Piaget's theory of cognitive development is a comprehensive theory about the nature and development of human intelligence. It was first developed by a Swiss developmental psychologist, Jean Piaget (1896–1980). Piaget believed that one's childhood plays a vital and active role to the growth of intelligence, and that the child learns through doing and actively exploring. The theory of intellectual development focuses on perception, adaptation and manipulation of the environment around them. It is primarily known as a developmental stage theory, but, in fact, it deals with the nature of knowledge itself and how humans come gradually to acquire, construct, and use it. To Piaget, cognitive development was a progressive reorganization of mental processes resulting from biological maturation and environmental experience. Accordingly, he believed that children construct an understanding of the world around them, then experience discrepancies between what they already know and what they discover in their environment. Moreover, Piaget claimed that cognitive development is at the center of the human organism, and language is contingent on knowledge and understanding acquired through cognitive development. Piaget’s earlier work received the greatest attention. Many parents have been encouraged to provide a rich, supportive environment for their child’s natural propensity to grow and learn. Child-centered classrooms and "open education" are direct applications of Piaget's views. Despite its huge success, Piaget’s theory has some limitations like any others, for example, a decalage that Piaget recognized himself. Below is a short description of Piaget's views about the nature of intelligence, followed by a description of the stages through which it develops until maturity.

Nature of intelligence: operative and figurative

Piaget noted that reality is a dynamic system of continuous change and, as such, is defined in reference to the two conditions that define dynamic systems. Specifically, he argued that reality involves transformations and states. Transformations refer to all manners of changes that a thing or person can undergo. States refer to the conditions or the appearances in which things or persons can be found between transformations. For example, there might be changes in shape or form (for instance, liquids are reshaped as they are transferred from one vessel to another, and similarly humans change in their characteristics as they grow older), in size (for example, a series of coins on a table might be placed close to each other or far apart), or in placement or location in space and time (e.g., various objects or persons might be found at one place at one time and at a different place at another time). Thus, Piaget argued, if human intelligence is to be adaptive, it must have functions to represent both the transformational and the static aspects of reality. He proposed that operative intelligence is responsible for the representation and manipulation of the dynamic or transformational aspects of reality, and that figurative intelligence is responsible for the representation of the static aspects of reality.

Operative intelligence is the active aspect of intelligence. It involves all actions, overt or covert, undertaken in order to follow, recover, or anticipate the transformations of the objects or persons of interest. Figurative intelligence is the more or less static aspect of intelligence, involving all means of representation used to retain in mind the states (i.e., successive forms, shapes, or locations) that intervene between transformations. That is, it involves perception, imitation, mental imagery, drawing, and language. Therefore, the figurative aspects of intelligence derive their meaning from the operative aspects of intelligence, because states cannot exist independently of the transformations that interconnect them. Piaget stated that the figurative or the representational aspects of intelligence are subservient to its operative and dynamic aspects, and therefore, that understanding essentially derives from the operative aspect of intelligence.

At any time, operative intelligence frames how the world is understood and it changes if understanding is not successful. Piaget stated that this process of understanding and change involves two basic functions: assimilation and accommodation.

Assimilation and accommodation

Through his study of the field of education, Piaget focused on two processes, which he named assimilation and accommodation. To Piaget,
assimilation meant integrating external elements into structures of lives or environments, or those we could have through experience. Assimilation is how humans perceive and adapt to new information. It is the process of fitting new information into pre-existing cognitive schemas. Assimilation in which new experiences are reinterpreted to fit into, or assimilate with, old idea. It occurs when humans are faced with new or unfamiliar information and refer to previously learned information in order to make sense of it. In contrast, accommodation is the process of taking new information in one’s environment and altering pre-existing schemas in order to fit in the new information. This happens when the existing schema (knowledge) does not work, and needs to be changed to deal with a new object or situation. Accommodation is imperative because it is how people will continue to interpret new concepts, schemas, frameworks, and more. Piaget believed that the human brain has been programmed through evolution to bring equilibrium, which is what he believed ultimately influences structures by the internal and external processes through assimilation and accommodation.

Piaget’s understanding was that assimilation and accommodation cannot exist without the other. They are two sides of a coin. To assimilate an object into an existing mental schema, one first needs to take into account or accommodate to the particularities of this object to a certain extent. For instance, to recognize (assimilate) an apple as an apple, one must first focus (accommodate) on the contour of this object. To do this, one needs to roughly recognize the size of the object. Development increases the balance, or equilibration, between these two functions. When in balance with each other, assimilation and accommodation generate mental schemas of the operative intelligence. When one function dominates over the other, they generate representations which belong to figurative intelligence.

**Sensorimotor stage**

Cognitive development is Jean Piaget’s theory. Through a series of stages, Piaget proposed four stages of cognitive development: the sensorimotor, preoperational, concrete operational and formal operational period. The sensorimotor stage is the first of the four stages in cognitive development which "extends from birth to the acquisition of language". In this stage, infants progressively construct knowledge and understanding of the world by coordinating experiences (such as vision and hearing) with physical interactions with objects (such as grasping, sucking, and stepping). Infants gain knowledge of the world from the physical actions they perform within it. They progress from reflexive, instinctual action at birth to the beginning of symbolic thought toward the end of the stage.

Children learn that they are separated from the environment. They have aspect of environment, even though they may be outside the reach of a child’s senses. In this stage, according to Piaget, the development of object permanence is one of the most important accomplishments. Object permanence is a child’s understanding that objects continue to exist even though he or she cannot be seen or heard. Peek-a-boo is a good test for that. By the end of the sensorimotor period, children develop a permanent sense of self and object.

Piaget divided the sensorimotor stage into six sub-stages.

<table>
<thead>
<tr>
<th>Sub-Stage</th>
<th>Age</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>1 Simple Reflexes</strong></td>
<td>Birth-6 weeks</td>
<td>&quot;Coordination of sensation and action through reflexive behaviors.&quot; Three primary reflexes are described by Piaget: sucking of objects in the mouth, following moving or interesting objects with the eyes, and closing of the hand when an object makes contact with the palm (palmar grasp). Over the first six weeks of life, these reflexes begin to become voluntary actions. For example, the palmar reflex becomes intentional grasping.</td>
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<tr>
<td><strong>2 First habits and primary circular reactions phase</strong></td>
<td>6 weeks-4 months</td>
<td>&quot;Coordination of sensation and two types of schema: habits (reflex) and primary circular reactions (reproduction of an event that initially occurred by chance). The main focus is still on the infant’s body. As an example of this type of reaction, an infant might repeat the motion of passing their hand before their face. Also at this phase, passive reactions, caused by classical or operant conditioning, can begin.</td>
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<tr>
<td><strong>3 Secondary circular reactions phase</strong></td>
<td>4–8 months</td>
<td>Development of habits. &quot;Infants become more object-oriented, moving beyond self-preoccupation; repeat actions that bring interesting or pleasurable results.&quot; This stage is associated primarily with the development of coordination between vision and prehension. Three new abilities occur at this stage: intentional grasping for a desired object, secondary circular reactions, and differentiations between ends and means. At this stage, infants will intentionally grasp the air in the direction of a desired object, often to the amusement of friends and family. Secondary circular reactions, or the repetition of an action involving an external object begin; for example, moving a switch to turn on a light repeatedly. The differentiation between means and ends also occurs. This is perhaps one of the most important stages of a child’s growth as it signifies the dawn of logic.</td>
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<tr>
<td><strong>4 Coordination of secondary circular reactions</strong></td>
<td>8–12 months</td>
<td>&quot;Coordination of vision and touch—hand-eye coordination; coordination of schemas and intentionality.&quot; This stage is associated primarily with the development of logic and the coordination between means and ends. This is an extremely important stage of development, holding what Piaget calls the &quot;first proper intelligence.&quot; Also, this stage...</td>
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stages | marks the beginning of goal orientation, the deliberate planning of steps to meet an objective.[27]
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5 Tertiary circular reactions, novelty, and curiosity | 12–18 months |
"Infants become intrigued by the many properties of objects and by the many things they can make happen to objects; they experiment with new behavior".[26] This stage is associated primarily with the discovery of new means to meet goals. Piaget describes the child at this juncture as the "young scientist," conducting pseudo-experiments to discover new methods of meeting challenges.[27]
6 Internalization of Schemas | 18–24 months |
"Infants develop the ability to use primitive symbols and form enduring mental representations".[26] This stage is associated primarily with the beginnings of insight, or true creativity. This marks the passage into the preoperational stage.

Pre-operational stage

Piaget's second stage, the pre-operational stage, starts when the child begins to learn to speak at age two and lasts up until the age of seven. During the Pre-operational Stage of cognitive development, Piaget noted that children do not yet understand concrete logic and cannot mentally manipulate information.[28] Children's increase in playing and pretending takes place in this stage. However, the child still has trouble seeing things from different points of view. The children's play is mainly categorized by symbolic play and manipulating symbols. Such play is demonstrated by the idea of checkers being snacks, pieces of paper being plates, and a box being a table. Their observations of symbols exemplifies the idea of play with the absence of the actual objects involved. By observing sequences of play, Piaget was able to demonstrate that, towards the end of the second year, a qualitatively new kind of psychological functioning occurs, known as the Pre-operational Stage.[29][30]

The pre-operational stage is sparse and logically inadequate in regard to mental operations. The child is able to form stable concepts as well as magical beliefs. The child, however, is still not able to perform operations, which are tasks that the child can do mentally, rather than physically. Thinking in this stage is still egocentric, meaning the child has difficulty seeing the viewpoint of others. The Pre-operational Stage is split into two substages: the symbolic function substage, and the intuitive thought substage. The symbolic function substage is when children are able to understand, represent, remember, and picture objects in their mind without having the object in front of them. The intuitive thought substage is when children tend to propose the questions of "why?" and "how come?" This stage is when children want the knowledge of knowing everything.[30]

Symbolic function substage

At about two to four years of age, children cannot yet manipulate and transform information in a logical way. However, they now can think in images and symbols. Other examples of mental abilities are language and pretend play. Symbolic play is when children develop imaginary friends or role-play with friends. Children's play becomes more social and they assign roles to each other. Some examples of symbolic play include playing house, or having a tea party. Interestingly, the type of symbolic play in which children engage is connected with their level of creativity and ability to connect with others.[31] Additionally, the quality of their symbolic play can have consequences on their later development. For example, young children whose symbolic play is of a violent nature tend to exhibit less prosocial behavior and are more likely to display antisocial tendencies in later years.[32]

In this stage, there are still limitations, such as egocentrism and precausal thinking.

Egocentrism occurs when a child is unable to distinguish between their own perspective and that of another person. Children tend to stick to their own viewpoint, rather than consider the view of others. Indeed, they are not even aware that such a concept as "different viewpoints" exists.[33] Egocentrism can be seen in an experiment performed by Piaget and Swiss developmental psychologist Bärbel Inhelder, known as the three-mountain problem. In this experiment, three views of a mountain are shown to the child, who is asked what a traveling doll would see at the various angles. The child will consistently describe what they can see from the position from which they are seated, regardless of from what angle they are asked to take the doll's perspective. Egocentrism would also cause a child to believe, "I like Sesame Street, so Daddy must like Sesame Street, too".

Similar to preoperational children's egocentric thinking is their structuring of a cause and effect relationships. Piaget coined the term
Concrete operational stage

An additional difficulty that children in the preoperational stage face is understanding the concept of conservation. Conservation is the understanding that a substance's properties remain constant, even when it is transformed or manipulated. Children in this stage often struggle with the idea that the amount of liquid in a container does not change simply because it is poured from one container to another. For example, if two identical beakers containing the same amount of liquid are placed in front of a child, and one of the beakers is poured into a taller and thinner container, children who are younger than seven or eight years old typically say that the two beakers no longer contain the same amount of liquid, and that the taller container holds the larger quantity (centration), without taking into consideration the fact that both beakers were previously noted to contain the same amount of liquid. Due to superficial changes, the child was unable to comprehend that the properties of the substances continued to remain the same (conservation).

Irreversibility is a concept developed in this stage which is closely related to the ideas of centration and conservation. Irreversibility refers to when children are unable to mentally reverse a sequence of events. In the same beaker situation, the child does not realize that, if the sequence of events was reversed and the water from the tall beaker was poured back into its original beaker, then the same amount of water would exist. Another example of children's reliance on visual representations is their misunderstanding of "less than" or "more than". When two rows containing equal amounts of blocks are placed in front of a child, one row spread farther apart than the other, the child will think that the row spread farther contains more blocks. Unlike deductive or inductive reasoning (general to specific, or specific to general), transductive reasoning refers to when a child reasons from specific to specific, drawing a relationship between two separate events that are otherwise unrelated. For example, if a child hears the dog bark and then a balloon popped, the child would conclude that because the dog barked, the balloon popped.

Intuitive thought substage

At between about the ages of 4 and 7, children tend to become very curious and ask many questions, beginning the use of primitive reasoning. There is an emergence in the interest of reasoning and wanting to know why things are the way they are. Piaget called it the "intuitive substage" because children realize they have a vast amount of knowledge, but they are unaware of how they acquired it. Centration, conservation, irreversibility, class inclusion, and transitive inference are all characteristics of preoperative thought. Centration is the act of focusing all attention on one characteristic or dimension of a situation, whilst disregarding all others. Conservation is the awareness that altering a substance's appearance does not change its basic properties. Children at this stage are unaware of conservation and exhibit centration. Both centration and conservation can be more easily understood once familiarized with Piaget's most famous experimental task.

In this task, a child is presented with two identical beakers containing the same amount of liquid. The child usually notes that the beakers do contain the same amount of liquid. When one of the beakers is poured into a taller and thinner container, children who are younger than seven or eight years old typically say that the two beakers no longer contain the same amount of liquid, and that the taller container holds the larger quantity (centration), without taking into consideration the fact that both beakers were previously noted to contain the same amount of liquid. Due to superficial changes, the child was unable to comprehend that the properties of the substances continued to remain the same (conservation).

Class inclusion refers to a kind of conceptual thinking that children in the preoperational stage cannot yet grasp. Children's inability to focus on two aspects of a situation at once inhibits them from understanding the principle that one category or class can contain several different subcategories or classes. For example, a four-year-old girl may be shown a picture of eight dogs and three cats. The girl knows what cats and dogs are, and she is aware that they are both animals. However, when asked, “Are there more dogs or animals?” she is likely to answer “more dogs”. This is due to her difficulty focusing on the two subclasses and the larger class all at the same time. She may have been able to view the dogs as dogs or animals, but struggled when trying to classify them as both, simultaneously. Similar to this is concept relating to intuitive thought, known as "transitive inference".

Transitive inference is using previous knowledge to determine the missing piece, using basic logic. Children in the preoperational stage lack this logic. An example of transitive inference would be when a child is presented with the information "A" is greater than "B" and "B" is greater than "C". This child may have difficulty here understanding that "A" is also greater than "C".

Concrete operational stage
The **concrete operational stage** is the third stage of Piaget's theory of cognitive development. This stage, which follows the preoperational stage, occurs between the ages of 7 and 11 (preadolescence) years, and is characterized by the appropriate use of logic. During this stage, a child's thought processes become more mature and "adult like". They start solving problems in a more logical fashion. Abstract, hypothetical thinking is not yet developed in the child, and children can only solve problems that apply to concrete events or objects. At this stage, the children undergo a transition where the child learns rules such as conservation. Piaget determined that children are able to incorporate inductive reasoning. Inductive reasoning involves drawing inferences from observations in order to make a generalization. In contrast, children struggle with deductive reasoning, which involves using a generalized principle in order to try to predict the outcome of an event. Children in this stage commonly experience difficulties with figuring out logic in their heads. For example, a child will understand that "A is more than B" and "B is more than C". However, when asked "is A more than C?", the child might not be able to logically figure the question out in their heads.

Two other important processes in the concrete operational stage are logic and the elimination of egocentrism.

Egocentrism is the inability to consider or understand a perspective other than one's own. It is the phase where the thought and morality of the child is completely self focused. During this stage, the child acquires the ability to view things from another individual's perspective, even if they think that perspective is incorrect. For instance, show a child a comic in which Jane puts a doll under a box, leaves the room, and then Melissa moves the doll to a drawer, and Jane comes back. A child in the concrete operations stage will say that Jane will still think it's under the box even though the child knows it is in the drawer. (See also False-belief task.)

Piaget determined that children in the concrete operational stage were able to incorporate inductive logic. On the other hand, children at this age have difficulty using deductive logic, which involves using a general principle to predict the outcome of an event. This includes mental reversibility. An example of this is being able to reverse the order of relationships between mental categories. For example, a child might be able to recognize that his or her dog is a Labrador, that a Labrador is a dog, and that a dog is an animal, and draw conclusions from the information available, as well as apply all these processes to hypothetical situations.

The abstract quality of the adolescent's thought at the formal operational level is evident in the adolescent's verbal problem solving ability. The logical quality of the adolescent's thought is when children are more likely to solve problems in a trial-and-error fashion. Adolescents begin to think more as a scientist thinks, devising plans to solve problems and systematically test opinions. They use hypothetical-deductive reasoning, which means that they develop hypotheses or best guesses, and systematically deduce, or conclude, which is the best path to follow in solving the problem. During this stage the adolescent is able to understand love, logical proofs and values. During this stage the young person begins to entertain possibilities for the future and is fascinated with what they can be.

Adolescents also are changing cognitively by the way that they think about social matters. Adolescent egocentrism governs the way that adolescents think about social matters, and is the heightened self-consciousness in them as they are, which is reflected in their sense of personal uniqueness and invincibility. Adolescent egocentrism can be dissected into two types of social thinking, imaginary audience that involves attention-getting behavior, and personal fable, which involves an adolescent's sense of personal uniqueness and invincibility. These two types of social thinking begin to affect a child's egocentrism in the concrete stage. However, it carries over to the formal operational stage when they are then faced with abstract thought and fully logical thinking.

**Testing for concrete operations**

Piagetian tests are well known and practised to test for concrete operations. The most prevalent tests are those for conservation. There are some important aspects that the experimenter must take into account when performing experiments with these children.

One example of an experiment for testing conservation is an experimenter will have two glasses that are the same size, fill them to the same level with liquid, which the child will acknowledge is the same. Then, the experimenter will pour the liquid from one of the small glasses into a tall, thin glass. The experimenter will then ask the child if the taller glass has more liquid, less liquid, or the same amount of liquid. The child
will then give his answer. The experimenter will ask the child why he gave his answer, or why he thinks that is.

- **Justification**: After the child has answered the question being posed, the experimenter must ask why the child gave that answer. This is important because the answers they give can help the experimenter to assess the child's developmental age.\[43\]

- **Number of times asking**: Some argue that if a child is asked if the amount of liquid in the first set of glasses is equal then, after pouring the water into the taller glass, the experimenter asks again about the amount of liquid, the children will start to doubt their original answer. They may start to think that the original levels were not equal, which will influence their second answer.\[44\]

- **Word Choice**: The phrasing that the experimenter uses may affect how the child answers. If, in the liquid and glass example, the experimenter asks, "Which of these glasses has more liquid?", the child may think that his thoughts of them being the same is wrong because the adult is saying that one must have more. Alternatively, if the experimenter asks, "Are these equal?", then the child is more likely to say that they are, because the experimenter is implying that they are.

### Formal operational stage

The final stage is known as the **formal operational stage** (adolescence and into adulthood, roughly ages 11 to approximately 15-20):

Intelligence is demonstrated through the logical use of symbols related to abstract concepts. This form of thought includes "assumptions that have no necessary relation to reality."\[45\] At this point, the person is capable of hypothetical and deductive reasoning. During this time, people develop the ability to think about abstract concepts.

Piaget stated that "hypothetico-deductive reasoning" becomes important during the formal operational stage. This type of thinking involves hypothetical "what-if" situations that are not always rooted in reality. It is often required in science and mathematics.

- **Abstract thought** emerges during the formal operational stage. Children tend to think very concretely and specifically in earlier stages, and begin to consider possible outcomes and consequences of actions.

- **Metacognition**, the capacity for "thinking about thinking" that allows adolescents and adults to reason about their thought processes and monitor them.\[46\]

- **Problem-solving** is demonstrated when children use trial-and-error to solve problems. The ability to systematically solve a problem in a logical and methodical way emerges.

While children in primary school years mostly used **inductive reasoning**, drawing general conclusions from personal experiences and specific facts, adolescents become capable of **deductive reasoning**, in which they draw specific conclusions from abstract concepts using logic. This capability results from their capacity to think hypothetically.\[47\]

"However, research has shown that not all persons in all cultures reach formal operations, and most people do not use formal operations in all aspects of their lives."\[48\]

### Experiments

Piaget and his colleagues conducted several experiments to assess formal operational thought.\[49\]

In one of the experiments, Piaget evaluated the cognitive capabilities of children of different ages through the use of a scale and varying weights. The task was to balance the scale by hooking weights on the ends of the scale. To successfully complete the task, the children must use formal operational thought to realize that the distance of the weights from the center and the heaviness of the weights both affected the balance. A heavier weight has to be placed closer to the center of the scale, and a lighter weight has to be placed farther from the center, so that the two weights balance each other.\[47\] While 3- to 5-year olds could not at all comprehend the concept of balancing, children by the age of 7 could balance the scale by placing the same weights on both ends, but they failed to realize that the importance of the location. By age 10, children could think about location but failed to use logic and instead used trial-and-error. Finally, by age 13 and 14, in early adolescence, some children more clearly understood the relationship between weight and distance and could successfully implement their hypothesis.\[50\]

### The stages and causation
However, by the time of Piaget's death in 1980, this notion had lost favor. One main problem was over the 

RNA concentrations had, indeed, been shown to correlate with learning, so the idea was quite plausible.

In 1967, Piaget considered the possibility of 

Postulated physical mechanisms underlying schemas and stages

In 1967, Piaget considered the possibility of RNA molecules as likely embodiments of his still-abstract schemas (which he promoted as units of action)—though he did not come to any firm conclusion. At that time, due to work such as that of Swedish biochemist Holger Hydén, RNA concentrations had, indeed, been shown to correlate with learning, so the idea was quite plausible.

However, by the time of Piaget's death in 1980, this notion had lost favor. One main problem was over the protein which, it was assumed,
such RNA would necessarily produce, and that did not fit in with observation. It was determined that only about 3% of RNA does code for protein. Hence, most of the remaining 97% (the "ncRNA") could theoretically be available to serve as Piagetian schemas (or other regulatory roles now under investigation). The issue has not yet been resolved experimentally, but its theoretical aspects were reviewed in 2008 — then developed further from the viewpoints of biophysics and epistemology. Meanwhile, this RNA-based approach also unexpectedly offered explanations for various other bio-mysteries, thus providing some measure of corroboration.

Relation to psychometric theories of intelligence

Piaget designed a number of tasks to verify hypotheses arising from his theory. The tasks were not intended to measure individual differences, and they have no equivalent in psychometric intelligence tests. Notwithstanding the different research traditions in which psychometric tests and Piagetian tasks were developed, the correlations between the two types of measures have been found to be consistently positive and generally moderate in magnitude. A common general factor underlies them. It has been shown that it is possible to construct a battery consisting of Piagetian tasks that is as good a measure of general intelligence as standard IQ tests.

Challenges to Piagetian Stage Theory

Piaget's theory is "domain general," predicting that cognitive maturation occurs concurrently across different domains of knowledge (such as mathematics, logic, and understanding of physics or language). Piaget did not take into account variability in a child's performance notably how a child can differ in sophistication across several domains.

More recently, research that was not available to Piaget when he was constructing his theory. One important finding is that domain-specific knowledge is constructed as children develop and integrate knowledge. This enables the domain to improve the accuracy of the knowledge as well as organization of memories. However, this suggests more of a "smooth integration" of learning and development than either Piaget, or his neo-nativist critics, had envisioned. Additionally, some psychologists, such as Lev Vygotsky and Jerome Bruner, thought differently from Piaget, suggesting that language was more important for cognition development than Piaget implied.

Post-Piagetian and Neo-Piagetian Stages

Main article: Neo-Piagetian theories of cognitive development
In recent years, several theorists attempted to address concerns with Piaget's theory by developing new theories and models that can accommodate evidence which violates Piagetian predictions and postulates.

- **The neo-Piagetian theories of cognitive development**, advanced by Robbie Case, Andreas Demetriou, Graeme S. Halford, Kurt W. Fischer, Michael Lamport Commons, and Juan Pascual-Leone, attempted to integrate Piaget's theory with cognitive and differential theories of cognitive organization and development. Their aim was to better account for the cognitive factors of development and for intra-individual and inter-individual differences in cognitive development. They suggested that development along Piaget’s stages is due to increasing working memory capacity and processing efficiency by “biological maturation”. Moreover, Demetriou’s theory ascribes an important role to hypercognitive processes of “self-monitoring, self-recording, self-evaluation, and self-regulation”, and it recognizes the operation of several relatively autonomous domains of thought (Demetriou, 1998; Demetriou, Mouyi, Spanoudis, 2010; Demetriou, 2003, p. 153).

- Piaget’s theory stops at the formal operational stage, but other researchers have observed the thinking of adults is more nuanced than formal operational thought. This fifth stage has been named postformal thought or operation. Postformal stages have been proposed. Michael Commons presented evidence for four postformal stages: systematic, metasystematic, paradigmatic, and cross-paradigmatic (Commons & Richards, 2003, p. 206-208; Oliver, 2004, p. 31). There are many theorists, however, who have criticized "postformal thinking," because the concept lacks both theoretical and empirical verification. The term "integrative thinking" has been suggested for use instead.

- A "sentential" stage, said to occur before the early preoperational stage, has been proposed by Fischer, Biggs and Biggs, Commons, and Richards.

- Searching for a micro-physiological basis for human mental capacity, Traill (1978, Section C5.4; 1999, Section 8.4) proposed that there may be "pre-sensorimotor" stages ("M<sup>-1</sup> L", "M<sup>-2</sup> L", ...), which are developed in the womb and/or transmitted genetically.

- Jerome Bruner has expressed views on cognitive development in a “pragmatic orientation” in which humans actively use knowledge for practical applications, such as problem solving and understanding reality.

- Michael Lamport Commons proposed the model of hierarchical complexity (MHC) in two ways: “Horizontal Complexity” and “Vertical Complexity” (Commons & Richards, 2003, p. 205).

- Kieran Egan has proposed five stages of understanding: “somatic”, “mythic”, “romantic”, “philosophic”, and “ironic”, which is developed through cognitive tools such as “stories”, “binary oppositions”, “fantasy” and “rhyme, rhythm, and meter” to enhance memorization to develop a long-lasting learning capacity.


- Andreas Demetriou has expressed Neo-Piagetian theories of cognitive development.

- Jane Loevinger’s stages of ego development occur through “an evolution of stages”. First is the Presocial Stage followed by the Symbiotic Stage, Impulsive Stage, Self-Protective Stage, Conformist Stage, Self-Aware Level: Transition from Conformist to Conscientious Stage, Individualistic Level: Transition from Conscientious to the Autonomous Stage, Conformist Stage, and Integrated Stage.

- Ken Wilber has incorporated Piaget’s theory in his multidisciplinary field of Integral Theory. The human consciousness is structured in hierarchical order and organized in “holon” chains or “Great Chain of Being”, which are based on the level of spiritual and psychological...
The process of initiation is a modification of Piaget’s theory integrating Abraham Maslow’s concept of self-actualization.


Christopher R. Hallpike proposed that human evolution of cognitive moral understanding had evolved from the beginning of time from its primitive state to the present time.

See also

- Ontogeny recapitulates phylogeny

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External links

- Piaget's Theory of Cognitive Development
- Cognitive development of a child
- Only one-third of adults can reason formally