The Structure and Function of Human Memory

- Encoding: Moving it into working memory
  - The “tape loop” and the “sketch pad”
  - Developmental changes
- Storage: A permanent home?
  - What’s the code?
  - How young children remember events
  - Forgetting and interference
- Retrieval
  - Context effects
  - Developmental changes
Encoding Information: The Verbal and the Spatial

- The Phonological Loop
  - Interference in remembering:
    - real/nonsense words > instrumental music > pulsed noise = 0
  - Word-length effect
- Visuo-spatial sketch pad
  - Records relative positions of parts and objects; orientation & distance/size
  - Excellent recognition memory!
    - Development of integration of visual recognition or retrieval and verbal retrieval: Little research
      - (But relevant to education!)
Features of phonological WM

- How large is the loop?
  - Miller: “magic number” 7 ±2  ...units of what?
  - Chunks: meaningful units of information:
    2 9 5 3 8 4 1 0 5 2 6 9
    1 4 9 2 1 7 7 6 2 0 0 0

- How long do chunks stay in the loop?
  - Up to 1 min

- What gets lost from the loop?
  - Serial position effects: Primacy and recency
  - (How do “implicit memory” effects affect our understanding of “what gets lost?”*)
Developmental Changes in Memory

- Maturational changes:
  - Processing speed? Capacity?

- Chunks get larger with age (why?)
  - Effects of knowledge acquisition

- Encoding relevant information improves w/age
  - Susceptibility to interference...

- Encoding strategies
  - Rehearsal
  - Other strategies: elaboration; association; external

- Storage & retrieval

- Metamemory
Content Knowledge and Memory: Facilitating Effects of Familiarity

- **Can knowledge increase working memory?**
- Knowledge and development:
  - **Lindberg:** Two lists of words to recall:
    - “Adult” words: window; magazine; island; Baroque
    - “Child” words: Red Rover, Star Wars, Mrs. Williams
  - *Results?*
- Conclusion: Familiarity aids recall
Ericsson: The Case of S.F.'s STS

Task: recall strings of random numbers
Lindberg results...

<table>
<thead>
<tr>
<th></th>
<th>Adult words</th>
<th>Child words</th>
</tr>
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<td></td>
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Legend:
- Red: Adult words
- Blue: Child words
Interference and Memory

Task (Hagen): recall where *animals* are

- 1st graders
- 5th graders

Bar chart showing recall performance with categories for animals and furniture.
Developing Strategies for Encoding: Rehearsal

- Training: 5-yr-olds learn to rehearse but don’t persist
  - Spontaneous rehearsal: 10% 5-yr-olds; 85% 10-yr-olds
- Is rehearsal effective?
  - Increases 5-yr-olds’ recall, BUT low quality
- Concept: *Utilization Deficiency*
Other strategies

- Elaboration
- Organization:
  - Learning useful schemes (e.g., alphabet) vs. learning to use them (i.e., utilization)
- External Aids:
  - Retrospective and Prospective memory
    - Using symbols for recall (Vygotsky!)
Eskritt & Lee: Using symbols to recall

- Concentration: 1st, 3rd, 5th, 7th-graders
- Opportunity to use notations: What makes notations useful?
Development of Storage

- What is remembered?
  - Schemas: taxonomies; scripts; models?
  - Distributed patterns of activation & association

- Do young children remember events?
  - Bauer: 1-year-olds recall events after months
  - Toddlers/preschoolers: How we talk to them about events shapes their memory
Development of Recall/Retrieval

- Recalling events: Older children report more
  - Children might not know what adults want to hear
    - Tend to report prosaic rather than distinctive details
- What do children know about their memories?
  - Source monitoring: “Where did I learn that?”
  - Knowing limits: “How hard will it be to recall?”
Development of metamemory

- Knowing own limitations on memory
  - prospective memory: crucial for self-regulation in school
- Knowing strategies and why they work
- Knowing conditions that affect learning and retrieval
  - e.g., effects of distraction
- Metamemory closely tied to academic and study skills
  - Link to expert thinking! (ch. 4) - e.g., novice/expert
Summary/Review

- Developmental changes in:
  - Encoding
    - what changes?
  - Storage
  - Retrieval
  - Metamemory

- Connected to school performance; expertise & knowledge; problem-solving