

# Cognitive Development: Overview

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## I. Main Objectives

Learn that:

- Developmental theory views cognition as a sequential and increasingly complex unfolding of biologically driven abilities. These abilities can be influenced by the environment.
- There are five basic aspects, or fields, of development. These fields are language, visual-motor tasks, fine motor development, gross motor development, and social behavior. Different theorists have proposed different theories on the development of each field.
- At varying ages, children sequentially achieve abilities that become increasingly complex. These abilities may be mediated by two central features related to the concept of "executive" functioning. The first is increasing development of "working memory" and the second is the influence of "expertise."
- Children develop at varying rates. Therefore, the exact age at which children develop skills is not necessarily predictive of their ultimate adult capabilities (i.e. children who begin to read at age 4 years may have similar outcomes as children who begin to read at age 7).

## II. Various Theorists of Development

### Arnold Gesell

Arnold Gesell was a pediatrician who wrote early books on development. He proposed a "sequential" theory to development where each stage of development was a prerequisite for the next stage.

### Erik Erikson

Erikson took a "psychological view" of development. He proposed a model made up of eight stages (known as the "Eight Stages of Man") that extended into adulthood. Failure to master these stages result in difficulties. For example, the failure to successfully master toilet training would result in shame rather than autonomy. In this case, Erikson believed that the child has some awareness of his/her skills and progress.

### Edgar A. Doll/Alfred Binet

Like Gesell, Doll/Binet proposed adaptive skill development. However, Doll extended his theories into adulthood. Doll's stages could be readily interpretable by a child's parents. For example, the stages included actions such as rolling over or drinking from the cup.

### Jean Piaget

Jean Piaget devoted his life to epistemology, or how thoughts were transformed into a body of knowledge. His theories of cognitive development were inspired by observations of his three children from infancy. Piaget believed that children were active participants in learning. He viewed children as busy, motivated explorers whose thinking developed as they acted directly on the environment using their eyes, ears, and hands. According to Piaget, between infancy and adolescence children move through four stages of development.

## III. Important Piagetian Concepts

### Scheme

A scheme is an organized way of making sense of experience, and it changes with age. In other words, a scheme describes a thought, notion, or behavior that has been learned and ingrained into the child's mind. The child then uses this scheme and applies it to the external environment. For example, at 2 months an infant will grasp anything placed in his hand the same way, but at 4 months the infant adjusts his hand to open to the size of the object offered.

### Assimilation

Assimilation is when a child changes/adapts something from the external environment so that it can "fit" into a pre-existing scheme. For example, if a child has developed a "dog scheme," she will call any furry, four-legged animal a dog until she develops a separate scheme for another animal.

#### **Accommodation**

Accommodation is when a child changes a pre-existing scheme or cognitive structure to better "fit" the external environment. For example, a child will notice the difference between a dog and cat. Thus, she may now call the cat a "funny dog."

#### **Organization**

Organization is the tendency to link schemes together in an interconnected system. For example, a child will link her schemes of a dog and cat together. This will enable her to pick out specific similarities and differences among them (i.e., cats meow and dogs bark).

#### **Adaptation**

Adaptation is a dynamic process combining assimilation and accommodation.

## **A. Piaget's Four Factors that Influence Cognitive Behavior**

*Note: A child's individual rate is determined by his/her innate intelligence and the four factors listed below.*

1. **Maturation of the nervous system**
2. **Experience**
3. **Social transmission of information or teaching**
4. **Equilibration** (innate tendency for mental growth to progress toward increasingly complex and stable levels of organization)

## **B. Piaget also defined 4 stages of cognitive development:**

All of the below stages correlate with brain development and growth.

1. **Sensorimotor** (0 to 2 years of life)
2. **Preoperational** (age 2 to 7 years)
3. **Concrete operations** (age 7 to 11 years)
4. **Formal operations** (adolescence)

Piaget also believed that development runs out after the age of 11, which is the last spurt of growth for the frontal lobes.

### **1. Sensorimotor Period (0-2 years)**

- The child passes through six stages of simple reflexes and ends with basic internal or symbolic representations of action.
- As the infant grows he goes through using primary, secondary, and tertiary circular reactions. At first, the young infant's actions and reflexes are centered upon his own body (primary circular reaction). As the infant grows, his actions are extended to the external environment (secondary circular reaction.) Finally, in the tertiary stage, the child develops the ability to manipulate his actions on the external environment and experiment with different outcomes.
- At around 8-10 months, the child develops the quality of **object permanence**. This is the ability to understand that an object, or person, continues to exist even when they are out of sight (e.g., ability to find a hidden object in the first location in which it was hidden).

### **2. Preoperational Period (2-7 years)**

- Child acquires language and symbolic functions, has the ability to search for hidden objects, perform imitation, and engage in symbolic play.
- **Egocentric.** The child assumes that others perceive, think and feel just the way they do.
- Children at this stage lack an understanding of conservation. For example, a child does not understand how two differently shaped containers can hold equal volumes of water.
- Child has trouble with hierarchical classification. For example, a child cannot put sticks of different length in order.
- The child at this stage also displays "magical" (unrealistic) thinking or exhibits "magical play."
- Preoperational children develop **objective morality** where the child's sense of right and wrong (and the amount of guilt that comes with it) is determined by the amount of damage that has been done, not the intent or the motivation behind the action.

### 3. Concrete Operations Period (7-11 years)

- Child develops conservation skills (first mass and then volume).
- Child begins to apply mental operations to real, concrete problems, objects, or events.
- Child now has the ability to decentrate; he can now take other people's point of view.
- Subjective morality - There is now a consideration of the intent behind an action. There is an almost "black-and-white" sense of right and wrong.

### 4. Formal Operations Period (11 years and up)

- Child can think abstractly, formulate hypotheses, use deductive reasoning, and can check solutions.

## IV. The Role of Language in Cognitive Development

Language is considered an indicator of cognitive development.

The following lists the developmental stages of language:

- *6 months:* babbling, all sounds
- *9 months:* narrowing of sounds
- *11 months:* first words
- *18 months:* 2-word combinations
- *2-3 years:* 3 words, word order, inflections
- *4-5 years:* nearly complete syntax
- *5-7 years:* complex production 9 years: understands all forms
- *11-13 years:* final shift in complexity

### A. Pragmatics in Language

Pragmatics of a language is not so much what is said, but rather how it is said. Language has intonations, context, verbal cues, and emotion that give meaning to words. Additionally, one word can stand for many different words. For example, "ball" can mean "I've lost the ball" or "bring me the ball" or "I want to play ball," depending on the intonation, context, and accompanying facial gestures and expressions.

### B. Language is Specialized in the Brain

The right hemisphere is involved with visual-spatial understanding and language. A stroke in the right hemisphere often results in a person who can still make words but can't think contextually.

In contrast, the left hemisphere involves vocabulary. A stroke in the left hemisphere may result in a loss of vocabulary and articulation but have a minimal effect on communication. Patients with these conditions may be able to communicate well with hands or other methods, but can not say words.

## C. Binet-Simon Scale (1905)

Binet was an educator in France who established programs for students with special needs. Ted Simon was a pediatrician who teamed up with Binet to develop a scale to help teachers place children in appropriate classrooms. Tests include copying increasingly complex tasks.

## V. Working Memory vs. Expertise

### A. Working Memory

According to Alan Baddeley, working memory is the simultaneous storage and processing of information. For example, the ability to recall a number of digits from memory. As the child grows, their capacity for working memory (the memory to solve a puzzle, read, etc.) grows. Working memory consists of three parts:

- **A central executive:** acts as "an attention controlling system" with two "slave systems" which subserve it:
  - The visual-spatial sketch pad: manipulates images
  - The phonological loop: manipulates speech

### B. Expertise

- Increases recall. Example: A child is able to remember more and more numbers in a row if he keeps practicing.
- It is skills that expand your working memory. For example, an expert chess player will be more adept at recalling the position of pieces on the board compared to a novice.
- It has profound effects on our performance.

## VI. Normal Development of a Child

**In order to identify what is abnormal in a child during a neurological examination, it's important to understand what is normal in a child's development.** *(As an aside, "normal" is defined as the mean plus or minus two standard deviations [encompassing 95% of the population]. Normality can be what is socially or culturally acceptable to a particular group. It can also be used to mean healthy, without pathology [i.e. no excess risk of future disease or psychopathology].)*

### A. Important Concepts in Childhood Development

Two important concepts of normal child development are:

- **temperament**
- **mental retardation**

**Temperament is the style of behavior that is stable and present in all developmental stages.**

#### 1. Three types of temperament:

**The Easy Child:**

A child that can quickly establish regular routines and adapts easily to new experiences. They are a delight to parents and have a relatively low risk of emotional or behavior problems.

**The Difficult Child:**

A child that has irregular daily routines and tends to act negatively to new experiences. These children are at the highest risk of developing behavior problems as they grow up.

**The Slow-to-warm-up Child:**

A child that is inactive, shows low-key reactions to environmental stimuli, may be negative in mood and adjusts slowly to new experiences. They tend to be at risk for developing behavioral problems, but their risks can be reduced with sensitive management by parents and teachers.

**Mental retardation is a condition of childhood onset defined by: a score on a standardized intelligence test that is significantly below average (1Q test score below 70) and significant impairment in adaptive functioning (measured by a test such as the Vineland Adaptive Behavior Scales).** Note that mild mental retardation (IQ from 50-55 to 70) is the most common category and is not attributable to a known medical cause. Instead, it is made up of a combination of factors: inheritance from parents whose genetic endowment are below average, lack of cognitive stimulation, malnutrition of the mother and the child, inadequate prenatal and pediatric medical care, or environmental toxins such as lead.

## B. Developmental Stages

There are six periods of development:

1. **prenatal**
2. **infant** (the first year)
3. **toddler** (1 to 3 years)
4. **early childhood** (3 to 6 years)
5. **school age** (6 to 12 years)
6. **adolescent periods**

At each developmental stage, it is important to pay attention to significant physical, cognitive, language, emotional, and social growth milestones. **A child's developmental outcome is not simple to predict. Rather, it is the result of multiple factors involving the child, the family, the school, and the larger culture.** Furthermore, **it is important to keep in mind that development does not proceed at a constant rate.** Periods of apparent stagnation alternate with periods of rapid growth.

### 1. Prenatal Development

Risks to prenatal development include:

1. **Prematurity.** Causes are multiple pregnancy, fetal abnormalities, and structural or endocrine abnormalities in the mother.
2. **Intrauterine Growth Retardation.** Babies are born small for their gestational age and may be delayed in other areas as well.
3. **Genetic Abnormalities.** Reduced by genetic counseling prior to pregnancy.
4. **Maternal Disease.** Early and thorough prenatal care reduces risk to the fetus by avoiding maternal diabetes, hypertension, or other disorders.
5. **Adolescent Pregnancy.** Mothers younger than 15 years increases risk for low birth weight and neonatal death.
6. **Maternal Ingestion of Substances Harmful to the Fetus.** These include the obvious like cigarette smoking, which can lead to hyperactive children with short attention spans and language

development delays. Babies born to mothers addicted to narcotics have a low birth weight and show a neonatal abstinence syndrome consisting of extreme irritability, emotional lability, and intense reactions to environmental stimuli.

7. **Emotional Factors.** Mothers with psychological problems in pregnancy usually lead to a maladaptive child.

## 2. Infancy: The First Year

1. Even in the first days of life, the newborn has considerable sensory, motor, intellectual, communicative, and affective abilities, which progress rapidly in the next 12 months. The number of synapses that develop in the brain of an infant is greater than that of adults. Excess synapses are pruned to reach adult numbers later on..
2. **Infants demonstrate an amazing array of proprioception, pressure, and touch senses at birth.** Within a week of birth infants, can distinguish their mother's voice and the smell of her breast milk from those of another women. Even premature infants are as sensitive to pain as adults.
3. The first year is a period of rapid growth with infants having a **300% increase** in weight.
4. At 4 months, the child exhibits primary circular reactions whereby motor reflexes or habits are centered upon his or her own body. For example, a child will place his thumb, toys, and blankets in his mouth.
5. At 4 to 10 months, secondary circular reactions emerge as infants try to reproduce interesting events in his/her external environment such as shaking his/her legs makes the crib jiggle.

### Motor Landmarks:

- By 16 weeks of age, the baby can hold up his hand.
- By 28 weeks, the child sits with support.
- By 40 weeks the child can sit alone.
- By 48 weeks, the child can stand alone.
- By 12 months, the child can walk with support

### Cognitive Landmarks:

- At 8 to 12 months, memory enhances.
- By 10 to 12 months, the infant is able to overcome simple obstacles, perceive a connection between events, and anticipate the next object in a series. Also, infants realize that an object continues to exist even if it is out of sight (object permanence).

### Communicative Landmarks:

- In first month of life, a baby's cry can be differentiated and acts as communication. A cry could mean fatigue, hunger, or pain.
- Between 5 to 10 months, the baby starts to babble and play with sounds.

### Attachment:

Infants also proceed through different stages of attachment. **Attachment is the infant's behavior, feelings, and cognitions directed toward the mothering figure.** This behavior promotes proximity or contact. Bowlby theorizes attachment develops out of protection from environmental danger. Attachment is also known to be important to an infant's development. A child that has a traumatic or prolonged separation from his/her mother can suffer anaclitic depression where the child is withdrawn and relatively mute and will not eat. Under 2 months, most infants form attachments to their mother. At 6 to 8 weeks, the baby recognizes the mom's smile and smiles in

response. This response is called a **social smile** and is seen in blind babies as well who smile selectively to their mother's voice.

There are four types of attachment:

1. **Securely attached:** infant experiences separation anxiety when left by the mother.
2. **Anxious resistant:** a type of insecure attachment, which is promoted by parental inconsistency (the parent is sometimes there but uses threats of leaving to discipline). This leads to feelings of uncertainty in children.
3. **Anxious avoidance:** another type of insecure attachment where the child expects to be rejected by others. This type of attachment develops from a mother's rejection or abuse when a child approaches her for comfort.
4. **Stranger anxiety:** develops between 9 and 18 months. The child expresses fear in response to unfamiliar adults.

It is also interesting to note that children of mothers who work full time in their first year of life are just as likely to be securely attached to their mothers as infants whose mothers do not work outside of the home. By end of the 1st year, it is normal for the child to chose a transitional object (a toy, blanket, and pillow) to which it attaches in times of separation.

### 3. The Toddler: Ages 1 to 3

#### Motor Landmarks:

- By 3 years, the child can stand, walk, and run with ease. The toddler wants to self-feed, first with fingers, then with utensils. There is also a dramatic loss in appetite.
- In the 18 to 30 month stage, toilet training may begin. However, if toilet training is started too early or when the child is not ready, it can have an adverse effect, making the learning process longer and more difficult.
- Daytime urination is controlled by 2 ½ years and night-time urination by 3 ½ years to 4 years.
- Bowel control is reached by age 4.

#### Cognition Landmarks:

- Tertiary circular reaction develops through which a child produces new events for his/her own sake by extending existing habits to a variety of objects.
- By 18 months, a toddler can recognize himself/herself in mirrors and pictures.

#### Communication Landmarks:

- From 1 to 1 ½ years, the toddler makes extensive use of jargon (sounds that resemble speech, but are unintelligible).
- 2 year olds have a 300-word vocabulary, use **2-word sentences**, and can point to body parts when named.
- 30 month old can use pronouns.
- Comprehension precedes expressive abilities.
- By the second year, the child looks to parents for emotional cues about a novel event.
- By the 3rd year, echolalia is heard (repetition of overheard words or phrases).
- By the 3rd year, the child struggles for psychological autonomy and separateness from the parents.

#### Behavioral Landmarks:

- By 3 years, children develop a sense of empathy for others and can label emotions verbally. They also develop reaction formation (toilet trained children now hate messiness).
- In this period, children develop fear of loud noises, animals, the dark, and separation from parents.
- Core morphologic or gender identity of being male or female develops through interaction of physiological and environmental factors - seen in 18 months or earlier and established by 24 to 30 months.

#### **4. Early Childhood: Ages 3 to 6**

##### **Motor Skill Landmarks:**

- Most 3 year olds can stand on one foot, jump, run smoothly, and climb stairs using alternating feet.
- 4 year olds should be able to ride a tricycle well, climb on a jungle gym, and throw a ball overhand.
- 5 year olds have better balance and can skip smoothly.
- Also see development of fine motor skills: 4 year olds can lace own shoes, and feed themselves neatly.
- Drawing skills: a 3 year old can copy a circle, a 4 year old can copy a cross and draw a simple man with head, eyes, and legs, and a 5 year old can copy a square and draw a man with recognizable body parts.

##### **Cognitive Landmarks:**

- Child develops ability to transcend space and time by use of nonverbal mental symbols, followed by language.
- Symbolic play appears, consisting of pretend, or imaginative play with toys or dramatizing roles and stories in which toys and roles symbolize real objects and real persons. This stage corresponds with Piaget's pre-operational stage and children are normally egocentric, relating everything to them.
- Children are animistic and believe that all events can be explained by the action of some humanlike agency or force that wills things to happen for its own purposes (magic always works).
- They also develop moral realism - the belief in imminent justice and the inevitability of punishment. Guilt is determined by amount of damage and not the intent or motivation.
- They are unable to see simultaneous positive and negative aspects of the same person or event (splitting). Parents need to set a good, loving, fair example to their children.
- Children also exhibit phenomenalistic causality where reasoning is transductive (attributing causality to juxtaposition in time or space).
- They believe that death is reversible and they understand concepts of yesterday and tomorrow.
- Play partners are of the same sex.
- Boys fear loss or damage to the genitals at this age stage, according to some theorists.
- Up to one-fifth of 3 to 6 year olds have an imaginary companion. Research shows that this extends to some adults with mental retardation.

##### **Communicative Landmarks:**

- Vocabulary develops at a rate of about 50 new words per day until the age of 6.

#### **5. Middle Childhood: Ages 6 to 12**

*Note: This period of development is also called the **Latency Period**.*

- By age 7, the brain has attained about 90% of its adult weight. The cerebral cortex is now myelinated and the EEG (electroencephalogram) shows stable alpha wave patterns.



- Between 7 and 10, balance, equilibrium, control of large muscles, and timing improve dramatically. Fine motor skills become adaptive.
- The child can **decentrate** (consider more than 1 dimension simultaneously.)
- The child also develops the ability to conserve - first quantity, then weight, and finally volume.
- Morality becomes subjective, as children understand feelings of other people and the influence of their own actions on others.
- Girls are better students than boys, according to some educational theorists.
- Most 8 year olds read for pleasure, but their ideas still exceed their writing ability.
- 10 year olds memorize well but still have difficulty with abstraction.
- A more realistic concept of death develops at 10 to 11.
- An 11 year old can interpret simple proverbs and perform multiplication and division.
- By age 10 to 12 children have developed metacognitive abilities (understand something about what they know and how they learn).
- This stage is also characterized by ego and superego development

## 6. Adolescence

- Dendrite connections reach adult level.
- Boys attain sexual maturity 2 years later than girls (typically at age 15 for girls).
- Youth can use abstract thought to devise hypotheses and ways of testing them.
- In late adolescence, youth can understand metaphors and complex, abstract subjects such as algebra and calculus. However, many adults do not reach this stage and are incapable of dealing in a flexible rational manner.
- Three leading causes of death in adolescence are accidents, homicide, and suicide.
- Masturbation is normal and serves a generalized function in reducing anxiety and discharging tension.

## VII. Sample Board Review Question

### Cognitive Development:

A child's pet has recently died. The child believes that the pet will soon come back to life. This child is most likely to be age

1. 4 years
2. 6 years
3. 7 years
4. 9 years
5. 11 years

(answer: 1)