, "Well, I learned how to think from my experiences and from the teaching I received from adults throughout my life."

Although this explanation seems intuitively correct to most people, many developmental psychologists believe that much more is involved in acquiring intellectual abilities than simple learning. The prevailing view about intellectual development is that it is a process of maturation, much like physical development, that occurs in a predictable fashion from birth through adulthood.

Do you look at an infant and see a person who, with enough learning, is capable of adult physical behaviors? Of course not. Instead, you know that the child's behavior will become increasingly complex over time through a process of physical maturation. You know that until the child achieves a certain level of development, all the learning in the world cannot produce certain behaviors. For example, consider the behavior of walking. You probably think of walking as a learned behavior. But imagine trying to teach a 6-month-old to walk. You could place the infant on an Olympic-level schedule of 8 hours of practice every day, but the child will not learn to walk. Why? Because the child has not yet reached the physical maturity to perform the behaviors needed to walk.

Intellectual, or cognitive, development occurs in much the same way. Children simply cannot demonstrate certain thinking and reasoning abilities until they reach an appropriate stage of cognitive development, no matter

how much learning they may have experienced. Psychology owes its understanding of this conceptualization of cognitive development in large part to the work of Swiss psychologist Jean Piaget (1896-1980).

Piaget is one of the most influential figures in the history of psychology. His work not only revolutionized developmental psychology but also formed the foundation for most subsequent investigations in the area of the formation of the intellect. Piaget was originally trained as a biologist and studied the in-born ability of animals to adapt to new environments. While Piaget was studying at the Sorbonne in Paris, he accepted a job (to earn extra money) at the Alfred Binet Laboratory, where the first human intelligence tests were being developed. He was hired to standardize a French version of a reasoning test that originally had been developed in English. It was during his employment in Paris that Piaget began to formulate his theories about cognitive development.

THEORETICAL PROPOSITIONS

The work at the Binet Laboratory was tedious and not very interesting to Piaget at first. Then he began to detect some interesting patterns in the answers given by children at various ages to the questions on the test. Children at similar ages appeared to be making the same mistakes. That is, they appeared to be using similar reasoning strategies to reach similar answers. What fascinated Piaget was not the correct answers but the thinking processes that produced the similar *wrong* answers. Based on his observations, he theorized that older children had not just learned more than the younger ones but were *thinking differently* about the problems. This led him to question the prevailing definition of intelligence at the time (the IQ score), in favor of a model that involved a more complete understanding of the cognitive strategies used in common by children at various ages (Ginzburg & Oppen, 1979).

Piaget devoted the next 50 years of his life and career to studying intellectual development in children. His work led to his famous theory of cognitive development, which for decades was a virtually undisputed explanation of how humans acquire their complex thinking skills. His theory holds that during childhood, humans progress through four stages of cognitive development that always occur in the same sequence and at approximately the same ages. These are summarized in Table 18-1.

Perhaps as important as his theory were the techniques Piaget used to study thinking abilities in children. At the Binet Laboratory, he realized that if he was to explore his new conceptualization of intelligence, he would also need to develop the methods to do so. Instead of the usual, rigid, standardized intelligence tests, he proposed an interview technique that allowed the child's answers to influence the direction of the questioning. In this way, he would be able to explore the processes underlying the child's reasoning.

One of the most remarkable aspects of Piaget's research is that in reaching many of his conclusions, he studied his *own* children: Lucienne, Jacqueline, and Laurent. By today's scientific standards, this method would be highly

TABLE 18-1 Piaget's Stages of Cognitive Development

STAGE	AGE RANGE	MAJOR CHARACTERISTICS
Sensori-motor	0-2 years	<ul style="list-style-type: none"> • All knowledge is acquired through senses and movement (such as looking and grasping). • Thinking is at the same speed as physical movement. • Object permanence develops.
Preoperational	2-7 years	<ul style="list-style-type: none"> • Thinking separates from movement and increases greatly in speed. • Ability to think in symbols develops. • Nonlogical, "magical" thinking occurs. • All objects have thoughts and feelings (animism). • Egocentric thinking (unable to see world from others' points of view) develops.
Concrete operations	7-11 years	<ul style="list-style-type: none"> • Logical thinking develops, including classifying objects and mathematical principles, but only as they apply to real, concrete objects. • Understanding of conservation of liquid, area, and volume develops. • Ability develops to infer what others may be feeling or thinking.
Formal operations	11 and up	<ul style="list-style-type: none"> • Logical thinking extends to hypothetical and abstract concepts. • Ability forms to reason using metaphors and analogies. • Ability forms to explore values, beliefs, philosophies. • Ability forms to think about past and future. • Not everyone uses formal operations to the same degree, and some not at all.

suspect because of the rather likely possibility of bias and lack of objectivity. However, as rules always have exceptions, Piaget's findings from his children could be applied to all children, universally.

A single chapter in this book is far too little space to explore more than a small fraction of Piaget's work. Therefore, we will focus on his discovery of one key intellectual ability, *object permanence*. This facility provides an excellent example of one of Piaget's most important findings, as well as ample opportunity to experience his methods of research.

Object permanence refers to your ability to know that an object exists even when it is hidden from your senses. If someone walks over to you now and takes this book out of your hands and runs into the next room, do you think that the book or the book snatcher has ceased to exist? Of course not. You have a *concept* of the book and of the person in your mind, even though you cannot see, hear, or touch them. However, according to Piaget, this was not always true for you. He demonstrated that your cognitive ability to conceive of objects as permanent and unchanging was something you, and everyone else, developed during your first 2 years of life. The reason this ability is

important is that problem solving and internal thinking are impossible without it. Therefore, before a child can leave the sensori-motor stage (0 to 2 years; see Table 18-1) and enter the preoperational period (2 to 7 years), object permanence must develop.

METHOD AND RESULTS

Piaget studied the development of object permanence using *unstructured evaluation methods*: because infants cannot exactly be "interviewed," these techniques often took the form of games he would play with his children. Through observing problem-solving ability and the errors the infants made playing the games, Piaget identified six *substages* of development that occur during the sensori-motor period and that are involved in the formation of object permanence. For you to experience the flavor of his research, these six stages are summarized here with examples of Piaget's interactions with his children quoted from his actual observational journals:

- *STAGE 1 (Birth to 1 month)*. This stage is concerned primarily with reflexes relating to feeding and touching. No evidence of object permanence is seen during this first month of life.
- *STAGE 2 (1 to 4 months)*. During stage 2, although no sign of an object concept is found, Piaget interprets some behaviors as preparing the infant for this ability. The child begins to repeat, on purpose, certain behaviors that center on the infant's own body. For example, if an infant's hand accidentally comes in contact with its foot, it might reproduce the same movements over and over again to cause the event to be repeated. Piaget called these *primary circular reactions*. Also, at this stage, infants are able to follow moving objects with their eyes. If an object leaves the child's visual field and fails to reappear, the child will turn its attention to other visible objects and show no signs of looking for the "vanished" object. However, if the object repeatedly reappears in the same location, the infant will look longer at that point. Piaget called this behavior *passive expectation*. The following interaction between Piaget and his son, Laurent, illustrates this:

Observation 2. Laurent at 0;2 [0 years, 2 months]. I look at him through the hood of his bassinet and from time to time I appear at a more or less constant point; Laurent then watches that point when I am out of his sight and obviously expects me to reappear, (p. 9)

The child limits himself to looking at the place where the object vanished: Thus he merely preserves the attitude of the earlier perception and if nothing reappears, he soon gives up. If he had the object concept... he would actively search to find out where the thing could have been put. . . . But this is precisely what he does not know how to do, for the vanished object is not yet a permanent object which has been moved; it is a mere image which reenters the void as soon as it vanishes, and emerges from it for no objective reason, (p. 11)

- *STAGE 3 (4 to 10 months)*. During this stage children begin to purposefully and repeatedly manipulate objects they encounter in their environment

(called *secondary circular reactions*). The child begins to reach for and grasp things, to shake them, bring them closer to look at them or place them in the mouth, and to acquire the ability of rapid eye movements to follow quickly moving or falling objects. Late in this stage, the first signs of object permanence appear. For example, children begin to search for objects that are obscured from view if a small part of the object is visible.

Observation 23. At 0;9 I offer Lucienne a celluloid goose which she has never seen before; she grasps it at once and examines it all over. I place the goose beside her and cover it before her eyes, sometimes completely, sometimes revealing the head. Two very distinct reactions. . . . When the goose disappears completely, Lucienne immediately stops searching even when she is on the point of grasping it. . . . When the beak protrudes, not only does she grasp the visible part and draw the animal to her, but . . . she sometimes raises the coverlet beforehand in order to grasp the whole thing! . . . Never, even after having raised the coverlet several times on seeing the beak appear, has Lucienne tried to raise it when the goose was completely hidden! Here . . . is proof of the fact that the reconstruction of a totality is much easier than the search for an invisible object, (pp. 29-30)

Still, however, Piaget maintains that the object concept is not fully formed. To the child at this stage, the object does not have an *independent* existence but is tied to the child's own actions and sensory perceptions. In other words, "It would be impossible to say that the half-hidden objective is conceived as being masked by a screen; it is simply perceived as being in the process of disappearing" (p. 35).

- *STAGE 4 (10 to 12 months)*. In the later weeks of stage 3 and early in stage 4, children have acquired the ability to know that objects continue to exist even when the objects are no longer visible. A child will search actively and creatively for an object that has been completely hidden from view. Although on the surface this may seem to indicate a fully developed object concept, Piaget found that this cognitive skill is still incomplete because the child lacks the ability to understand *visible displacements*. To understand what Piaget meant by this, consider the following example (you can try this yourself the next time you are a baby around 1 year old). If you sit with an 11-month-old and hide a toy completely under a towel (call this place A), the child will search for and find it. However, if you then hide the toy, as the child watches, under a blanket (place B), the child will probably go back to searching for it where it was previously found, in place A. Furthermore, you can repeat this process over and over and the child will continue to make the same error, which Piaget called the *A-not-B effect*.

Observation 40. At 0;10 Jacqueline is seated on a mattress . . . I take her parrot from her hands and hide it twice in succession under the mattress, on her left, in A. Both times Jacqueline looks for the object immediately and grabs it. Then I take it from her hands and move it very slowly before her eyes to the corresponding place on her right, under the mattress, in B. Jacqueline watches the movement very attentively, but at the moment

when the parrot disappears in B she turns to her left and looks where it was before, in A. (p. 51)

Piaget's interpretation of this error in stage 4 was not that children are absentminded but that the object concept is not the same for them as it is for you or me. To 10-month-old Jacqueline, her parrot is not a permanent, separate thing that exists independently of her actions. When it was hidden and then successfully found in A, it became a "parrot-in-A," a thing that was defined not only by its "parrotness" but also by its hiding place. In other words, the parrot is just a piece of the overall picture in the child's mind and not a separate object.

- *STAGE 5 (12 to 18 months)*. Beginning around the end of the first year of life, the child gains the ability to follow visible sequential displacements and searches for an object where it was last visibly hidden. When this happens, Piaget claimed that the child had entered stage 5 of the sensori-motor period.

Observation 54. Laurent, at 0;11, is seated between two cushions, A and B. I hide the watch alternately under each; Laurent constantly searches for the object where it has just disappeared, that is sometimes in A, sometimes in B, without remaining attached to a privileged position as during the preceding stage, (p. 67)

However, Piaget points out that true object permanence remains incomplete because the child is unable to understand what he called *invisible displacements*. Imagine the following example: You watch someone place a coin in a small box and then, with his or her back to you, the person walks over to the dresser and opens a drawer. When the person returns you discover that the box is empty. This is an invisible displacement of the object. Naturally, you would go to the dresser and look in the drawer. Piaget and Jacqueline demonstrated this as follows.

Observation 55. At 1;6 Jacqueline is sitting on a green rug and playing with a potato, which interests her very much (it is a new object for her). She . . . amuses herself by putting it into an empty box and taking it out again. I then take the potato and put it in the box while Jacqueline watches. Then I place the box under the rug and turn it upside down, thus leaving the object hidden by the rug without letting the child see my maneuver, and I bring out the empty box. I say to Jacqueline, who has not stopped looking at the rug and who realized that I was doing something under it: "Give Papa the potato." She searches for the object in the box, looks at me, again looks at the box minutely, looks at the rug, etc., but it does not occur to her to raise the rug in order to find the potato underneath. During the five subsequent attempts the reaction is uniformly negative, (p. 68)

- *STAGE 6 (18 to 24 months)*. As the child approaches the end of the sensori-motor period (refer back to Table 18-1), the concept of the permanent object becomes fully realized. Entry into this stage is determined by

the child's ability to represent mentally objects that undergo invisible displacements.

Observation 66. At 1;7 Jacqueline reveals herself to be ... capable of conceiving of the object under a series of superimposed or encasing screens. I put the pencil in the box, put a piece of paper around it, wrap this in a handkerchief, then cover the whole thing with the beret and the coverlet. Jacqueline removes these last two screens, then unfolds the handkerchief. She does not find the box right away, but continues looking for it, evidently convinced of its presence; she then perceives the paper, recognizes it immediately, unfolds it, opens the box, and grasps the pencil, (p. 81)

Piaget considered the cognitive skill of object permanence to be the beginning of true thought: the ability to use insight and mental symbolism to solve problems. This, then, prepares the child to move into the next full stage of cognitive development: the *preoperational period*, during which thought separates from action, allowing the speed of mental operations to increase greatly. In other words, object permanence is the foundation for all subsequent advances in intellectual ability. As Piaget stated:

The conservation of the object is, among other things, a function of its localization; that is, the child simultaneously learns that the object does not cease to exist when it disappears and he learns where it does go. This fact shows from the outset that the formation of the schema of the permanent object is closely related to the whole spatio-temporal and causal organization of the practical universe. (Piaget & Inhelder, 1969)

DISCUSSION

This method of exercises and observation of behavior formed the basis of Piaget's work throughout his formulation of all four stages of cognitive development. Piaget contended that all of his stages applied universally to all children, regardless of cultural or family background. In addition, he stressed several important aspects relating to the stages of development of the object concept during the sensori-motor period (see Ginzburg & Opper, 1979, for an elaboration of these points).

1. The ages associated with each stage are approximate. Because Piaget's early work only involved three children, it was difficult for him to predict age ranges with a great deal of confidence. For example, certain abilities he observed in Jacqueline at age 1;7 were present in Lucienne at 1;3.
2. Piaget maintained, however, that the sequence of the stages was invariant. All children must pass through each stage before going on to the next, and no stage can ever be skipped.
3. Changes from one stage to the next occur gradually over time so that the errors being made at one stage slowly begin to decrease as new intellectual abilities mature. Piaget believed that it is quite common and normal for children to be between stages and exhibiting abilities from earlier and later stages at the same time.

4. As a child moves into the next higher stage, the behaviors associated with the lower stages do not necessarily disappear completely. It would not be unusual for a child in stage 6 to apply intellectual strategies used in stage 5. Then when these prove unsuccessful, the child will invoke new methods for solving the problem typical of stage 6 reasoning.

CRITICISMS AND RECENT APPLICATIONS

Although Piaget's conceptualization of cognitive development dominated the field of developmental psychology for several decades, his view has certainly not been without critics. Some of them have questioned Piaget's basic notion that cognitive development happens in discrete stages. Many learning theorists have disagreed with Piaget on this issue and contend that intellectual development is continuous, without any particular sequence built into the process. They believe that cognitive abilities, like all other behaviors, are a result of modeling and a person's learning and conditioning history.

Other critics of Piaget's ideas have claimed that the age ranges at which he asserted specific abilities appear are incorrect, and some even argue that certain cognitive skills may already be present at birth. Object permanence is one of those abilities that has been drawn into question. In a series of ingenious studies using research techniques known as *preference looking* (see Reading 5 on Fantz's discovery of this research methodology), developmental psychologist Renee Baillargeon and her associates have demonstrated that infants as young as 2½ months of age appear to possess early forms of object permanence (Aguilar & Baillargeon, 1999; Baillargeon, 1987). She and others have asserted that Piaget's methods were inadequate to measure accurately the abilities of very young infants because they required motor skills that infants do not possess.

Piaget's concepts and discoveries have influenced research in a wide variety of fields. This is evidenced by the fact that more than 50 scientific articles each year cite the book by Piaget that forms the basis for this discussion. For example, one study compared 614-month-old infants' tendency to search for objects hidden by darkness to their tendency to search for objects hidden under a cloth in the light, as in Piaget's games with his children (Shinsky & Munakata, 2003). Interestingly, the researchers found that the infants were better at looking for objects in the dark compared to searching for them when the objects were covered by a cloth in the light. Why would this be true? One explanation may be that the appearance of the cloth interferes with the infants' new, fragile ability to represent the object mentally. An alternate explanation may be that our ability to think about, and search for, objects in (potentially dangerous) darkness was more adaptive from an evolutionary, survival perspective than doing so when items are merely hidden in the light.

Another fascinating study relating to Piaget's work found an association between infants' ability to differentiate among objects and their comprehension of the words for the objects (Rivera & Zawaydeh, 2007). Using preference-looking

techniques, this study revealed that infants at only 10 or 11 months of age were able to differentiate between objects only if they understood the words for both objects. The authors propose that 'These results suggest that comprehending the words for occluded/disoccluded [hidden and revealed] objects provides a kind of 'glue' which allows infants to bind the mental index of an object with its perceptual features (thus precipitating the formation of two mental indexes, rather than one)" (p. 146). That is, knowing the names for objects appears to help infants mentally store an image of an object as unique and recognizable in comparison with other objects.

An intriguing study citing Piaget's work on object permanence found an association between development of the object concept and sleep in 9-month-old infants (Scher, Amir, & Tirosh, 2000). These findings indicated that infants with a more advanced grasp of object permanence experienced significantly fewer sleep difficulties than those with lower levels of the object concept. This may make a certain intuitive sense, if you think about it. If you were not sure all your stuff would still exist in the morning, you probably wouldn't sleep very well either!

CONCLUSION

As methods have been refined for studying infants' cognitive abilities, such as preference-looking and habituation-dishabituation techniques, some of Piaget's discoveries are being drawn into question (for more information about these research methods, see Reading 5 on Fantz in this book; also, Craig & Dunn, 2007). In fact, numerous ongoing controversies surrounding Piaget's theory of cognitive development are swirling through the field of developmental psychology. Such controversy is healthy; it motivates discussion and research that will eventually lead to even greater understanding and knowledge about the sources and growth of human cognition.

Controversy notwithstanding, Piaget's theory remains the catalyst and foundation for all related research. His work continues to guide enlightened people's ideas about research with children, methods of education, and styles of parenting. Piaget's contribution was and is immeasurable.

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