Assumptions of information-processing approaches

- Limited capacity to working memory
- $7 \pm 2$ (George A. Miller, 1957)

What Changes?

- Speed of processing
- Capacity
- Efficiency of processing
- Strategies
- Attention
- Knowledge

Children’s Knowledge Base and Cognitive Development

- Experts and Novices
- Chi: Chess
- McPherson & Thomas: tennis players

Information Processing System

- Atkinson-Shiffrin (1968) multistore models of memory
- Sensory register
- Short-term memory (now working memory)
- Long-term memory
- Control Processes
- Response Generator
Changes in children’s information processing: “How many are there?”

Atkinson & Shiffrin

Short term store (working memory)

- Memory span: digit span increases with age
- Knowledge base helps
  - Chi: Chess players
- Strategies help
- Developmental differences in articulatory loop (Baddeley): with age, digits faster

Speed of processing

- Changes with age
- Necessary but not sufficient to increase processing time for younger children
- Possible explanation: myelination

Capacity models of cognitive development

- Pascua-Leone: M-space
- Halford, Case
- What changes: mental capacity
- Applications?
  - Simply: omit nonessential elements

Efficiency of processing

- What changes?
  - Not absolute capacity, but efficiency with which capacity is used
- Case: age-related declines in the amount of mental effort
  - storage space
  - operating space
- when operating space decreases, more storage space available

Metacognition is influenced by availability of resources

- Influences
- Domain-specific strategies
- Context independent strategies
What changes?

- Knowledge
- Metacognition
- Speed and efficiency of processing

1. Discuss the rule of strategies in cognitive development. Describe the course of developmental change in the use of strategies.

Strategy Deficiencies

- Production Deficiencies (Flavell)
  - Helps if prompted to use
  - Not spontaneously used
- Mediational Deficiencies (Reese)
  - even if you teach it
  - it doesn't help
- Utilization Deficiencies (Miller)

Utilization Deficiencies (Miller)

- Even when children begin to use helpful strategy
- It may not help!
- May use too many resources? (Bjorklund & Harnishfeger)

What are production deficient children doing?

- Other, nonhelpful strategies
- DeLoache & Brown
  - Selective attending
  - Spontaneously labeling
  - External memory cues
  - Looking or pointing at hiding place

Knowledge and Strategies

- Knowledge influences
- Availability of resources
- Speed and efficiency of processing
- Domain specific strategies
- Context independent strategies, which influence task performance
The cost of strategy use

- Strategies cost mental capacity
- Insufficient left to improve performance

Applications
- Teach strategies with very familiar material
- Insure sufficient practice to reduce mental capacity required

Processes

- Automatic
- Effortful

What changes with development?

- With practice, automaticity
- Only some kinds of practice produce automaticity
- Embedded practice doesn’t help

Applications

- Appropriate timing for drill
- Practice that’s non conceptually grounded does not help!
- Bugs need to be identified before they’re automatized
- Assessing automaticity is clue for increasing complexity of task
  - Baratta-Lorton: from counting to adding

Automatic strategies

- Require no mental effort
- Not available to consciousness
- Do not interfere with other processes
- Do not improve with practice
- Do not vary with individual differences in intelligence, motivation, or education

Effortful strategies

- Require mental effort
- Are available to consciousness
- Interfere with other processes
- Improve with practice
- Vary with individual differences
Process activities take all one’s attention…

Once skill is automatized—it’s hard to recall the steps!

Applications?

- Sequential or simultaneous practice
- Complex skills require automatization of simpler components
- 16-year-olds: drive with the radio off and without passengers!

Multiple Strategy Use

- Siegler’s waves: no one strategy dominates
- Example:
  - 53 + 74
  - 89 + 76
  - 76 + 89
  - 76 + 90
- Did you use the same strategy?

Siegler’s strategy choice model

3. Describe the principles of fuzzy-trace theory; discuss the strengths and limits of fuzzy trace theory over traditional information processing.
Fuzzy trace theory

- Intuitionism
- People prefer to think processing inexact "fuzzy" memory representations
- Younger children: literal, verbatim representations (Brainerd)
- Older children & adults: fuzzy, imprecise, gistlike traces

Advantages of Fuzzy Traces

- Fuzzy traces more easily accessed
- Generally require less effort to use
- Less susceptible to interference
- Less susceptible to forgetting

4. Describe the development of children’s attentional abilities; support with evidence.

Attention

- Sustaining Attention
- What change?
- Increases in focused attention
- More ability to resist distractions
- More ability to inhibit task inappropriate thoughts

Application?

- Eliminate extraneous
- Help children focus

Selective Attention

- What changes?
- Incidental memory decreases (Hagan)
- Applications
- Avoid distractions
- Older children (Schiff): learn only what told to learn
Attentional Strategies

• Vurpillot (Paris)
• Children under six different from 6 to 9
• Older children
  – Increase with age of extent of time and space of range of perceptual activity
  – More systematic
  – More efficient

Applications

• Impact of reading? Left to right, top to bottom
• Craft, copying activities
• Conceptual Tempo
• Older children more reflective

Application

• Simultaneous vs sequential tasks (Gallini)
• When learning involves comparison of counterexamples that are similar
• Same superordinate, different coordinate
• Hierarchical learning (Tennyson)
  – Positive or negative
• Matrix learning (Kiewra)

Resistance to Interference: Hypothesized developmental changes

Dempster (Bjorklund, p. 149)
2. Compare and contrast information processing perspectives with Piaget's theory. Which approach do you find more useful in describing, explaining, and predicting cognitive development?

Recent critiques

- Parallel models
- Multiple stores

What causes changes?

- Little progress on mechanisms for development
- Simple models will just not do for developmental psychology
- Serious theorizing about basic mechanisms of cognitive growth has actually never been a popular pasttime

Newell (1990)

I have asked some of my developmental friends where the issue stands on transitional mechanisms. Mostly they said that developmental psychologists don’t have good answers. Moreover, they haven’t had the answer for so long now that they don’t very often ask the question anymore not daily, in terms of their own research.

Next week

- Chapter 7: Representation
- Greenhoot (Meagan)