

Memory

8 4 5
6 9 1
3 7 2

You have to begin to lose your memory, if only in bits and pieces, to realize that memory is what makes our lives. Without it, we are nothing.

- Luis Buñuel

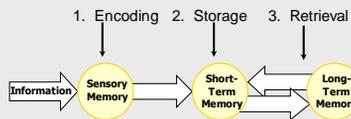
What is Memory?

- **ABILITY TO RECALL**
- **STORAGE SYSTEM**

I. How Does the Memory Process Begin?

A. The brain as Information Processor

Three Processes



B. Encoding

- Organizing sensory information so nervous system can process it
 - Visual
 - Auditory
 - Olfactory
 - Etc.

B. Encoding

1. Attention is important
 - Divided attention interferes with encoding
2. Levels of Processing
 - Brain encodes information in different ways or on different levels
 - Craik and Lockhart (1972)
 - Deeper processing leads to deeper memory

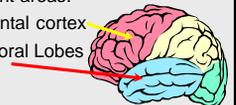
3. Neuroscience and Encoding

- PET and fMRI used to study neurobiological bases
- Two important areas:
 - a. Prefrontal cortex
 - Left: Encoding new memories
 - Right: Retrieving old memories

3. Neuroscience and Encoding

Two important areas:

- a. Prefrontal cortex
- b. Temporal Lobes



Anterior Medial (front middle) temporal lobes active during encoding of associations

3. Neuroscience and Encoding

- PET scans show more of brain is activated when encoding fact-based information than when listening passively
 - Regions of the:
 - Prefrontal Cortex
 - Thalamus
 - Temporal Cortex
- Consistent with levels-of-processing view

II. Types of Memory Storage

Storage is:

- **Process** of maintaining or keeping information readily available
- **Locations** where information is held
 - **Memory stores**

II. Types of Memory Storage

A. Sensory Memory

- Performs initial encoding
- Very brief storage
- Two types
 - Iconic Memory 
 - Echoic Memory 
- Info must get to STM or is lost
- Why do we need sensory memory?

II. Types of Memory Storage

B. Short-Term Storage

- Holds information for processing
- Fragile
- Other terms:
 - Short-term Memory (emphasizes duration)
 - Working Memory (emphasizes active nature)

B. Short-Term Storage

1. Early Research on STM
 - a. Duration
 - Max = 30 sec
 - b. Capacity
 - 7 items, ± 2
 - But...what is an *item*?

Memorize the following list of numbers:

186119141941

Write down the numbers in order.

Now, try again...

1861 1914 1941

149162536496481100121144

1. Early Research on Short-Term Memory

- c. Rehearsal
 - Verbalizing or thinking about info to keep it active in memory
 - Two types:
 - Maintenance rehearsal
 - Elaborative rehearsal
 - example...



B. Short-Term Storage

- 2. The Emergence of Working Memory
 - Temporarily holds current or recent information for immediate or short-term use
 - Does not simply store information
 - Information is maintained for 20–30 seconds while active processing (e.g., rehearsal) takes place

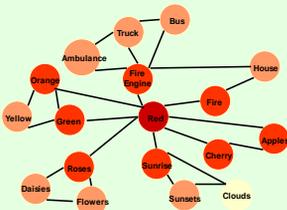
II. Types of Memory Storage

- C. Long-Term Memory
 - Relatively permanent record of memory
 - Stored indefinitely
 - Capacity seems unlimited
 - Several different types

C. Long Term Memory

- 1. Types:
 - a. Types based on content
 - i. Procedural
 - ii. Declarative
 - a) Episodic
 - b) Semantic
 - b. Types based on awareness
 - i. Explicit
 - ii. Implicit

Semantic Networks



C. Long Term Memory

- 2. Practice and Storage
 - Two types:
 - Massed practice
 - Distributed practice
 - Studies show distributed is best

II. Types of Memory Storage

- D. Neuroscience and Storage
 - Hippocampus and medial temporal lobe involved in explicit memory
 - The case of H.M.

H.M.

An MIT faculty member writes, "He is considered the most important patient in the study of the human brain, known worldwide only by his initials, H.M. In death, we learned his name. He was Henry Gustav Molaison. He died December 2, 2008, at the age of 82, after living for most of his life in a state of permanent amnesia.



H.M.

"Over 55 years, he's credited with helping scientists unlock secrets of how we form memories. When he was 27, Mr. Molaison underwent brain surgery to cure a seizure disorder, and that surgery left him unable to form new memories of his own.



H.M.

"He and his court-appointed guardian...agreed to donate his brain for future study. The result was a far better understanding of how our brains makes new memories, and researchers were able to tease out the differences between short-term and long-term memory creation."



III. Retrieval

- The process by which stored information is recovered from memory
 - Depends on
 - How retention is measured
 - How information is encoded and stored

III. Retrieval

- A. Retention: Measures of Retrieval
Three types of tasks:
1. Recall
 - Free recall
 - Serial recall
 - Paired associate
 2. Recognition
 3. Relearning

III. Retrieval

D. Flashbulb Memories

- Detailed memory for events surrounding a dramatic event
- 
- Vivid
 - Remembered with confidence

D. Flashbulb Memories

- Brown and Kulik (1977)
 - Special type of memory for highly emotional events
 - Makes them especially accurate

D. Flashbulb Memories

- Other psychologists disagree
 - Not a special mechanism
 - Emotional component makes these memories
 - More distinctive (affecting encoding)
 - More often rehearsed (helps retrieval)

D. Flashbulb Memories

- Research shows that flashbulb memories
 - Are vivid
 - Are far from accurate
 - Can change over time

III. Retrieval

C. What Facilitates Retrieval?

1. Primacy and Recency Effects

a. Primacy Effect

- Better memory for items at the beginning of a list
- Better attention
- More time for rehearsal

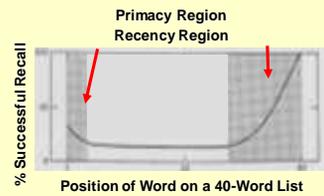
1. Primacy and Recency Effects

b. Recency Effect

- Better memory for items at the end of a list
- Items still in short-term storage

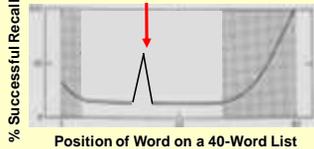
c. Serial Position Curve

Serial Position Curve



Serial Position Curve

How do we explain this?



1. Primacy and Recency Effects

• Exception:

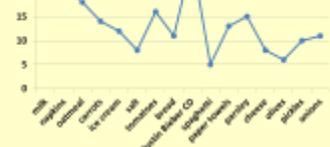
• Von Restorff effect

- Occurs when recall is better for a distinctive item, even if it occurs in the middle of a list

Serial Position Curve

• Does our data support the research on the subject?

• How might this variation be explained?



C. What Facilitates Retrieval

2. Imagery

- The creation of a mental picture of a sensory or perceptual experience
- Important memory aid
- Preserves perceptual information that might otherwise decay

IV. Forgetting

A. Early Studies

1. Hermann Ebbinghaus (1850–1909)

- First to study memory scientifically
- Nonsense syllables
- Recorded how many times he had to study a list to remember it well
- Relearning

1. Hermann Ebbinghaus

- Forgetting curve
- 50% lost in first 20 minutes



A. Early Studies

- Current explanations center on reconstructive nature of memory
 - Memory formation often relies on a schema
 - We cannot remember all details of an event
 - Schemas help fill in the missing details

IV. Forgetting

- B. Key Causes of Forgetting
- 1. **Decay** of Information
 - The loss of information from memory due to disuse and passage of time
 - Disintegration of a physiological **memory trace**
- 2. Interference in Memory
 - The suppression of one bit of information by another

2. Interference in Memory

- Two types of interference
- a. **Proactive interference**
 - Old information interferes with ability to learn new information
- b. **Retroactive interference**
 - New information interferes with ability to recall old information

B. Key Causes of Forgetting

- 3. Interference with Attention
 - Likely causes absentmindedness
 - Encoding failure
 - **Divided attention**
 - Problem for both encoding and retrieval
 - More of a problem during encoding

IV. Forgetting

- C. Special Types of Forgetting
- 1. Eyewitness Testimony
 - Both jurors and judges place high confidence in eyewitnesses
 - Research shows eyewitnesses are often inaccurate
 - Loftus' (1975, 1979) research
 - » Demonstrated memory distortion may be caused by the wording of a question

1. Eyewitness Testimony

- Demonstrates the misinformation effect
- High motivation to remember an event can actually distort it
- Accuracy and confidence are uncorrelated
 - Speed of identification is a better indicator of accuracy than confidence

C. Special Types of Forgetting

- 2. Motivated Forgetting
 - Occurs when frightening, traumatic events are forgotten because people *want* to forget them
 - First suggested by Freud (1933)
 - Believed such memory loss occurred through repression
 - Underlies the debate on recovered memory

2. Motivated Forgetting

- Difficult to study in the lab for ethical reasons
 - Researchers have successfully created false memories of non-traumatic events
 - Neither repression nor trauma are necessary to create false memories
- Many psychologists are critical of the use of "recovered" repressed memories in child abuse cases

Point – Counterpoint

Are Recovered Memories Real?
YES

- Memories may be repressed and then consciously remembered
- Brain activity is different when people are actively trying to suppress a memory

NO

- Recovered memories are more often false than accurate
- Prevalence of repressed memories has been overestimated

What do you think?

IV. Forgetting

D. Neuroscience and Forgetting: Studies of Amnesia

- Two basic kinds of amnesia
 1. Retrograde amnesia
 2. Anterograde Amnesia
- The existence of different types of amnesia supports the view that memory is extremely varied
- Memory is as much a process as it is an event or thing