Piaget’s Theory of Cognitive Development

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Piaget's theory of cognitive development is a comprehensive theory about the nature and development of human intelligence first developed by Jean Piaget. 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 it, construct it, and use it. Moreover, Piaget claims the idea that cognitive development is at the centre of human organism and language is contingent on cognitive development. Below, there is first a short description of Piaget's views about the nature of intelligence and then a description of the stages through which it develops until maturity.

The Nature of Intelligence: Operative and Figurative Intelligence

Piaget believed that reality is a dynamic system of continuous change, and as such is defined in reference to the two conditions that define dynamic systems that change. 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, humans change in their characteristics as they grow older), in size (e.g., a series of coins on a table might be placed close to each other or far apart) 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, that 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 believed 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 believed that this process of understanding and change involves two basic functions: Assimilation and accommodation.

Assimilation and Accommodation

Through studying the field of education Piaget focused on accommodation and assimilation. Assimilation, one of two processes coined by Jean Piaget, describes how humans perceive and adapt to new information. It is the process of taking one's environment and new information and fitting it into pre-existing cognitive schemas. Assimilation occurs when humans are faced with new or unfamiliar information and refer to previously learned information in order to make sense of it. Accommodation, unlike assimilation is the process of taking one's environment and new information, and altering one's pre-existing schemas in order to fit in the new information.

With the disciplining of psychology came the methods approaching psychologist's observations towards internalizing the technical means in knowing what terms processes like assimilation can be thought in. The term 'assimilation' was derived in this manner and defined explicitly as one's own perspective on an issue that anchors all other perspectives. Judging the stimuli close to that anchor (the 'latitude of acceptance') will always assimilate easier, while stimuli further from one's perspective anchor (the 'latitude of rejection') manages to take a longer time in assimilating. This particular form of social and psychological judgment is referenced within disciplined psychology as the "assimilation-contrast model." Jean Piaget first discovered this as a result of observing his infant son "grab and thrust" a rattle into his mouth and then assimilated the "grab and thrust" motion, also placing Piaget's expensive watch into his mouth.

Through a series of stages, Piaget explains the ways in which characteristics are constructed that lead to specific types of thinking; this chart is called Cognitive Development. To Piaget, assimilation is integrating external elements into structures of lives or environments or those we could have through experience. It is through assimilation that accommodation is derived. Accommodation is imperative because it is how people will continue to interpret new concepts, schemas, frameworks, etc. Assimilation is different than accommodation because of how it relates to the inner organism due to the environment. Piaget believes that the human brain has been programmed through evolution to bring equilibrium, and to move upwards in a process to equilibriate what is not. The equilibrium is what Piaget believes ultimately influences structures because of the internal and external processes through assimilation and accommodation.

Piaget's understanding is that these two functions cannot exist without the other. 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 needs first to 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.

Following from this conception Piaget theorized that intelligence is active and constructive. It is active in the literal sense of the term as it depends on the actions (overt or covert, assimilatory or accommodatory), which the thinker executes in order to build and rebuild his models of the world. It is also constructive because actions, particularly mental actions, are coordinated into more inclusive and cohesive systems, thus they are raised to more stable and effective levels of functioning. Piaget believed that this process of construction leads to systems of mental operations better able to resist the illusions of perceptual appearances and thus less prone to error. In other words, the gradual construction of the system of mental operations involved in the operative aspect of intelligence enables the developing person to grasp more hidden and complex aspects of the world. Below we will summarize the development of operative intelligence.

Piaget's four stages According to Jean Piaget's theory of cognitive development, intelligence is the basic mechanism of ensuring equilibrium in the relations between the person and the environment. This is achieved through the actions of the developing person on the world. At any moment in development, the environment is assimilated in the schemes of action that are already available and these schemes are transformed or accommodated to the peculiarities of the objects of the environment plus of the surroundings and entire universe, if they are not completely appropriate. Thus, the development of intelligence is a continuous process of assimilations and accommodations that lead to increasing expansion of the field of application of schemes, increasing coordination between them, increasing interiorization, and increasing abstraction. The mechanism underlying this process of increasing abstraction, interiorization, and coordination is reflecting abstraction. That is, reflecting abstraction gradually leads to the rejection of the external action components of sensorimotor operations on objects and to the preservation of the mental, planning or anticipatory, components of operation. These are the mental operations that are gradually coordinated with each other, generating structures of mental operations. These structures of mental operations are applied on representations of objects rather than on the objects themselves. Language, mental images, and numerical notation are examples of representations standing for objects and thus they become the object of mental operations. Moreover, mental operations, with development, become reversible. For instance, the counting of a series of objects can go both forward and backward with the understanding that the number of objects counted is not affected by the direction of counting because the same number can be retrieved both ways. Piaget described four main periods in the development towards completely reversible equlibrated thought structures. These are the periods described below. As shown below, for Piaget intelligence is not the same at different ages. It changes qualitatively, attaining increasingly broader, more abstract, and more equilibrated structures thereby allowing access to different levels of organization of the world.

Sensorimotor Stage

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 construct an understanding of the world by coordinating sensory experiences (such as seeing and hearing) with physical, motoric actions. Infants gain knowledge of the world from the physical actions they perform on it. An infant progresses from reflexive, instinctual action at birth to the beginning of symbolic thought toward the end of the stage. Piaget divided the sensorimotor stage into six sub-stages":0-2 years, Infants just have senses-vision, hearing, and motor skills, such as grasping, sucking, and stepping.--from Psychology Study Guide by Bernstein, Penner, Clarke-Stewart, Roy.

Sub-Stages

1. Simple Reflexes

Birth-6 weeks

Coordination of sensation and action through reflexive behaviors". 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.).

2. First habits and primary circular reactions phase

6 weeks-4 months

Coordination of sensation and two types of schemes: habits (reflex) and primary circular reactions (reproduction of an event that initially occurred by chance). 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.

3. Secondary circular reactions phase

4-8 months

Development of habits. "Infants become more object-oriented, moving beyond self-preoccupation; repeat actions that bring interesting or pleasurable results." 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.

4. Coordination of secondary circular reactions stages

8-12 months

Coordination of vision and touch-hand-eye coordination; coordination of schemes and intentionality." 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 "first proper intelligence." Also, this stage marks the beginning of goal orientation, the deliberate planning of steps to meet an objective.

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." 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.

6. Internalization of Schemes

18-24 months

"Infants develop the ability to use primitive symbols and form enduring mental representations." This stage is associated primarily with the beginnings of insight, or true creativity. This marks the passage into the preoperational stage. By the end of the sensorimotor period, objects are both separate from the self and permanent. Object permanence is the understanding that objects continue to exist even when they cannot be seen, heard, or touched. Acquiring the sense of object permanence is one of the infant's most important accomplishments, according to Piaget.

Preoperational Stage

The preoperative stage is the second of four stages of cognitive development. 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.

(Pre)Operatory Thought is any procedure for mentally acting on objects. The hallmark of the preoperational stage is sparse and logically inadequate mental operations. During this stage, the child learns to use and to represent objects by images, words, and drawings. The child is able to form stable concepts as well as mental reasoning and magical beliefs. The child however is still not

able to perform operations; tasks that the child can do mentally rather than physically. Thinking is still egocentric: The child has difficulty taking the viewpoint of others. Two substages can be formed from preoperative thought.

The Symbolic Function Substage

Occurs between about the ages of 2 and 7. During 2-4 years old , kids cannot yet manipulate and transform information in logical ways, but they now can think in images and symbols. The child is able to formulate designs of objects that are not present. Other examples of mental abilities are language and pretend play. Although there is an advancement in progress, there are still limitations such as egocentrism and animism. Egocentrism occurs when a child is unable to distinguish between their own perspective and that of another person's. Children tend to pick their own view of what they see rather than the actual view shown to others. An example is an experiment performed by Piaget and Barbel Inhelder. Three views of a mountain are shown and the child is asked what a traveling doll would see at the various angles; the child picks their own view compared to the actual view of the doll. Animism is the belief that inanimate objects are capable of actions and have lifelike qualities. An example is a child believing that the sidewalk was mad and made them fall down.

The Intuitive Thought Substage

Occurs between about the ages of 4 and 7. Children tend to become very curious and ask many questions; begin 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 know it. Centration and conservation are both involved in preoperative thought. Centration is the act of focusing all attention on one characteristic compared to the others. Centration is noticed in conservation; the awareness that altering a substance's appearance does not change its basic properties. Children at this stage are unaware of conservation. In Piaget's most famous task, a child is presented with two identical beakers containing the same amount of liquid. The child usually notes that the beakers have the same amount of liquid. When one of the beakers is poured into a taller and thinner container, children who are typically younger than 7 or 8 years old say that the two beakers now contain a different amount of liquid. The child simply focuses on the height and width of the container compared to the general concept. Piaget believes that if a child fails the conservation-of-liquid task, it is a sign that they are at the preoperational stage of cognitive development. The child also fails to show conservation of number, matter, length, volume, and area as well. Another example is when a child is shown 7 dogs and 3 cats and asked if there are more dogs than cats. The child would respond positively. However when asked if there are more dogs than animals, the child would once again respond positively. Such fundamental errors in logic

show the transition between intuitiveness in solving problems and true logical reasoning acquired in later years when the child grows up.

Piaget considered that children primarily learn through imitation and play throughout these first two stages, as they build up symbolic images through internalized activity.

Studies have been conducted among other countries to find out if Piaget's theory is universal. Psychologist Patricia Greenfield conducted a task similar to Piaget's beaker experiment in the West African nation of Senegal. Her results stated that only 50 percent of the 10-13 year old understood the concept of conservation. Other cultures such as central Australia and New Guinea had similar results. If adults had not gained this concept, they would be unable to understand the point of view of another person. There may have been discrepancies in the communication between the experimenter and the children which may have altered the results. It has also been found that if conservation is not widely practiced in a particular country, the concept can be taught to the child and training can improve the child's understanding. Therefore, it is noted that there are different age differences in reaching the understanding of conservation base on the degree to which the culture teaches these tasks.

Concrete Operational Stage

The concrete operational stage is the third of four stages of cognitive development in Piaget's theory. This stage, which follows the preoperational stage, occurs between the ages of 7 and 11 years and is characterized by the appropriate use of logic. Important processes during this stage are:

Seriation--the ability to sort objects in an order according to size, shape, or any other characteristic. For example, if given different-shaded objects they may make a color gradient.
Transitivity- The ability to recognize logical relationships among elements in a serial order, and perform 'transitive inferences' (for example, If A is taller than B, and B is taller than C, then A must be taller than C).
Classification--the ability to name and identify sets of objects according to appearance, size or other characteristic, including the idea that one set of objects can include another.
Decentering--where the child takes into account multiple aspects of a problem to solve it. For example, the child will no longer perceive an exceptionally wide but short cup to contain less than a normally-wide, taller cup.
Reversibility--the child understands that numbers or objects can be changed, then returned to their original state. For this reason, a child will be able to rapidly determine that if 4+4 equals t, t–4 will equal 4, the original quantity.
Conservation--understanding that quantity, length or number of items is unrelated to the arrangement or appearance of the object or items.

Elimination of Egocentrism--the ability to view things from another's perspective (even if they think incorrectly). 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).

Children in this stage can, however, only solve problems that apply to actual (concrete) objects or events, and not abstract concepts or hypothetical tasks.

Formal Operational Stage

The formal operational period is the fourth and final of the periods of cognitive development in Piaget's theory. This stage, which follows the Concrete Operational stage, commences at around 11 years of age (puberty) and continues into adulthood. In this stage, individuals move beyond concrete experiences and begin to think abstractly, reason logically 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 testing solutions. 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 such things as love, "shades of gray", 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 are changing cognitively also 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.

The Stages and Causation

Piaget sees children's conception of causation as a march from "primitive" conceptions of cause to those of a more scientific, rigorous, and mechanical nature. These primitive concepts are characterized as magical, with a decidedly nonnatural or nonmechanical tone. Piaget attributes this to his most basic assumption: that babies are phenomenists. That is, their knowledge "consists of assimilating things to schemas" from their own action such that they appear, from the child's point

of view, "to have qualities which in fact stem from the organism." Consequently, these "subjective conceptions," so prevalent during Piaget's first stage of development, are dashed upon discovering deeper empirical truths. Piaget gives the example of a child believing the moon and stars follow him on a night walk; upon learning that such is the case for his friends, he must separate his self from the object, resulting in a theory that the moon is immobile, or moves independently of other agents. The second stage, from around three to eight years of age, is characterized by a mix of this type of magical, animistic, or "nonnatural" conceptions of causation and mechanical or "naturalisitic" causation. This conjunction of natural and nonnatural causal explanations supposedly stems from experience itself, though Piaget does not make much of an attempt to describe the nature of the differences in conception; in his interviews with children, he asked specifically about natural phenomena: what makes clouds move? What makes the stars move? Why do rivers flow? The nature of all the answers given, Piaget says, are such that these objects must perform their actions to "fulfill their obligations towards men." He calls this "moral explanation."

Challenges to Piagetian Stage Theory

Piagetians' accounts of development have been challenged on several grounds. First, as Piaget himself noted, development does not always progress in the smooth manner his theory seems to predict. 'Decalage', or unpredicted gaps in the developmental progression, suggest that the stage model is at best a useful approximation. More broadly, Piaget's theory is 'domain general', predicting that cognitive maturation occurs concurrently across different domains of knowledge (such as mathematics, logic, understanding of physics, of language, etc.). During the 1980s and 1990s, cognitive developmentalists were influenced by "neo-nativist" and evolutionary psychology ideas. These ideas de-emphasized domain general theories and emphasized domain specificity or modularity of mind. Modularity implies that different cognitive faculties may be largely independent of one another and thus develop according to quite different time-tables. In this vein, some cognitive developmentalists argued that rather than being domain general learners, children come equipped with domain specific theories, sometimes referred to as 'core knowledge', which allows them to break into learning within that domain. For example, even young infants appear to be sensitive to some predictable regularities in the movement and interactions of objects (e.g. that one object cannot pass through another), or in human behavior (e.g. that a hand repeatedly reaching for an object has that object, not just a particular path of motion), as its be the building block out of which more elaborate knowledge is constructed. More recent work has strongly challenged some of the basic presumptions of the 'core knowledge' school, and revised ideas of domain generality--but from a newer dynamic systems approach, not from a revised Piagetian perspective. Dynamic systems approaches harken to modern neuroscientific 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 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 Vygotsky and Jerome Bruner, thought differently from Piaget, suggesting that language was more