COGNITIVE DEVELOPMENT

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Cognition

- Ability of knowing

- Making and using of knowledge

- Attentiveness/information processing/intuition/memory/skill,...

- Develop from infancy to adulthood

Development

- Sequential increase in structural and functional complexity of a system

Cognition

- Scientists: Cognition to be any instance of a mental operation that display **intentionality**

- Piaget: Cognition organizes and channels the psychological energy generated by affect as a car engine

- Some: cognitive development as the increasing speed and sophistication of mental activity independent of knowledge

- Other believe that content of knowledge determine cognitive development

Six theories

- Piaget

- Contextualist or socio cultural (Vygotsky)

- Information processing

- Neo Piagetian

- Knowledge based

- psychometric

Jean piaget

- He proposed that logic was the basis of all cognitive structure.

- Humans are innately predisposed to organize whatever is taken in by the nervous system.

Overview

- Jean Piaget (1896—1980)
  - Swiss psychologist
  - Believed child to be active explorer of his environment
    - "child scientist"
  - Developed one of the most influential theories of cognitive development to date

Piaget s stage sequence of development

🞣 The sensorimotor stage (birth through 18 to 24 M):

The infant's first strategies for organizing her or his experience are such innate reflexes as grasping and rooting.

During this stage, the infant transforms her or his reflexes into self-generated schemes of action.

However, sensorimotor cognition is still nonrepresentational; it can only operate on an environment that is immediately apprehended by the senses and the motor system.
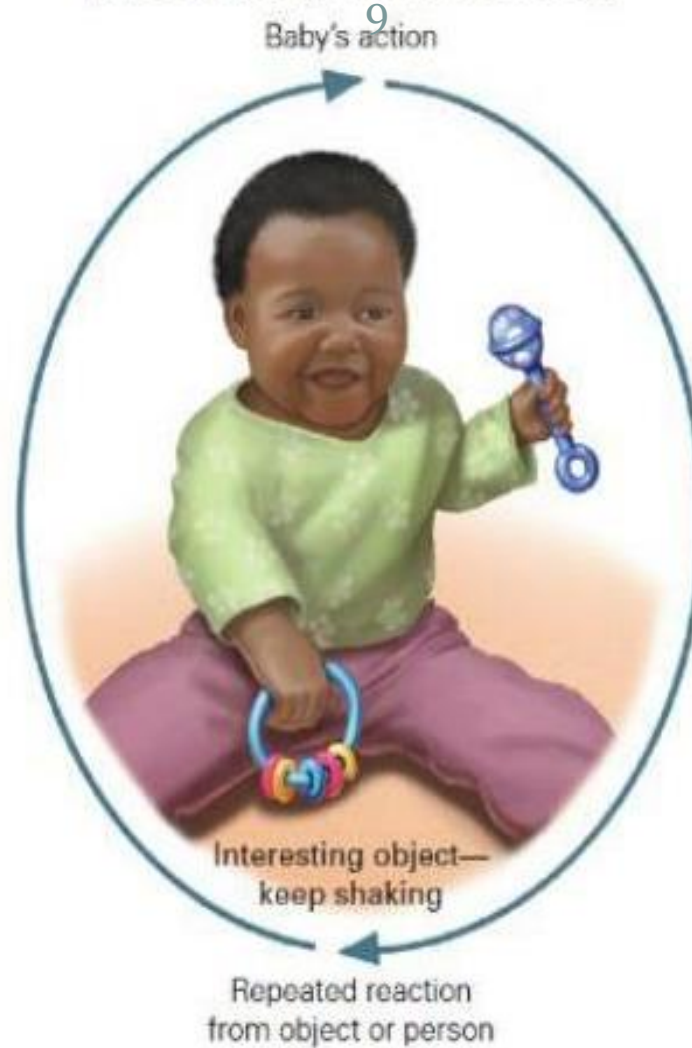
The sensorimotor stage (birth through 18 to 24 M):

⚐ By the end of this stage, the development of mental representations permits the transition from a physical to a psychological basis for thought.

⚐ Primary circular reaction

⚐ Secondary circular reaction

⚐ Tertiary circular reaction

⚐ Symbolic or semiotic function

(a) Primary circular reaction
Baby's action →
Feels good—keep sucking
← Baby's reaction

(b) Secondary circular reaction
Baby's action →
Interesting object—keep shaking
← Repeated reaction from object or person

(c) Tertiary circular reaction
Baby's action →
Fascinating reaction—what else can I do?
← Novel reaction from object or person

6 Subcategories of Sensorimotor Stage

- **Substage 1 (0 – 1 1/2 months)**
  - *Reflex Schemas*
- **Substage 2 (1 1/2 – 4 months)**
  - *Primary Circular Reactions*
- **Substage 3 (4 – 8 months)**
  - *Secondary Circular Reactions*
- **Substage 4 (8 – 12 months)**
  - *Coordinated Secondary Circular Reactions*
- **Substage 5 (12 – 18 months)**
  - *Tertiary Circular Reactions*
- **Substage 6 (18 – 24 months)**
  - *Beginnings of Symbolic Representation*

The Preoperational Stage (2 Through 5 to 7 Years)

- Achievement of the symbolic function ushers in the preoperational period that is representational but not yet logical.

- Object Permanence and Centration

- Egocentrism

The Concrete Operational Stage: 6 to 11 Years

- Classification

- Seriation

- Conservation

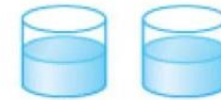**Tests of Various Types of Conservation**

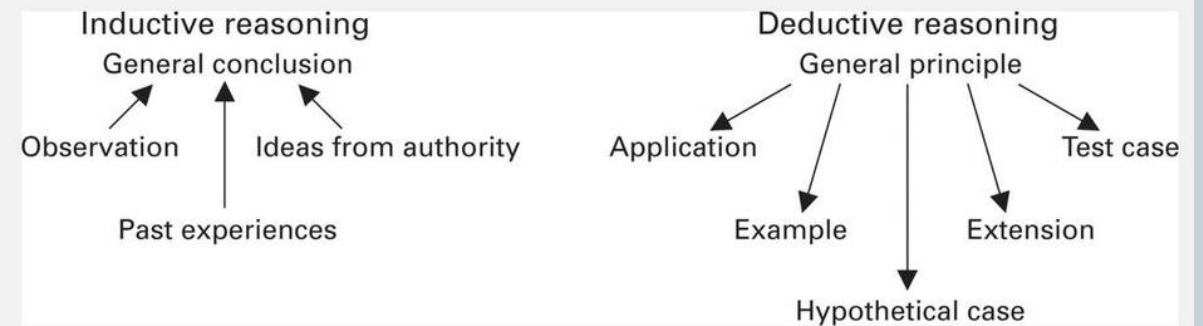| Type of Conservation	Initial Presentation	Transformation
Volume	Two equal glasses of liquid.	Pour one into a taller, narrower glass.
Number	Two equal lines of checkers.	Increase spacing of checkers in one line.
Matter	Two equal balls of clay.	Squeeze one ball into a long, thin shape.
Length	Two sticks of equal length.	Move one stick.

The Formal Operational Stage (11 Years to Adulthood)

- Empirico -deductive reasoning

- Hypothetico-deductive reasoning

Hypothetical-Deductive Reasoning

Inductive reasoning
General conclusion

Observation   Ideas from authority

Past experiences

Deductive reasoning
General principle

Application   Test case

Example   Extension

Hypothetical case

Summery:
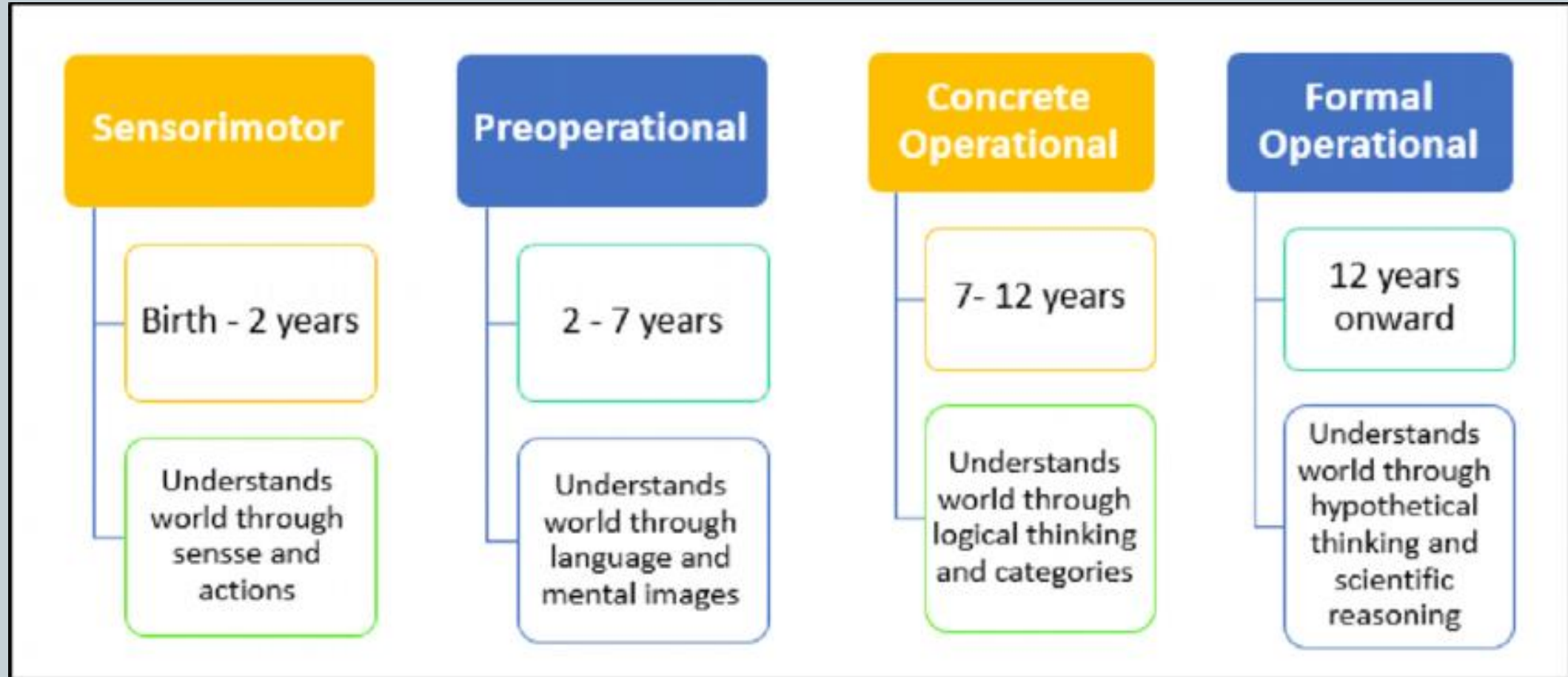
Vygotsky: The Contextualist Approach

Cognitive development in three domains:

- Genetic domains—phylogenesis (evolution)

- Cultural history

- Ontogenesis (individual development)

Vygotsky's Big 4 Ideas

1. People learn best if their learning is guided by a "more knowledgeable other." (They don't learn as well without guidance.)
2. People learn best if they are given challenging tasks that gradually get harder (as long as they have enough guidance during the task.) ZPD idea.
3. Language is really important --Language guides learning because thoughts are in the form of internal language.
4. Culture is a learning tool because a person's culture helps teachers know how to make learning content and delivery culturally meaningful.
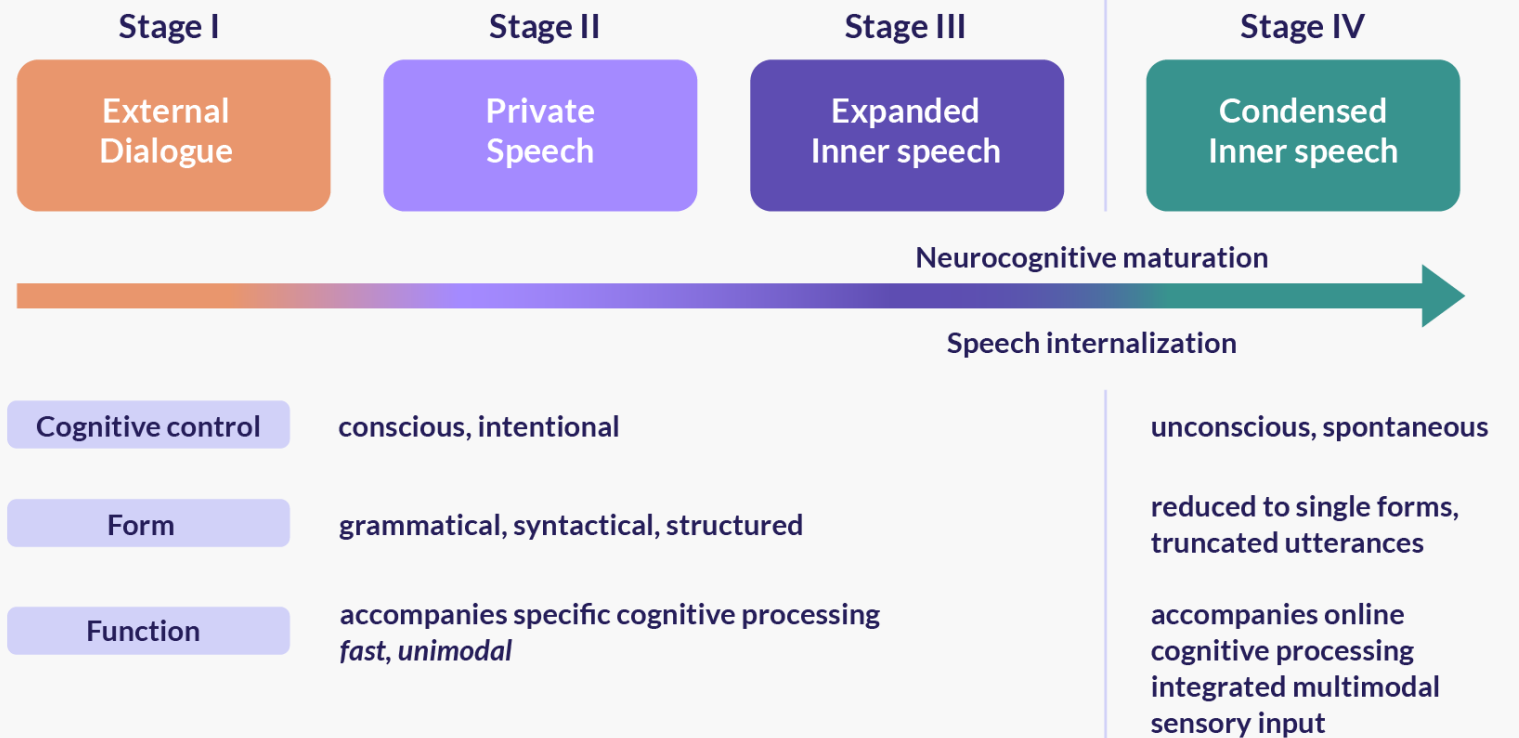
Lev Vygotsky, 1896-1934

vygotsky

- Social speech
- Inner speech

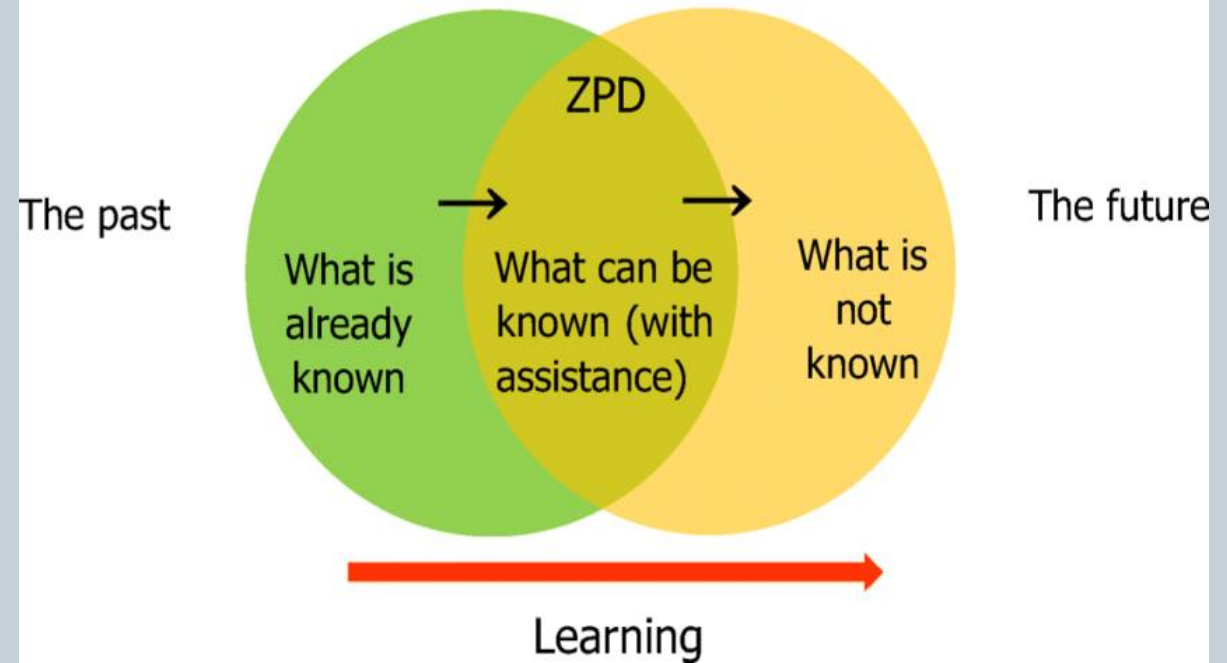## Stages of Internal Speech Development

Stage I	Stage II	Stage III	Stage IV
External Dialogue	Private Speech	Expanded Inner speech	Condensed Inner speech

Neurocognitive maturation →

Speech internalization

Cognitive control	conscious, intentional	unconscious, spontaneous
Form	grammatical, syntactical, structured	reduced to single forms, truncated utterances
Function	accompanies specific cognitive processing *fast, unimodal*	accompanies online cognitive processing integrated multimodal sensory input

✦ HealthMatch

vygotsky

+ Proximal zone

Vygotsky's zone of proximal development (ZPD)

The past — What is already known — ZPD — What can be known (with assistance) — What is not known — The future

Learning

The Information-processing Approach

- The Child's Mind as a Computational Device

- Information-processing theory is not tied to the work of a single pioneer investigator, so it is not as unitary as Piaget's or Vygotsky's.

- Focus on the information that children represent, the processes that they use to transform the information, and the memory limits that constrain the amount of information they can represent and process.

The Information-processing Approach

- The mind is seen to be, essentially, a problem-solving device, and cognitive scientists have constructed computer-based cognitive architectures to model human thought.

Computational Transformation: Data, Information, and Knowledge

- **<u>DATA</u>** are simply "facts without context in a form . . . that can be entered into a computer.

- Once entered, Human organization and interpretation give data <u>context</u> and <u>meaning</u>, producing **<u>information.</u>**

Computational Transformation: Data, Information, and Knowledge

- If information may be distinguished from data by meaning, **knowledge** may be distinguished from information by <u>longevity</u> and <u>purpose</u>.

- Knowledge is the "representation of facts (including generalizations) and concepts organized for future use, including problem-solving"

- In summary, the transition from **data** to **knowledge** involves increasing <u>contextualization</u> and more <u>sophisticated</u> rules of application.

Cognitive Architecture

- Must be able to transform input into an **internal representation** it can operate on; that is, to encode.

- It must be able to hold new information "on screen" for **appraisal** and transform it into knowledge by connecting it with <u>prior knowledge</u>, in addition to the **storage** capacity to keep the new knowledge for future use. By analogy, in order to learn, children must first be able to transform **data** into **information** by encoding them as **mental representations**.

Cognitive Architecture

- Children then must hold the representation in **active memory** while **retrieving** relevant knowledge from their accumulated store.

- The new information is brought together with existing knowledge, and if it is deemed **important** to the ongoing life of the child, the information will be **stored** with related.

The Classical Processing Model

- The Magical Number **Seven Plus or Minus Two**: Some Limits on Our Capacity to Process Information.

- For example, it would be too difficult for most people to repeat back the 13 digit series **7472462121945** without a strategy. However, if one associated 747 with the aircraft, 246 with the first three even numbers, 212 as the boiling point of water in 8°F, and 1945 as the end of World War II, the original 13 units become 4 and the task is manageable.

The Classical Processing Model

- **Immediate Memory** as the locus of information processing and proposed chunking to be the principal strategy for increasing available processing space.

- **Chunks** are aggregates of related facts , concepts, or percepts. Chunks become larger and more complex with <u>experience</u> and are often hierarchically integrated, one inside another, like <u>Russian</u> <u>dolls</u>, so as to take up less processing space.

- **Development** may be seen as the increasing capacity of "immediate" or short-term memory—now refined and expanded as **working memory**.

- If so, is this owing to biological maturation or increasingly effective and sophisticated strategies to chunk information?

- Clearly, one's general knowledge base and specific knowledge of memory strategies influence this capacity.

The Development of Processing Capacity

- Development in IP models is toward faster processing and greater organizational complexity of cognitive architecture.

- A cognitively mature person can manage more information per unit of time and deal better with complex and ambiguous information than an immature one.

- Infants cannot handle complex information as well as older children because they would have to "attend to and interrelate more pieces of information than their working memory capacities can handle".

Thanks