Information Processing

- The Information Processing Approach
- Attention
- Memory
- Thinking
- Metacognition

What Is the Information-Processing Approach?
- Focuses on ways people process information about their world
  - Manipulate information
  - Monitor it
  - Create strategies to deal with it
  - Effectiveness involves attention, memory, thinking
Computers and Human Information Processing

- Encoding: Mechanism by which information gets into memory
- Automaticity: Ability to process information with little or no effort
- Strategy Construction: Discovering new procedure for processing information
- Metacognition: Cognition about cognition, or “knowing about knowing”
Comparisons With Piaget’s Theory

<table>
<thead>
<tr>
<th>Piaget</th>
<th>Information Processing</th>
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<tbody>
<tr>
<td>• Constructivist</td>
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<tr>
<td>• Cognitive capabilities and limits at points in development</td>
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<tr>
<td>• Development occurs abruptly in distinct stages</td>
<td>• Individuals develop gradually increasing capacity for information-processing</td>
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Speed of Processing Information

• Assessed using reaction time tasks
• Changes in speed processing
  – Improves dramatically through childhood and adolescence
  – Changes due to myelination or experience?
  – Decline begins in early adulthood; continues in middle and late adulthood
Does Processing Speed Matter?

- Linked with competence in thinking
- For many everyday tasks, speed is unimportant
- Efficient strategies can compensate for slower reaction times and speed
- Slower processing may be responsible for linking IQ and mortality

What Is Attention?

- Focusing of mental resources
- Three ways attention can be allocated
  - Sustained attention
  - Selective attention
  - Divided attention

Types of Attention

<table>
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<tr>
<th>Attention</th>
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<tr>
<td>Sustained Attention</td>
<td>State of readiness to detect and respond to small changes occurring at random times in environment; also called vigilance</td>
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<tr>
<td>Selective Attention</td>
<td>Focusing on specific aspect of experience that is relevant while ignoring others</td>
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<tr>
<td>Divided Attention</td>
<td>Concentrating on more than one activity at a time</td>
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Infancy

- Newborns can detect contours and fixate
- 4-month-olds have selective attention
- Processes closely linked to attention
  - Habituation: decreased responsiveness to stimulus after repeated presentations
  - Dishabituation: recovery of a habituated response after change in stimulation

Childhood and Adolescence

- Most research on selective attention
- Cognitive control of attention shows changes
  - Preschooler attends to external salient stimuli
  - Child of 6 to 7 attentive to relevant information
  - Ability to shift attention increases with age; allows for more complex task involvement

Adulthood

- Older adults may not be able to focus on relevant information as effectively as younger adults
- Less adept at selective attention
- Older adults (50-80) performed worse in the divided attention condition than two younger groups
What Is Memory?

- Retention of information over time
- Allows humans to span time in reflection over life’s activities
- Memory has imperfections

Processes of Memory

1. Encoding
   - Getting information into memory
2. Storage
   - Retaining information over time
3. Retrieval
   - Taking information out of storage

Constructing Memories

- **Schema theory**
  - Many reasons why memories are inaccurate
  - People construct and reconstruct memories; mold to fit information already existing in mind
  - **Schemas**: mental frameworks that organize concepts and information; affect encoding and retrieval
False Memories

- New information such as questions or suggestions can alter memories
- Concerns about
  - Implanting false memories in eyewitnesses
  - Accuracy of eyewitness testimonies at trials
- Culture and gender linked to memory

Infancy

- **First Memories**
  - Rovee-Collier infant memory experiments
- **Implicit memory**: memory without conscious recollection; skills and routine done automatically
- **Explicit memory**: conscious memory of facts and experiences; doesn’t appear until after 6 months

Infancy

- **Infantile Amnesia**
  - Adults recall little or none of first three years
  - Also called childhood amnesia
  - Due to immaturity of prefrontal lobes in brain; play important role in memory of events
Childhood Memory

- Considerable improvement after infancy
- **Short-term memory** — memory span for up to 15 to 30 seconds without rehearsal
- **Working memory** — kind of mental **workbench** for manipulating and assembling information
  - Make decisions, solve problems
  - Comprehend written and spoken language

Childhood Memory

- **Long-term memory** — relatively permanent and unlimited type of memory
- Children as eyewitnesses
  - Age differences in susceptibility
  - Individual differences in susceptibility
  - Interviewing techniques can cause distortions; determines if child’s testimony is accurate

Working Memory Model

![Working Memory Model Diagram](image)
Long-Term Memory Strategies

- Activities to improve information processing
  - **Rehearsal** — repetition
  - **Organizing** — trying to group related information
  - **Imagery** — creating mental images
  - **Elaboration** — engaging in more extensive processing of information

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Imagery and Memory of Verbal Information

![Bar graph](image)

**Fig. 7.9**

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Fuzzy Trace Theory

- Memory best understood by considering two types of memory
  - **Verbatim memory trace**: precise details
  - **Gist**: central idea of information
- **Knowledge**
  - Influences what people notice and how they organize, represent, interpret information
Working Memory and Processing Speed

- Working memory performance peaked at 45 years of age, and declined at 57 years of age.
- Decline affected both new and old information.
- Working memory linked to:
  - Reading and math achievement.
  - Processing speed.

Explicit Memory

- Part of long-term memory; declarative memory.
  - Episodic memory—retention of information about where and when of life’s happenings.
  - Semantic memory—one’s knowledge about world.
    - Fields of expertise.
    - General academic knowledge.
    - “Everyday knowledge.”

Aging and Explicit Memory

- Younger adults have better episodic memory than older adults.
- Older adults remember older events better than more recent events; take longer to retrieve semantic information.
  - Older the semantic memory, the less accurate it is.
Memory for Spanish as a Function of Age Since Spanish Was Learned

Aging and Implicit Memory
- Memory of skills and routines, also called procedural memory
- Less adversely affected by aging than explicit memory

Source Memory
- Ability to remember where something was learned
- Contexts of
  - Physical setting
  - Emotional setting
  - Identity of speaker
- Failures increase with age in adult years; relevancy of information affects ability
Prospective Memory

- Remembering to do something in the future
- Age-related declines depend on task
  - Time-based tasks decline more
  - Event-based tasks show less decline

Influences on the Memory of Older Adults

- Physiological and psychological factors
- Health
- Beliefs, expectations, and feelings
- Education, memory tasks, assessment
- Memory training
  - Method of loci
  - Chunking
  - Increasing attention

Fig. 7.12 Memory, Age, and Time of Day Tested (A.M. or P.M.)
What Is Metacognition?

- Knowledge about when and where to use particular strategies
- **Metamemory**—knowledge about memory
- **Theory of mind**—thoughts about how mental processes work

The Child’s Theory of Mind

- Ages 2 to 3 — begin to understand
  - Perceptions
  - Desires
  - Emotions
- Age 5 — realization of false beliefs
- Middle and late childhood — mind seen as active constructor of knowledge

Developmental Changes In False Belief Performance

![Graph showing developmental changes in false belief performance](Fig. 7.14)
Metamemory in Children

- Limited in children
- Preschoolers have
  - Inflated opinion of memories
  - Little appreciation for importance of memory cues
- Understanding of memory abilities and skill in evaluating performance improves considerably by 11 to 12 years of age

Metacognition in Adolescence and Adulthood

- Adolescents more likely than children to manage and monitor thinking
- Middle age adults have accumulated a great deal of metacognitive knowledge
- Older adults tend to overestimate memory problems they experience on daily basis