COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

Science of Psychology

PSY W1001 Section 2
MW 8:40-9:55 Fall 2012

Monday, October 1

Memory

Announcements

- Exam #1 on Wednesday
  - Exam begins at 8:30
    - Please be here on time
    - Late arrivals do not get extra time
  - Bring your ID to turn in your exam
  - Read the exam policies carefully.
- Short answer questions are graded.
  - Review your comments
- Any questions from the last lecture?

What is memory?

- Differentiating among types of memories
  - Capacity
  - Type of information

Encoding, Storage, Retrieval

- Any act of memory requires success at three aspects:
  - The acquisition of knowledge
    - Encoding
  - Creation of a memory trace
    - Storage of knowledge
  - Ability to use the knowledge
    - Retrieval for use

Acquisition of Memory

- Methods of encoding
  - Elaborative
  - Visual Imagery
  - Organizational

Processing and Memory

- Elaborative Encoding - Depth of processing
  - Deep processing:
    - Meaning-based attention
    - Anything that connects new information to already-learned material
    - Material that "makes sense" will be encoded more efficiently
    - Results in superior recall
- One group of participants is asked to decide if each word on a list has the letter "p" in it. Another group is asked if the word is concrete or conceptual (tree versus ethical). Which group should remember more of the words?

Hint: You should be able to identify the independent and dependent variables from this design.

Other encoding methods

- Visual Imagery Encoding
  - I'm going on a picnic and in my basket I'm taking…..
    - Using visual imagery of each item on the picnic table aids in recall

- Organizational Encoding
  - Information that is categorized is better remembered.
    - More likely to recall items in categories.

Evidence for separate methods

- Premise: different encoding methods represent unique processes
- Evidence:
  - If the processes are unique we should be able to demonstrate non-overlapping activity
    - Elaborative encoding
      - Activation in left temporal lobe and lower left frontal lobe
    - Visual Imagery
      - Activation in visual cortex
    - Organizational encoding
      - Activation in upper left temporal cortex

Memory as an active process

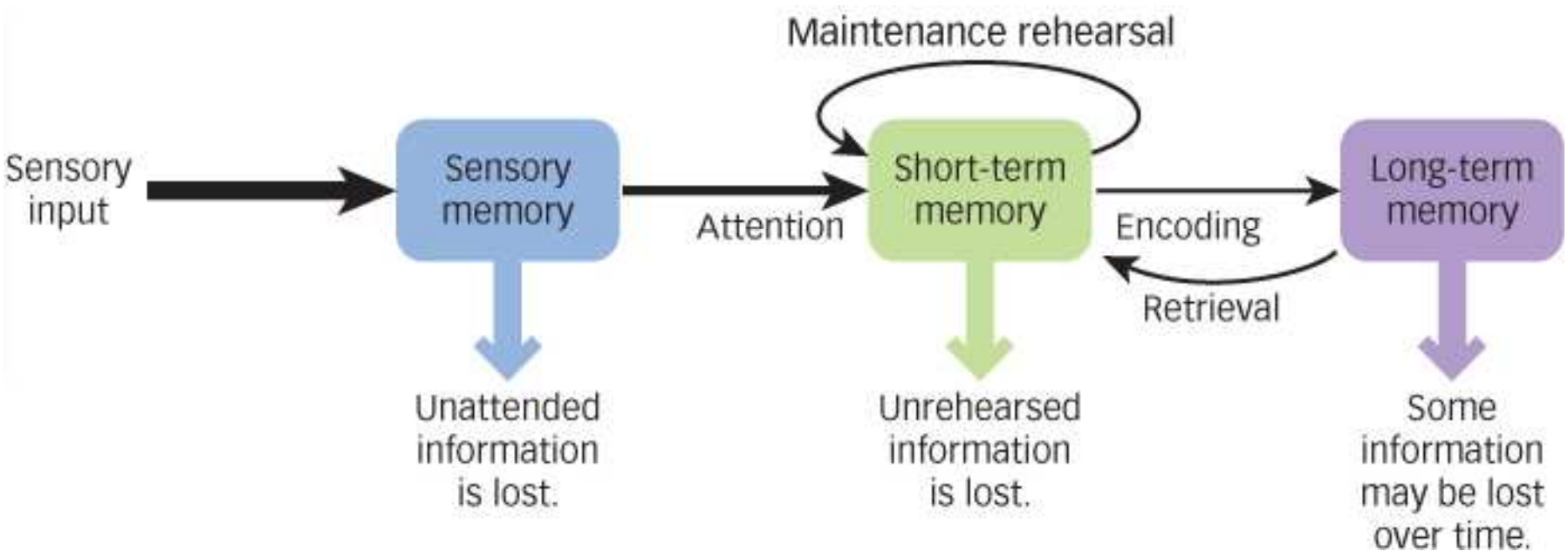
- We actively process the information in our memory system
- Storing the memory is an active process, not a recording on a video tape.

- How do we process the information in preparation for storage?

The Stage Theory of Memory

- Different types of memory, each with different properties
  - Sensory Memory
  - Short Term Memory
    - Smaller storage capacity
  - Working memory
    - Instantly accessible information
    - "Loading Dock"
  - Long-term memory
    - Less instantly accessible
    - Presumed to have infinite capacity

The Flow of Information through the Memory System



Storage Capacity

- Long term capacity: limitless
- Working capacity: more modest
- Memory span: way of measuring working memory capacity
  - Random, unrelated information
    - "the magic number 7" $\pm$ 2

"Mr. Osborne, may I be excused? My brain is full."

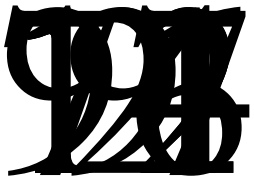
Working Memory

- "Loading platform" analogy
- Long term memory must be "loaded" or "pass through" WM
- How does it move? How is it transformed into Long term memory?
  - Rehearsed
  - Chunked

Chunking Memory

- Try to recall the following list of digit in order

Chunking Demonstration



Chunking Demonstration

Chunking Demonstration

- The digits are the same

  14921776911212

- But if you put them into larger, more meaningful units……

  1492 1776 911 212

…you can keep your 7± 2 items but hold more individual pieces.

Storage - permanent

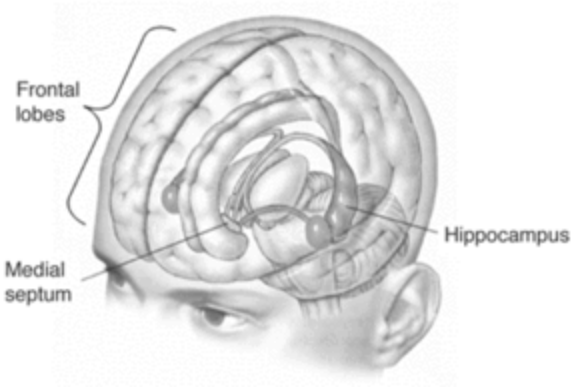
- Once encoded, must be stored until needed
- Record: *memory trace* or the *engram*
- Storage process difficult to research
  - Memory is NOT stored in a single location
    - Different aspects of a memory are stored in different brain structures
- Neuroscience is working to understand the changes in the brain that accompany memory storage
  - Possible mechanism is LTP

Storage requires consolidation

- Consolidation: the *engram* is created over time (several hours usually)
  - Achieved through some aspect of protein synthesis and neural reorganization
- Evidence for consolidation?
  - Retrograde amnesia: a blow to the head can interrupt the process of consolidation for events that happened 1-2 hours *before* the accident occurred
  - Memory for events during that time period is lost
    - Appears to be completely gone – no evidence of prior learning, events, etc.
- Sleep also essential for consolidation

Hippocampus and Memory

- HM
- Hippocampus and memory consolidation
  - Index for memory retrieval and storage?
- Anterograde versus retrograde amnesia



Retrieval

- Must be able to *access* the memory when needed
- Inadequate coding → failure to retrieve
- Cues for retreival
  - With an adequate *retrieval cue*, sometimes can retrieve memory believed to be "lost"
    - Can you remember your friend's dog's name now? When you see the dog?
- Retrieval cues
  - Links between *engrams* are activated
  - Context reinstatement

Cued Retrieval

- Give me a hint….
  - Encoding specificity
  - State dependency
  - Transfer appropriate

Study Questions

- Define each of the stages of memory
- Define each of the following parts of memory: acquisition, storage and retrieval
- Discuss the role of encoding in the acquisition of a memory
- What are 3 methods of encoding? Give an example of each.
- Describe the experiment that demonstrates differences in memory based on depth of processing. Be sure to identify the independent and dependent variables, and the operational definition of each.
- Are these methods of encoding the same basic process? If not, is there evidence to suggest that each of these encoding strategies are unique processes?
- What is the storage capacity of short term memory?
- What is the storage capacity of long term memory?
- What is working memory?
- What does the demonstration of chunking tell us about the storage capacity of. short term memory?
- What is memory consolidation?
- Describe how studies of retrograde amnesia support the phenomenon of memory consolidation.
- What is the role of the hippocampus in memory consolidation? Provide evidence for this premise from the patient HM.
- What is retrieval? Discuss the role of cues for retrieval.