Chapter 5

Cognitive Development in Infants and Toddlers
At Birth…

- Infant’s nervous system is still immature
- Most synapses not yet formed
- Neurons have no myelin sheath to insulate axons and speed up the transmission of neural impulses
Cognition and Perception

- **Cognition**: mental processes
  - Thinking
  - Remembering
  - Solving problems
  - Communicating with language

- **Sensation**: detecting information about objects in the environment through the senses

- **Perception**: organizing, coordinating and interpreting information
How do researchers know…

- If Infants can hear or see
- What information they prefer
- Do infants take a long time to learn to coordinate information from different sense, or do they show this capability soon after birth?
Research using preferential-looking technique shows that newborns look longer at

- moving objects
- outer edges
- sharp color contrasts
- patterns
- the human face
Visual Preference

Figure 5.2 • Preferential Looking Results
This graph shows results from an early preferential-looking study. Stimuli were presented one at a time in random order to newborns who were only 2 to 5 days old. What types of features caught the newborns' eyes? (Based on Fantz, 1963.)

Why do you think the newborns spent more time looking at the face than at any of these other stimuli?
How can parents stimulate their baby’s sensory systems?
Other research on visual preference

- Infants tend to prefer patterns that resemble the human face

*Figure 5.3  •  Face Stimuli* Researchers showed these patterns one at a time to newborns who were only a few minutes old. Although they had yet to see their first real face, the newborns preferred to look at the pattern that most resembled the arrangement of the human face. Why do you think this was so? (Goren, Sarty, & Wu, 1975.)
Other research on visual preference

- At 2 months infants are able to judge the physical attractiveness of faces!!!!
Visual Discrimination

Can infants see the difference between colors and shapes?

- Research using *habituation-dishabituation* technique shows that infants look longer at new stimuli, and that they see difference in color and shape.
Habituation & Dishabituation Research

- **habituation** - tendency of infants to reduce response to stimuli that are shown repeatedly.

- **dishabituation** - increase in infant’s response to a new stimulus.
Infant Perception

Visual
20/20 eye sight by 6-12 months
Color vision is present by 6 months

Auditory
Infants hear several weeks before birth
Infants are more sensitive to higher frequencies
Infants prefer
  • mother’s voice
  • child directed speech (rising and falling inflection, slow, clear)
  • human voices
  • familiar sounds

Smell
Newborns show preference for some smells (bananas) over others (rotten eggs)

Taste
Newborns prefer sweet over sour taste
Intermodal Perception- process of combining or integrating information across sensory modalities.

Most of our experiences involve multiple sensory input
Infants combine senses to understand experience.

Ex: looking at a face and hearing a voice at the same time
Who was Piaget?
Before Piaget People thought...

- Children were passive recipients of information
- Children memorized facts
- Did not have **logical** and **regular ways** of thinking
Cognitive Development
Piaget
1896-1980

Constructivist view

- People interpret their current experiences based on past knowledge and experiences

- Children build on what they already know
Constructivism- Piaget

- children are active thinkers
- children’s thinking is consistent, even when it’s incorrect
  
  ex: children of the same age give the same wrong answers.

Conservation task
Constructivism- Piaget

**Scheme**: organized pattern of action or thought
- building block for cognition; a starting point
- built, modified, and reorganized over time
- new experiences filter through existing schema
- interaction with environment essential
Example of schemes

- Organized pattern of physical actions
  infant reaching to grasp an object

- Mental action
  high school student thinking about how to solve an algebra problem
Interacting with the environment

A. Organization
B. Adaptation
C. Reflective abstraction
Interacting with the environment

**Organization** - tendency to combine separate elements into a system
Ex: Cell-tissue-organs-organ systems-body

- People try to organize their knowledge all the time.
- Thinking about something that didn’t make sense even when you don’t want to.
- People will either organize thinking in a correct or incorrect way.
Interacting with the environment

Adaptation - changing thinking or environment in order to make sense of environment
1. assimilation - bringing new objects or information into a scheme that already exists
2. accommodation - change old schemes or creating new ones to better fit new information

Inconsistencies or confusion cause cognitive disequilibrium
Figure 5.6 • Adaptation and Equilibration In the cycle of adaptation and equilibration, a new experience is first assimilated into an existing scheme. If it does not fit properly, cognitive disequilibrium results. Accommodating (adjusting) the scheme brings the child to cognitive equilibrium until a new assimilation challenges the scheme again.

1. Lily sees her first cow. “Look Mommy, doggies.”

2. “But it has udders and gives milk, and dogs aren’t that large.”

3. Change “dog scheme”: Dogs are smaller and don’t give milk.

4. Add new “cow scheme”: Cows are larger and give milk.

5. Lily properly identifies dogs and cows.

6. Then Lily sees an elephant . . .
Interacting with the environment

**Reflective Abstraction**
- awareness of something in the environment
- reflection on it
- change of thinking if needed

Ex: Lily could not have accommodated her understanding of dogs had she not been able to notice that cows were larger than dogs, and reflected and thought about it.
People’s continual organization and adaptation leads to periodic reorganizations that result in the 4 stages of cognitive development.
### Piaget’s Four Stages of Cognitive Development

<table>
<thead>
<tr>
<th>STAGE</th>
<th>LIMITATIONS</th>
<th>ACHIEVEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensorimotor Thought: Birth to 2 years</td>
<td>• No representational thought; infants cannot form internal symbols early in this stage.&lt;br&gt;• Object permanence is lacking early in this stage.</td>
<td>• Representational, symbolic thought gradually emerges as the stage progresses.&lt;br&gt;• Object permanence develops as the stage progresses.</td>
</tr>
<tr>
<td>Preoperational Thought: 2–7 years</td>
<td>• Intuitive logic leads to egocentrism, animism, artificialism, and an inability to use more objective forms of logic.&lt;br&gt;• Schemes are not reversible, not operational.&lt;br&gt;• Children fail conservation tasks because of centration, focus on static endpoints, and lack of reversibility.</td>
<td>• Flourishing mental representations and symbols are seen in language, art, and play.</td>
</tr>
<tr>
<td>Concrete Operational Thought: 7–12 years</td>
<td>• Logic is limited to concrete, tangible materials and experiences.</td>
<td>• Logical thought is more objective, allows skills such as class inclusion and transitivity.&lt;br&gt;• Schemes can be reversible, operational.&lt;br&gt;• Children pass conservation problems due to decentration, focus on dynamic transformations, reversibility.</td>
</tr>
<tr>
<td>Formal Operational Thought: 12 years and up</td>
<td>• Adolescent egocentrism is seen in the imaginary audience and personal fable.</td>
<td>• Hypothetico-deductive reasoning emerges.&lt;br&gt;• Abstract thought emerges.</td>
</tr>
</tbody>
</table>
Sensorimotor Thought

- all experiences involve sensory input and physical actions

**Sensory**: see, smell, taste, touch, hear

**Motor**: sucking, reaching, grasping
Sensorimotor Thought

- **Symbolic representational thought**: ability to form symbols that stand for objects or events in the world.
- Infants have no mental representations of objects or events – here and now.
- 6 substages as representational thought develops.
<table>
<thead>
<tr>
<th>SENSORIMOTOR SUBSTAGE</th>
<th>AGE</th>
<th>CHARACTERISTIC</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Basic Reflexes</td>
<td>0–1 month</td>
<td>The first schemes are inborn reflexes.</td>
<td>Rooting, sucking, grasping reflexes.</td>
</tr>
<tr>
<td>2. Primary Circular Reactions</td>
<td>1–4 months</td>
<td>Infants discover actions involving their own bodies by accident, then learn by trial and error to repeat the actions until they become habits (schemes).</td>
<td>At first thumb comes to mouth by accident. Through trial and error, infants learn to reproduce the event until a thumb-sucking scheme becomes established.</td>
</tr>
<tr>
<td>3. Secondary Circular Reactions</td>
<td>4–10 months</td>
<td>Infants discover actions involving objects in the environment by accident, then learn by trial and error to repeat them until they become habits (schemes).</td>
<td>Holding a rattle, an infant might accidentally shake the rattle and enjoy the noise. Through trial and error, the infant learns to reproduce the event until a shaking scheme becomes established.</td>
</tr>
<tr>
<td>4. Coordination of Secondary Schemes</td>
<td>10–12 months</td>
<td>Infants intentionally put two schemes together to solve a problem or reach a goal. Intentionality is a new feature—these new behaviors are no longer discovered by accident.</td>
<td>An infant sees a toy behind a box, pushes the box aside, then reaches for the toy. The infant intentionally combined pushing and reaching schemes to reach the goal (the toy).</td>
</tr>
<tr>
<td>5. Tertiary Circular Reactions</td>
<td>12–18 months</td>
<td>Babies are curious about objects in the world and explore them in a trial-and-error fashion, trying to produce novel reactions.</td>
<td>A baby drops a ball from shoulder height and watches what happens. The baby then explores the dropping scheme by dropping the ball from hip height, then head height, then knee height, observing each new result.</td>
</tr>
<tr>
<td>6. Transition to Symbolic Thought</td>
<td>18–24 months</td>
<td>Toddlers begin to form symbolic representations of events, showing the beginnings of mental thought. Representations still tend to be physical (rather than purely mental), as when toddlers use their own body movements to represent movements of objects in the world.</td>
<td>A 1½-year-old girl would like to open the lid of a box; to think about this, she opens and closes her hand repeatedly. Rather than working directly on the box, she first uses her hand motion as a way to “think” about how to open it. She is thinking about the box using a symbolic representation (her hand).</td>
</tr>
</tbody>
</table>
Moving through Sensorimotor Stage

1. Infants move from interacting reflexively, trial & error, deliberate and intentional actions with the environment.
2. Child develops mental representations of objects, events, and people.
How can parents tell that an infant has achieved representational thought?

1. **use of language** - words represent things
2. **deferred imitation** — child observes a behavior and imitates it later
3. **object permanence** — objects continue to exist when they are out of sight

2 years
Language Development

Key features of human language

- **Semanticity**: represents thoughts, objects, events through specific abstract symbols
  
ex: “baby” doesn't look or sound like a real baby

- **Productive**: unlimited number of things that can be said and understood

- **Quality of Displacement**: communicate about things that are distant in time or space, or are impossible or non existent
Language Development

- **comprehension** – what is understood (receptive)
- **production** – what is said (expressive)

Young children often understand more than they can produce.

Most researchers agree that humans have a strong instinct to acquire language.
Language Development - Theories

Learning Theory (nurture)

- Skinner (operant conditioning)
- Bandura (imitation)
  - language is learned like any other skill
  - sounds that resemble words are reinforced - non word sounds are ignored (dada- gaga)
  - adults model and expand language

Criticism

- adults are inconsistent in reinforcement
- adults are often poor language models
- children say things that they have not heard
Language Development - Theories

Nativist Theory (Nature) (Noam Chomsky)
- humans born with LAD (language acquisition device) – specialized brain area
- predisposition to pay attention to certain aspects of language
- language develops in consistent pattern in almost all humans regardless of environment

Criticism
- no single area in brain responsible for language
- adults do provide feedback and correction
- language skills do not develop without appropriate environment
Language Development - Theories

Cognitive (Piaget)
- children develop language when they need symbols to represent objects

Social Interactionist
- language is the result of biological disposition and social interaction
- children seek out interactions
- adults provide feedback, expansions, formats, labels, child directed speech
How Language Starts

1. perception of sounds
   babies recognize differences between speech sounds
2. use of sounds to communicate
### TABLE 5.3 The Development of Speech Sounds in Infancy

<table>
<thead>
<tr>
<th>AGE</th>
<th>TYPE OF SPEECH SOUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>• Vegetative and undifferentiated sounds: Reflexive, nonintentional sounds such as crying, burps, sneezing, coughing</td>
</tr>
<tr>
<td>2 months</td>
<td>• Greater variation in cries</td>
</tr>
<tr>
<td></td>
<td>• Cooing to indicate comfort and pleasure</td>
</tr>
<tr>
<td>4 months</td>
<td>• Distinctive cries to signal specific states</td>
</tr>
<tr>
<td></td>
<td>• Cooing and laughing</td>
</tr>
<tr>
<td>5 months</td>
<td>• Transitional babbling: Single syllables with one consonant and one vowel sound (“ma”)</td>
</tr>
<tr>
<td>6 months</td>
<td>• True babbling: Repeated vowel-consonant pair (“mamama”)</td>
</tr>
<tr>
<td>8 to 12 months</td>
<td>• Echolalia: Immediate imitation of words</td>
</tr>
<tr>
<td>9 to 18 months</td>
<td>• Variegated babbling: Multiple, differing syllables (“bapadaga”)</td>
</tr>
<tr>
<td></td>
<td>• Jargon babbling: Babbling that includes native language intonation patterns, rhythms, and stresses</td>
</tr>
<tr>
<td></td>
<td>• Protowords: Consistent sound patterns used to refer to specific objects and events</td>
</tr>
<tr>
<td>One year</td>
<td>• First true words, usually accompanied by gestures, babbling, and/or protowords</td>
</tr>
</tbody>
</table>

(Adapted from Hulit & Howard, 1997)
First words

- combination of real words, protowords (baba) gestures and babbling for several months
- average child says 50 words by 18 months – usually names of favorite things
- fast mapping – some understanding of word after only one exposure
- errors do occur
  - Overextension- parrot are all birds
  - Underextension- parrot is only their bird
First words

*Holoprase* – single word used by child to communicate idea or sentence
Example: “up?” meaning – “I want you to pick me up!”

Two-three word sentence
Examples: “no ball”, “me go”

*Telegraphic Speech*
Examples: “I play ball”
beginning understanding of grammar, word order