

Cognitive Development: The Mind of Jean Piaget

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Jean Piaget

Jean Piaget was born in Neuchâtel, Switzerland, on August 9, 1896. His father, Arthur Piaget, was a professor of medieval literature with an interest in local history. His mother, Rebecca Jackson, was intelligent and energetic, but Jean found her a bit neurotic -- an impression that he said led to his interest in psychology, but away from pathology! The oldest child, he was quite independent and took an early interest in nature, especially the collecting of shells. He published his first "paper" when he was ten -- a one page account of his sighting of an albino sparrow.

He began publishing in earnest in high school on his favorite subject, mollusks. He was particularly pleased to get a part time job with the director of Neuchâtel's Museum of Natural History, Mr. Godel. His work became well known among European students of mollusks, who assumed he was an adult! All this early experience with science kept him away, he says, from "the demon of philosophy."

Later in adolescence, he faced a bit a crisis of faith: Encouraged by his mother to attend religious instruction, he found religious argument childish. Studying various philosophers and the application of logic, he dedicated himself to finding a "biological explanation of knowledge." Ultimately, philosophy failed to assist him in his search, so he turned to psychology.

After high school, he went on to the University of Neuchâtel. Constantly studying and writing, he became sickly, and had to retire to the mountains for a year to recuperate. When he returned to Neuchâtel, he decided he would write down his philosophy. A fundamental point became a centerpiece for his entire life's work: "In all fields of life (organic, mental, social) there exist 'totalities' qualitatively distinct from their parts and imposing on them an organization." This principle forms the basis of his structuralist philosophy, as it would for the Gestaltists, Systems Theorists, and many others.

In 1918, Piaget received his Doctorate in Science from the University of Neuchâtel. He worked for a year at psychology labs in Zurich and at Bleuler's famous psychiatric clinic. During this period, he was introduced to the works of Freud, Jung, and others. In 1919, he taught psychology and philosophy at the Sorbonne in Paris. Here he met Simon (of Simon-Binet fame) and did research on intelligence testing. He didn't care for the "right-or-wrong" style of the intelligent tests and started interviewing his subjects at a boys school instead, using the psychiatric interviewing techniques he had learned the year before. In other words, he began asking how children reasoned.

In 1921, his first article on the psychology of intelligence was published in the *Journal de Psychologie*. In the same year, he accepted a position at the Institut J. J. Rousseau in Geneva. Here he began with his students to research the reasoning of elementary school children.

This research became his first five books on child psychology. Although he considered this work highly preliminary, he was surprised by the strong positive public reaction to his work.

In 1923, he married one of his student coworkers, Valentine Châtenay. In 1925, their first daughter was born; in 1927, their second daughter was born; and in 1931, their only son was born. They immediately became the focus of intense observation by Piaget and his wife. This research became three more books!

In 1929, Piaget began work as the director of the International Bureau of Education, a post he

would hold until 1967. He also began large scale research with A. Szeminska, E. Meyer, and especially Bärbel Inhelder, who would become his major collaborator. Piaget, it should be noted, was particularly influential in bringing women into experimental psychology. Some of this work, however, wouldn't reach the world outside of Switzerland until World War II was over.

In 1940, He became chair of Experimental Psychology, the Director of the psychology laboratory, and the president of the Swiss Society of Psychology. In 1942, he gave a series of lectures at the Collège de France, during the Nazi occupation of France. These lectures became *The Psychology of Intelligence*. At the end of the war, he was named President of the Swiss Commission of UNESCO.

Also during this period, he received a number of honorary degrees. He received one from the Sorbonne in 1946, the University of Brussels and the University of Brazil in 1949, on top of an earlier one from Harvard in 1936. And, in 1949 and 1950, he published his synthesis,

Introduction to Genetic Epistemology.

In 1952, he became a professor at the Sorbonne. In 1955, he created the International Center for Genetic Epistemology, of which he served as director the rest of his life. And, in 1956, he created the School of Sciences at the University of Geneva.

He continued working on a general theory of structures and tying his psychological work to biology for many more years. Likewise, he continued his public service through UNESCO as a Swiss delegate. By the end of his career, he had written over 60 books and many hundreds of articles. He died in Geneva, September 16, 1980, one of the most significant psychologists of the twentieth century.

Theory

Jean Piaget began his career as a biologist -- specifically, a malacologist! But his interest in science and the history of science soon overtook his interest in snails and clams. As he delved deeper into the thought-processes of doing science, he became interested in the nature of thought itself, especially in the development of thinking. Finding relatively little work done in the area, he had the opportunity to give it a label. He called it genetic epistemology, meaning the study of the development of knowledge.

He noticed, for example, that even infants have certain skills in regard to objects in their environment. These skills were certainly simple ones, sensori-motor skills, but they directed the way in which the infant explored his or her environment and so how they gained more knowledge of the world and more sophisticated exploratory skills. These skills he called schemas.

For example, an infant knows how to grab his favorite rattle and thrust it into his mouth. He's got that schema down pat. When he comes across some other object -- say daddy's expensive watch, he easily learns to transfer his "grab and thrust" schema to the new object. This Piaget called assimilation, specifically assimilating a new object into an old schema.

When our infant comes across another object again -- say a beach ball -- he will try his old schema of grab and thrust. This of course works poorly with the new object. So the schema will adapt to the new object: Perhaps, in this example, "squeeze and drool" would be an appropriate title for the new schema. This is called accommodation, specifically accommodating an old schema to a new object.

Assimilation and accommodation are the two sides of adaptation, Piaget's term for what most of us would call learning. Piaget saw adaptation, however, as a good deal broader than the kind of learning that Behaviorists in the US were talking about. He saw it as a fundamentally biological process. Even one's grip has to accommodate to a stone, while clay is assimilated into our grip. All living things adapt, even without a nervous system or brain.

Assimilation and accommodation work like pendulum swings at advancing our understanding of the world and our competency in it.

According to Piaget, they are directed at a balance between the structure of the mind and the environment, at a certain congruency between the two, that would indicate that you have a good (or at least good-enough) model of the universe. This ideal state he calls equilibrium.

As he continued his investigation of children, he noted that there were periods where assimilation dominated, periods where accommodation dominated, and periods of relative equilibrium, and that these periods were similar among all the children he looked at in their nature and their timing. And so he developed the idea of stages of cognitive development. These constitute a lasting contribution to psychology.

The sensorimotor stage

The first stage, to which we have already referred, is the sensorimotor stage. It lasts from birth to about two years old. As the name implies, the infant uses senses and motor abilities to understand the world, beginning with reflexes and ending with complex combinations of sensorimotor skills.

Between one and four months, the child works on primary circular reactions -- just an action of his own which serves as a stimulus to which it responds with the same action, and around and around we go. For example, the baby may suck her thumb. That feels good, so she sucks some more... Or she may blow a bubble. That's interesting so I'll do it again....

Between four and 12 months, the infant turns to secondary circular reactions, which involve an act that extends out to the environment: She may squeeze a rubber duckie. It goes "quack." That's great, so do it again, and again, and again. She is learning "procedures that make interesting things last."

At this point, other things begin to show up as well. For example, babies become ticklish, although they must be aware that someone else is tickling them or it won't work. And they begin to develop object permanence. This is the ability to recognize that, just because you can't see something doesn't mean it's gone! Younger infants seem to function by an "out of sight, out of mind" schema. Older infants remember, and may even try to find things they can no longer see.

Between 12 months and 24 months, the child works on tertiary circular reactions. They consist of the same "making interesting things last" cycle, except with constant variation. I hit the drum with the stick -- rat-tat-tat-tat. I hit the block with the stick -- thump-thump. I hit the table with the stick -- clunk-clunk. I hit daddy with the stick -- ouch-ouch. This kind of active experimentation is best seen during feeding time, when discovering new and interesting ways of throwing your spoon, dish, and food.

Around one and a half, the child is clearly developing mental representation, that is, the ability to hold an image in their mind for a period beyond the immediate experience. For example, they can engage in deferred imitation, such as throwing a tantrum after seeing one an hour ago. They can use mental combinations to solve simple problems, such as putting down a toy in order to open a door. And they get good at pretending. Instead of using dollies essentially as something to sit at, suck on, or throw, now the child will sing to it, tuck it into bed, and so on.

Preoperational stage

The preoperational stage lasts from about two to about seven years old. Now that the child has mental representations and is able to pretend, it is a short step to the use of symbols.

A symbol is a thing that represents something else. A drawing, a written word, or a spoken word comes to be understood as representing a real dog. The use of language is, of course, the prime example, but another good example of symbol use is creative play, wherein checkers are cookies, papers are dishes, a box is the table, and so on. By manipulating symbols, we are essentially thinking, in a way the infant could not: in the absence of the actual objects involved!

Along with symbolization, there is a clear understanding of past and future. For example, if a child is crying for its mother, and you say "Mommy will be home soon," it will now tend to stop crying. Or if you ask him, "Remember when you fell down?" he will respond by making a sad face.

On the other hand, the child is quite egocentric during this stage, that is, he sees things pretty

much from one point of view: his own! She may hold up a picture so only she can see it and expect you to see it too. Or she may explain that grass grows so she won't get hurt when she falls.

Piaget did a study to investigate this phenomenon called the mountains study. He would put children in front of a simple plaster mountain range and seat himself to the side, then ask them to pick from four pictures the view that he, Piaget, would see. Younger children would pick the picture of the view they themselves saw; older kids picked correctly.

Similarly, younger children center on one aspect of any problem or communication at a time. For example, they may not understand you when you tell them "Your father is my husband." Or they may say things like "I don't live in the USA; I live in Pennsylvania!" Or, if you show them five black and three white marbles and ask them "Are there more marbles or more black marbles?" they will respond "More black ones!"

Perhaps the most famous example of the preoperational child's centrism is what Piaget refers to as their inability to conserve liquid volume. If I give a three year old some chocolate milk in a tall skinny glass, and I give myself a whole lot more in a short fat glass, she will tend to focus on only one of the dimensions of the glass. Since the milk in the tall skinny glass goes up much higher, she is likely to assume that there is more milk in that one than in the short fat glass, even though there is far more in the latter. It is the development of the child's ability to decenter that marks him as having moved to the next stage.

Concrete operations stage

The concrete operations stage lasts from about seven to about 11. The word operations refers to logical operations or principles we use when solving problems. In this stage, the child not only uses symbols representationally, but can manipulate those symbols logically. Quite an accomplishment! But, at this point, they must still perform these operations within the context of concrete situations.

The stage begins with progressive decentering. By six or seven, most children develop the ability to conserve number, length, and liquid volume. Conservation refers to the idea that a quantity remains the same despite changes in appearance. If you show a child four marbles in a row, then spread them out, the preoperational child will focus on the spread, and tend to believe that there are now more marbles than before.

Or if you have two five inch sticks laid parallel to each other, then move one of them a little, she may believe that the moved stick is now longer than the other.

The concrete operations child, on the other hand, will know that there are still four marbles, and that the stick doesn't change length even though it now extends beyond the other. And he will know that you have to look at more than just the height of the milk in the glass: If you pour the milk

from the short, fat glass into the tall, skinny glass, he will tell you that there is the same amount of milk as before, despite the dramatic increase in mild-level!

By seven or eight years old, children develop conservation of substance: If I take a ball of clay and roll it into a long thin rod, or even split it into ten little pieces, the child knows that there is still the same amount of clay. And he will know that, if you rolled it all back into a single ball, it would look quite the same as it did -- a feature known as reversibility.

By nine or ten, the last of the conservation tests is mastered: conservation of area. If you take four one-inch square pieces of felt, and lay them on a six-by-six cloth together in the center, the child who conserves will know that they take up just as much room as the same squares spread out in the corners, or, for that matter, anywhere at all.

If all this sounds too easy to be such a big deal, test your friends on conservation of mass: Which is heavier: a million tons of lead, or a million tons of feathers?

In addition, a child learns classification and seriation during this stage. Classification refers back to the question of whether there are more marbles or more black marbles? Now the child begins to get the idea that one set can include another. Seriation is putting things in order. The younger child may start putting things in order by, say size, but will quickly lose track. Now the child has no problem with such a task. Since arithmetic is essentially nothing more than classification and seriation, the child is now ready for some formal education!

Formal operations stage

But the concrete operations child has a hard time applying his new-found logical abilities to non-concrete -- i.e. abstract -- events. If mom says to junior "You shouldn't make fun of that boy's nose. How would you feel if someone did that to you? he is likely to respond "I don't have a big nose!" Even this simple lesson may well be too abstract, too hypothetical, for his kind of thinking.

Don't judge the concrete operations child too harshly, though. Even adults are often taken-aback when we present them with something hypothetical: "If Edith has a lighter complexion than Susan, and Edith is darker than Lily, who is the darkest? Most people need a moment or two.

From around 12 on, we enter the formal operations stage. Here we become increasingly competent at adult-style thinking. This involves using logical operations, and using them in the abstract, rather than the concrete. We often call this hypothetical thinking.

Here's a simple example of a task that a concrete operations child couldn't do, but which a formal operations teenager or adult could -- with a little time and effort. Consider this rule about a set of cards that have letters on one side and numbers on the other: "If a card has a vowel on one side,

then it has an even number on the other side." Take a look at the cards below and tell me, which cards do I need to turn over to tell if this rule is actually true? You'll find the answer at the end of this chapter.

It is the formal operations stage that allows one to investigate a problem in a careful and systematic fashion. Ask a 16 year old to tell you the rules for making pendulums swing quickly or slowly, and he may proceed like this:

A long string with a light weight -- let's see how fast that swings.

A long string with a heavy weight -- let's try that.

Now, a short string with a light weight.

And finally, a short string with a heavy weight.

His experiment -- and it is an experiment -- would tell him that a short string leads to a fast swing, and a long string to a slow swing, and that the weight of the pendulum means nothing at all!

The teenager has learned to group possibilities in four different ways:

By conjunction: "Both A and B make a difference" (e.g. both the string's length and the pendulum's weight).

By disjunction: "It's either this or that" (e.g. it's either the length or the weight).

By implication: "If it's this, then that will happen" (the formation of a hypothesis).

By incompatibility: "When this happens, that doesn't" (the elimination of a hypothesis).

On top of that, he can operate on the operations -- a higher level of grouping. If you have a proposition, such as "it could be the string or the weight," you can do four things with it:

Identity: Leave it alone. "It could be the string or the weight."

Negation: Negate the components and replace or's with and's (and vice versa). "It might not be the string and not the weight, either."

Reciprocity: Negate the components but keep the and's and or's as they are. "Either it is not the weight or it is not the string."

Correlativity: Keep the components as they are, but replace or's with and's, etc. "It's the weight and the string."

Someone who has developed his or her formal operations will understand that the correlate of a reciprocal is a negation, that a reciprocal of a negation is a correlate, that the negation of a correlate is a reciprocal, and that the negation of a reciprocal of a correlate is an identity (pew!!!).

Maybe it has already occurred to you: It doesn't seem that the formal operations stage is something everyone actually gets to. Even those of us who do don't operate in it at all times. Even some cultures, it seems, don't develop it or value it like ours does. Abstract reasoning is simply not

universal.

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