

Today: Memory

- Including:
 - 2 memory “threesomes”
 - Several memory “pairs”
 - And 1 famous memory patient
 - That doesn’t sound too hard, does it?
- Knowing about how your memory system functions can help you improve your memory.
- Apply what you learn in this unit!

The first “threesome”: Information processing model of memory 3 Memory Processes

- Encoding (mentally processing information so it can be entered into memory).
- Storage (holding that information for a period of time)
- Retrieval (accessing or recalling stored memories when needed)

The second “threesome”: 3 Types or Stages of Memory

- **Sensory memory** – brief lasting of the sensory experience in our **sensory register**
- **Short-term memory (STM)** or **working memory**-holds information we are actively thinking about; limited in capacity (~ 7 items) & duration (sometimes less than a minute unless we’re actively rehearsing)
- **Long-term memory (LTM)** – held almost permanently; LTM has virtually unlimited capacity. Some lasting change in brain needed for a LTM.

How good is your STM?

On average STM holds about
7 + or - 2 bits of information.

Remember Our Two-Track Mind (Dual Processing)?

How good is your STM?

STM capacity increased by “chunking” – combining separate items into a larger unit.

- Both tracks are involved in memory processes
 - Conscious mind – processes and stores informational memories & life experiences
 - Unconscious mind- stores “motor or skill memories” and “associations” or “links” learned through basic conditioning processes

Two Types of Encoding

- These 2 tracks result in 2 categories of memories:
- **Explicit or declarative** memories that you can consciously recollect & talk about
- **Implicit or nondeclarative** memories – memories that we don't have the same conscious access to, but we know they exist because learning has resulted in a change in behavior/response
- **Some types of memory require Effortful Processing**
 - E.g. learning the functions of brain areas, memorizing a poem or the quadratic equation
- **Some types of memory undergo Automatic Processing (no special effort required)**
 - e.g. classical/Pavlovian conditioning
- **Some memories initially require effortful encoding, but encoding becomes more automatic later on.**

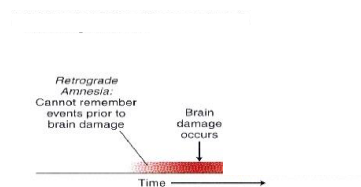
The last " threesome": 3 Types of Long-Term Memories

- **Episodic Memories** (life experiences)
- **Semantic Memories** (information/knowledge/vocab.)
 - (the 2 above often called "**declarative**" memories because we can consciously recollect & talk about them)
- **Procedural Memories** (how to do things and learned body responses) We know "how-to" memories have been stored because you've "improved" but you don't have the same kind of conscious recollection of how your body changed when you learned to ride that bike or how to serve that tennis ball. Procedural memories are largely "**non-declarative**" - you can't completely verbally describe the how-to memory that allows you to ace that serve.
- Cases of memory loss or amnesia support the 2 track memory system and the different categories of memories.

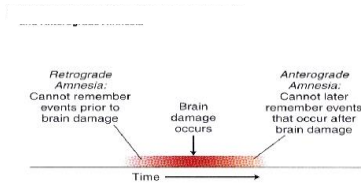
Most Common Amnesia: Retrograde Amnesia

- Head trauma or other *temporary* disruption of normal brain functioning interrupts the storage of recent memories that are still in the process of becoming long-term memories.
- Person loses memories for events that immediately preceded the trauma.

Retrograde Amnesia



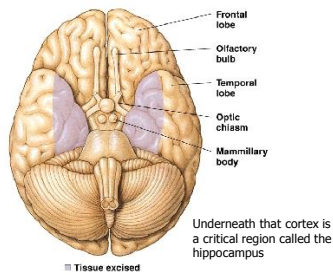
Retrograde vs. Anterograde Loss



Anterograde Amnesia: The Case of H.M.

- H.M. suffered uncontrolled seizures in his hippocampus/medial temporal lobe cortex
- This region was removed in the 60's to try to control his seizures (and it did)

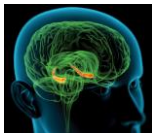
► Medial Temporal Lobectomy



H.M.

- After the removal, H.M. was unable to store new *declarative* (episodic and semantic) memories
- This is called anterograde amnesia
- But he has learned new motor skills (procedural memories) so these must be handled by another part of the brain
- Another case – this one caused by encephalitis:
- Clive Wearing (go to 2:06)
- <https://www.youtube.com/watch?v=OmkiMlvLKto>

Explicit- Memory System: Hippocampus and Frontal Lobes



THE HIPPOCAMPUS Explicit memories for facts and episodes are processed in the hippocampus and fed to other brain regions for storage.

- Frontal lobes involved in working memory – the active files you have open, the things you are keeping in mind during your day.
- Long term memories are not stored in their original form – visual, auditory, touch, emotional, informational components are stored in various cortical regions for those functions.

Our Two Memory Systems (Fig 8.12)

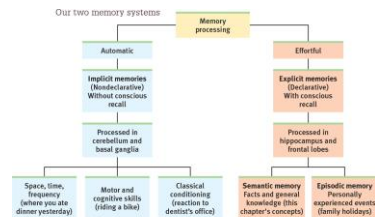
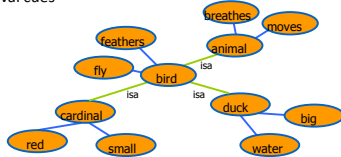


Figure 8.12 Myers, Exploring Psychology, 10e, © 2016 Worth Publishers

Network Theory of Memory Bank Organization

- Conscious memories depend on a complex web of associations
- Multiple experiences with the same material builds links & retrieval cues



- The number of links/connections to a topic provide different routes for retrieval.

- Example: the more “connections” you have to the items on the following list, the more easily you will come up with the answers.
- (apologies to our international students – this is a “USA” example)

The more links you have to the following, the easier the task.
Name the Capitol of :

- Alaska
- South Dakota
- Missouri
- Kansas
- North Carolina
- Vermont
- Washington
- Mississippi

Are you experiencing the “Tip of the Tongue Phenomenon”?
(knowing you know something but not able to retrieve it)

If your own retrieval cues can't get you to the memory,
how about if I give you an extra retrieval cue?

Name the Capitol of :

- | | |
|------------------|-----|
| • Alaska | • J |
| • South Dakota | • P |
| • Missouri | • J |
| • Kansas | • T |
| • North Carolina | • R |
| • Vermont | • M |
| • Washington | • O |
| • Mississippi | • J |

Retrieval: Getting Information Out

• Ways of assessing memory retention

- Recall
- Recognition
- Relearning

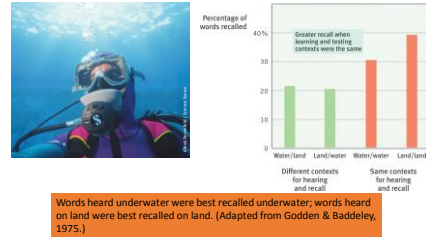
Prepare Your Memory With the Goal in Mind: Recall vs Recognition Tests

- Recall tests (e.g. essays) demand that you retrieve the memories without many external cues
- Recognition tests (e.g. multiple choice) – response alternatives provide some cues
- Study with the type of test in mind (e.g. intentionally create your own memory cues to prepare for an essay; really use the cues provided by the choices in a MC test)

Other Retrieval Cues

- Context effects
- State-dependent memory
- Mood-congruent memory

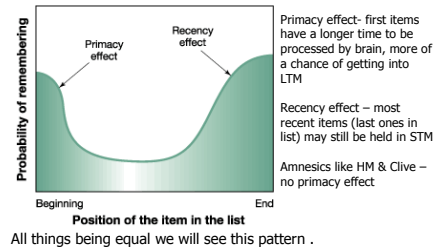
The Effects of Context on Memory



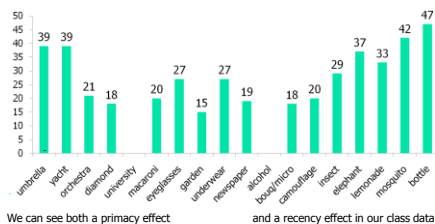
Other Factors Affecting Recall

- “Motivated forgetting”
- Emotionality of Memories
 - Most often strong emotion & the hormones produced strengthen memories
 - Example: flashbulb memories
- “Repression” (keeping strongly emotionally threatening memories hidden down in your unconscious) is the exception, rather than the rule.

The “Serial Position” Effect



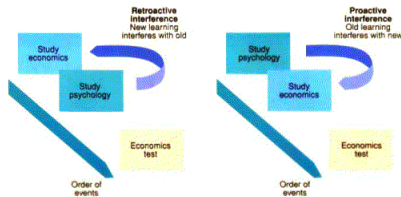
How many of 57 people recalled each word?



Some Reasons for “Forgetting”

- Encoding failure (didn't pay attention)
- Retrieval failure: Insufficient cues/links to retrieve stored memory
 - Tip of the tongue phenomenon
- Retrieval failure: Cue Confusion or Interference
 - Proactive interference
 - Older memories interfere with new memory recall
 - Retroactive interference
 - Newer memories interfere with old memory recall

Interference



Nature of Memory

- Subject to change - not a fixed permanent record
- Memories files are "updated" with new info
- Memories are *reconstructed* in pieces during recall
- Memories depend on our attention, expectations, past experiences, how we're questioned
- Since memory is malleable (changeable), always question its accuracy.
- Accuracy of memory is only weakly correlated with confidence – can be very confident and still be wrong!
- For these reasons, eyewitness testimony is not reliable



Elizabeth Loftus
Memory Researcher

Internationally well-known for fascinating research in several memory areas:

Eyewitness testimony

How memories are changed or distorted by others

False memories

Misinformation Effect

- False or misleading information encountered (as you talk to others or are questioned by police or read the paper) after eyewitness event is often incorporated into one's memory of event
- "Source amnesia or misattribution" – we often have difficulty distinguishing where a bit of memory/ information came from. Did we see it ourselves? Hear it from someone?

Research on Memory Distortion Changing Memory for Actual Events



How you are questioned can change your memory



The "Misinformation Effect"

- Loftus showed participants a film or slideshow of a traffic accident
- If asked "How fast was the car going when it passed the barn?" participants later on included the barn (not in film) in their recollections. If asked about a "Yield sign" (not really present) participants were more likely to mistakenly report a Yield sign rather than a Stop sign.
- So what we hear from others or how we are questioned can actually modify stored memories
- Can rate themselves as quite confident about misinfo!!

Loftus & Palmer

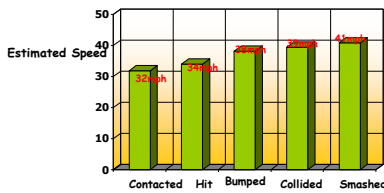
- What effect can leading questions have on eyewitness testimony?

How fast were the cars going when they ********* each other?

- Contacted
- Hit
- Bumped
- Collided into
- Smashed into

Just a change in wording can change other details in the person's "recollection"

Speed estimates for the different verbs used in the witness question



Interviewed later, over twice as many in "smashed" group recalled broken glass than those in "hit" group (there was none actually)

The "Lost in the Mall" Study

- College students and their family members reported their memories of significant family events in the life of the college student.



All the family stories put in a journal for student with one confirmed-to-be-false story

When you were about two years old, your family went for a camping trip to... Towards the end, you were with Gail and her family, John and Lila, and your grandparents. You made a lot of friends at the campsite, and spent most of the time with them and Steven.	When you were about four, your family went for a family reunion to... Towards the end, Steve's friend Diane also went with you. You sat up late by the fire, and while you were there you went to the rest... and cooked popcorns over the fire.	You, your mom, and your brother went to Aunt's... Your mother gave each of you some money to spend... You sat down to get into the car... and for your day in the hotel... Your mother said you going to an... ...wedding.	When you were about four years old, Aunt Dan was about seven, your family went for a trip to Christchurch, to your Uncle... John's wedding... After the luncheon you walked to the store and when the bricks and popcorn made a... ...garden down to the... ...recognition.
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Two weeks later student was questioned about what they remembered about family events.
False Memory Rate: 25%

http://www.youtube.com/watch?v=PQR_1jvYz8

Loftus & Pickrell, 1995

Loftus Studies Other Possible False Memory Situations



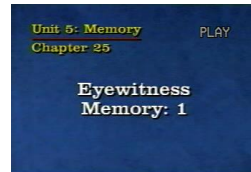
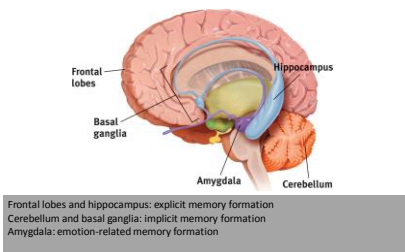
Loftus talk about false mems

- <http://www.youtube.com/watch?v=NGLrNjaPmJA&list=UU943UnajVxe9SpFjpwpxLsQ&index=3>
- Imagination causing false mems
- <http://www.youtube.com/watch?v=JLH17FsZeDY&list=UU943UnajVxe9SpFjpwpxLsQ&index=4>

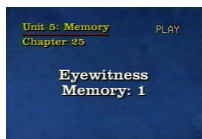
Imagining Visualization

- <http://www.youtube.com/watch?v=JLH17FsZeDY&list=UU943UnajVxe9SpFjpwpxLsQ&index=4>

Key Memory Structures in the Brain



Stop at "Menu" and go to bottom of next slide



More Planted Memories

- Overnight hospitalization (Hyman: 20%)
- Cake accident at Wedding (Hyman: 25%)
- Serious animal attack UBC: 26% com 30% par
- Rescued by lifeguard (Tenn: Heaps & Nash) - 37%

Creating Impossible Memories

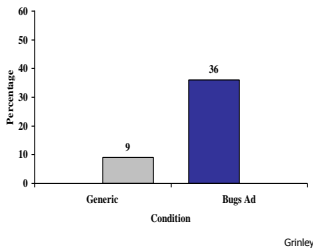
120 adults who had been to Disneyland or Disney World were recruited for a "marketing research" study and asked to evaluate some potential ads. They were later asked about their own experiences at Disneyland or Disney World.

Group 1 Ad

Group 2 Ad



Later 36 out of 60 who saw Bugs ad "remembered" meeting Bugs when they had visited Disneyland !!



They described these "memories" of Bugs

- Shook his hand 62%
- Hugged him 46%
- Touched his ear 23%
- Touched his tail 23%
- Heard "What's up doc." 23%
- Holding a carrot

- Considering the evidence for the malleability of memory, Loftus cautions that these same kinds of alterations in memories could occur, intentionally or unintentionally, in a therapeutic or counseling setting. How you are questioned about possible past sexual abuse could, in fact, end up creating abuse memories.

- https://www.ted.com/talks/eliza_beth_loftus_the_fiction_of_memory?language=en
- Play 12 minutes