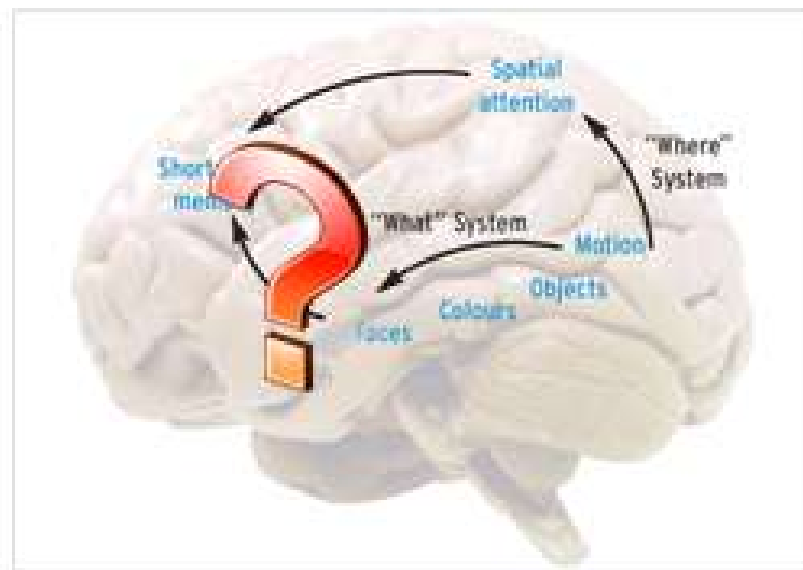




Cognition

# Memory

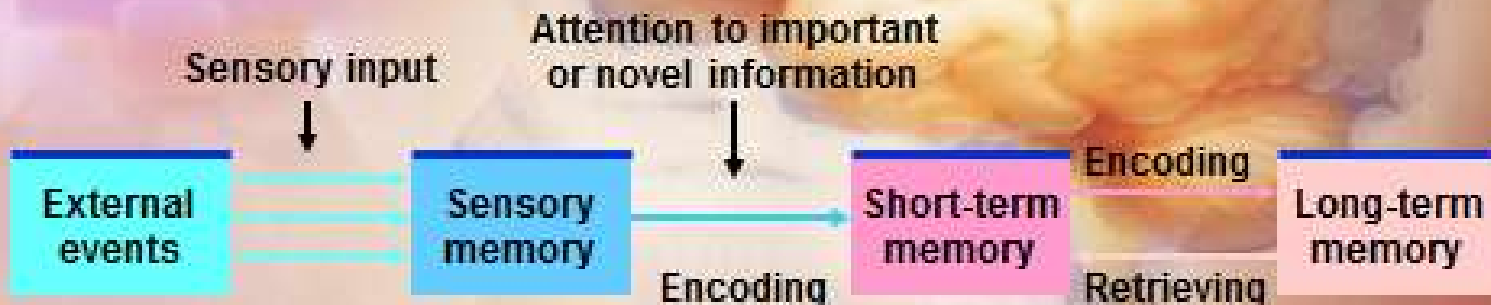
- Memory: A system that encodes, stores and retrieves information.



•While we are learning more about memory every day, psychologists still are unsure exactly what parts of the brain are involved and where it is all stored.

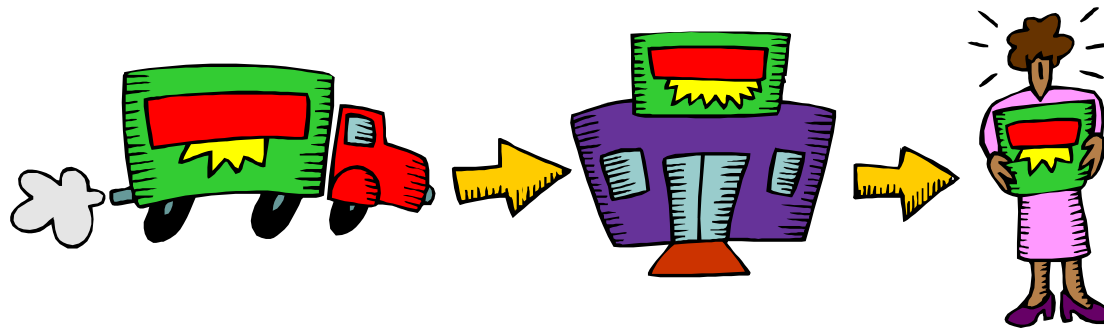
# Memory's Three Basic Tasks

- According to the *information-processing model*, the human brain takes essentially meaningless information and turns it into meaningful patterns.
- It does this through three steps:
  - Putting it in: Encoding
  - Keeping it in: Storage
  - Getting it out: Retrieval



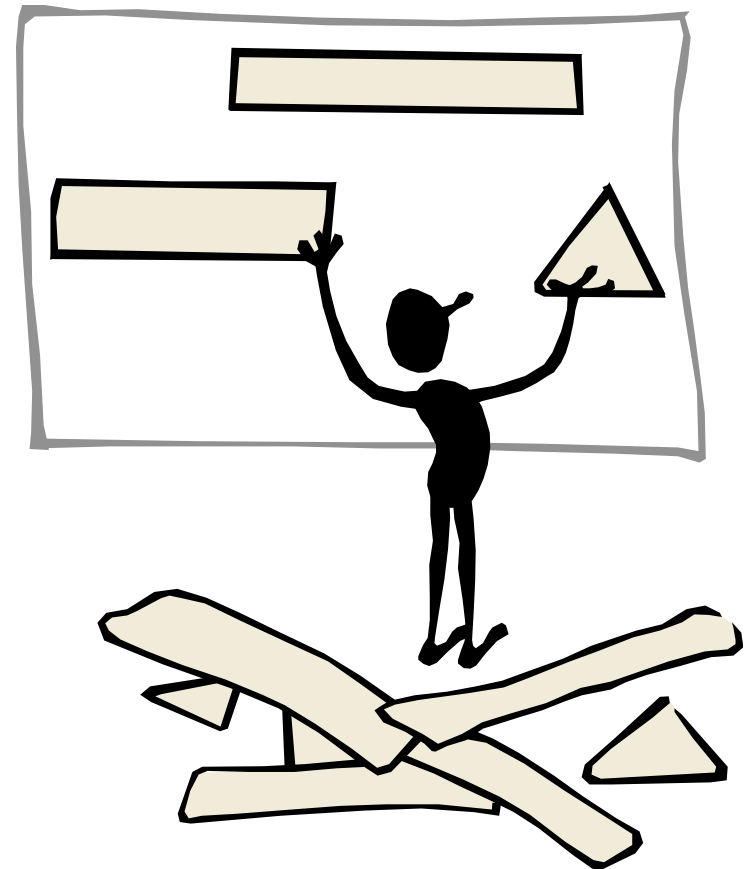
# 3 Processes of Memory

- Encoding
- Storage
- Retrieval



# Encoding

- The translation of information into a form that can be stored
- **Visual codes**-picture it in your mind
- **Acoustic codes**-hear it
- **Semantic codes**-make sense of it



# Storage

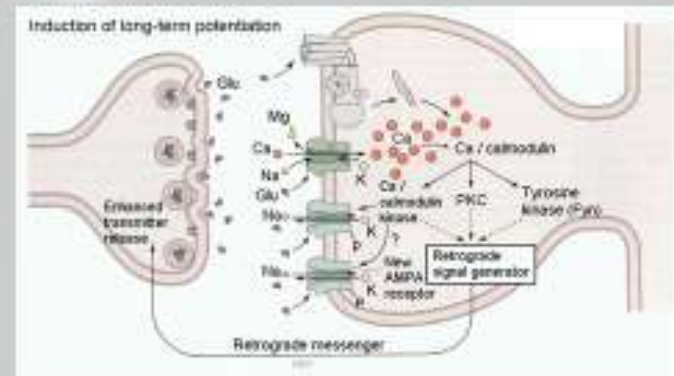


- Maintenance of encoded information over a period of time-stored
- **Maintenance rehearsal**-Repeating over and over to rehearse
- **Elaborative rehearsal**-Relate to info already known
- **Organizational systems**-The more organized the storage the better chances for retrieval

# Synaptic Changes and Storage

- One physical change in the brain during memory storage is in the synapses.
- Memories begin as impulses whizzing through the brain circuits, leaving a semi-permanent trace.
  - The more a memory is utilized, the more potential strength that neuron has, called long-term potentiation (LTP).
- Neural basis for learning and remembering associations

This stuff gets super complicated...keep it simple for now



# Strengthening LTP

- Research suggests that the best way to remember things is to **study them and then sleep!**
- Once LTP has occurred, even passing an electrical current through **the brain will not erase well stored memories.**
  - More recent memories will be wiped out
    - People who have a concussion and cannot remember what happened just before or after the injury have not had a chance to “consolidate” their memories to the long-term





# Retrieval

- Locating information and returning it to conscious thought
- Retrieval of info stored previously like a computer retrieves and locates files

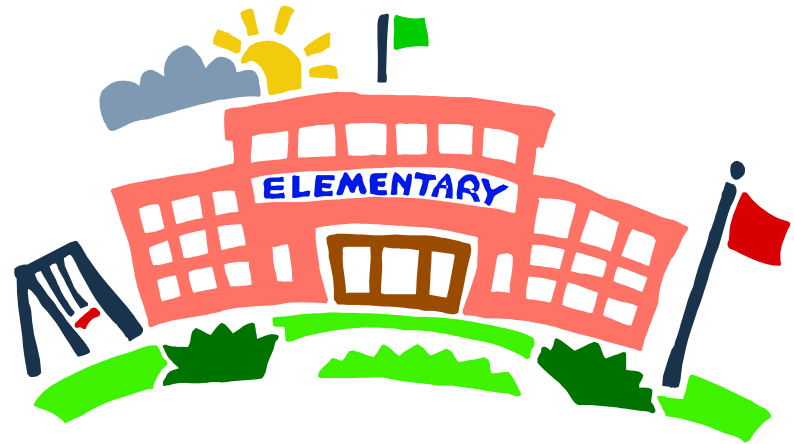


Bob's wine cellar

# Context-Dependent Memory

## Retrieval continued

- Dependent on the place where the memory was stored i.e.. the environment
- E.g.. Visiting Elementary school and some memory from that experience comes back



# State-Dependent Memory

## Retrieval continued



© Ron Leishman \* www.ClipartOf.com/441875

- Easier to retrieve these type of memories when the same emotion or mood is achieved that is similar to when the memory was encoded
- E.g..Happy times triggers memories of other happy times

# On the Tip of the Tongue

## Retrieval continued

- Sometimes we are so close to retrieving information it is said to be on the Tip of the tongue

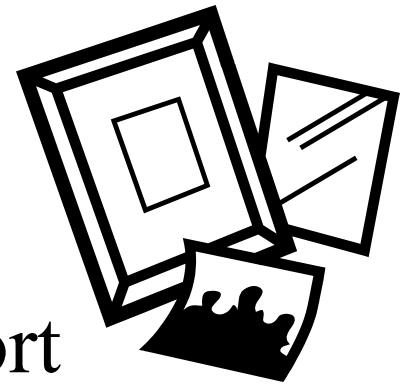


# Three Stages of Memory



# Sensory Memory

- First stage of memory-initial recording of information through our senses
1. Iconic memory -Snapshots very accurate photographic memories short period of time
  2. Eidetic Memory- Visual memories over a long period of time
  3. Echoic Memory-Mental traces of sound (acoustic easier to remember than visual)



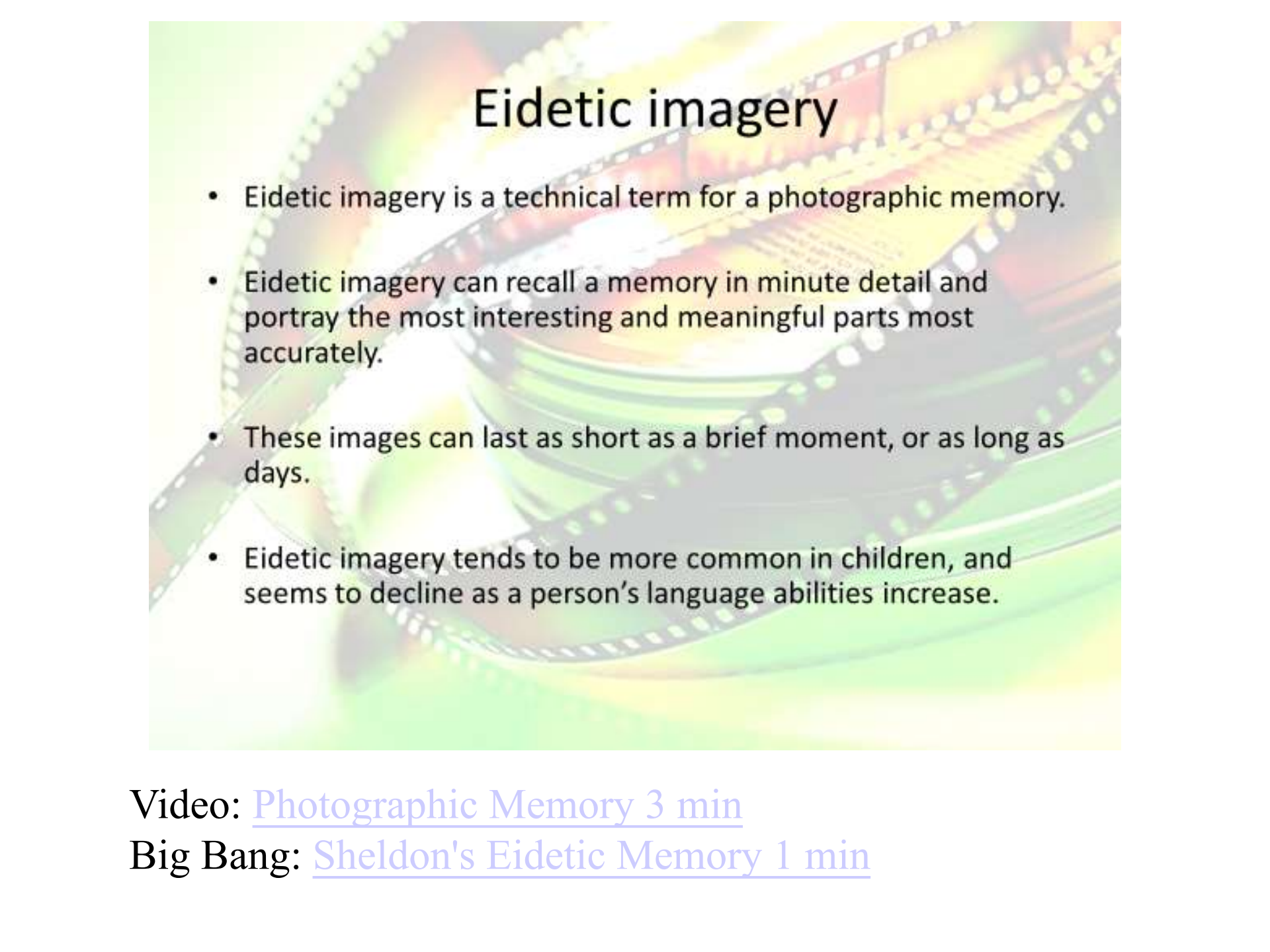
## Sperling's Test Sensory Memory

K	Z	R
Q	B	T
S	G	N

- George Sperling flashed a group of letters (see left) for 1/20 of a second. People could recall only about half of the letters
- When he signaled to recall a particular row immediately after the letters disappeared with a specific tone, they could do so with near-perfect accuracy.



George Sperling is an American cognitive psychologist, researcher, and educator. Sperling documented the existence of iconic memory. Through several experiments, he showed support for his hypothesis that human beings store a perfect image of the visual world for a brief moment, before it is discarded from memory.

The background of the slide features a close-up, artistic shot of a film strip. The strip is curved and shows various frames with different colors and patterns. In the center, a camera lens is visible, partially obscured by the film strip. The overall lighting is soft and warm, with a mix of green, yellow, and red tones.

# Eidetic imagery

- Eidetic imagery is a technical term for a photographic memory.
- Eidetic imagery can recall a memory in minute detail and portray the most interesting and meaningful parts most accurately.
- These images can last as short as a brief moment, or as long as days.
- Eidetic imagery tends to be more common in children, and seems to decline as a person's language abilities increase.

Video: [Photographic Memory 3 min](#)

Big Bang: [Sheldon's Eidetic Memory 1 min](#)



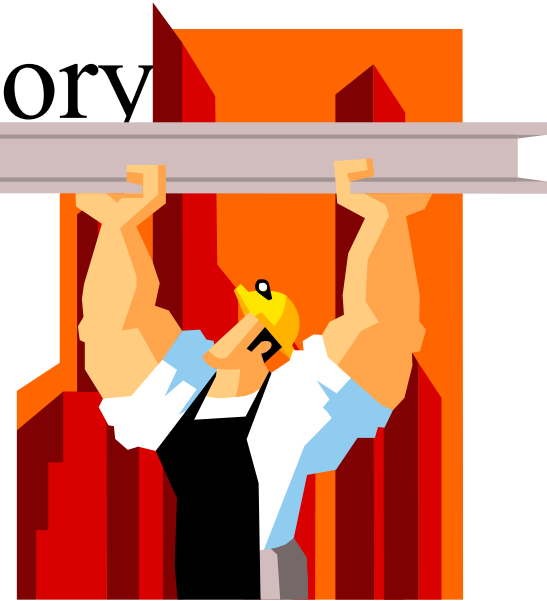
# AUTISM & EIDETIC MEMORY

[Autistic Man draws Rome from Memory 5 min](#)

[Autistic Man draws NY 1 min](#)



# Stage 2: Short-Term Memory aka Working Memory



- Information is transferred from the Sensory memory to this second stage of memory processing
- Consciously thinking about the information here
- Rapidly begins to fade after several seconds so attention must be paid to the information to pass it along further to the LT memory

# Memory cont.



## **Serial Position effect**

- The serial position effect is a form of interference related to the sequence in which material is presented.
- Generally items in the middle are remembered less.
  - Information in the middle is exposed to both retroactive and proactive interference.
- **Primacy effect**-recall initial items in a sequence
- **Recency effect**- Tendency to remember the last items of a sequence
- **Chunking**- organization of units into manageable familiar units
- **Interference**-When new information takes the place of old information in the working memory

# Levels of Processing ( Craik and Lockhart, 1972)

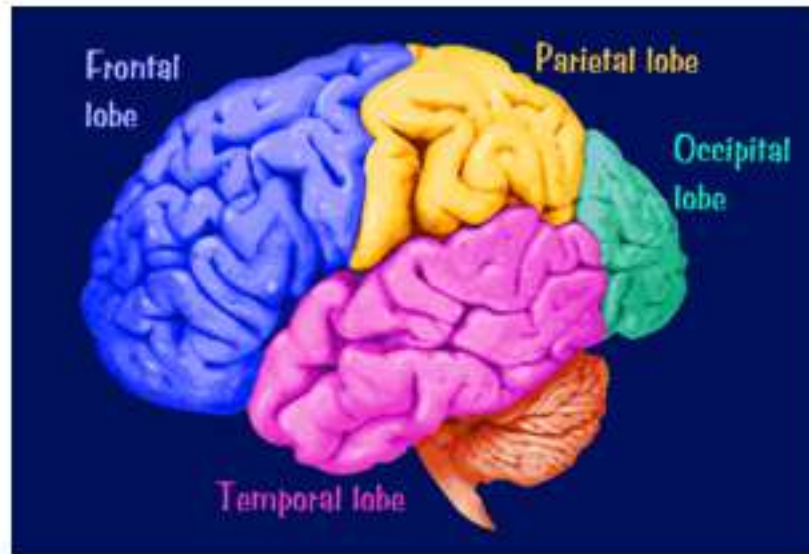
- In working memory, information can be elaborated on, or connected with long term memories.
  - **The Levels-of-processing theory** - The idea that the way information is encoded affects how well it is remembered. The deeper the level of processing, the easier the information is to recall (shallow or deep)

Level of processing	Type of encoding	Example of questions used to elicit appropriate encoding
Shallow processing	Structural encoding: emphasizes the physical structure of the stimulus	Is the word written in capital letters?
Intermediate processing	Phonemic encoding: emphasizes what a word sounds like	Does the word rhyme with weight?
Deep processing	Semantic encoding: emphasizes the meaning of verbal input	Would the word fit in the sentence: "He met a _____ on the street"?

© 2007 Holtworth, Thomson

## Stage 2: Working memory: location

- While the location in the brain of all three stages of memory are still not fully understood, the likely location for the working memory is in the frontal cortex.



# Long-Term Memory

- Third and final stage of memory
- No limit to the capacity of long-term memory (infinite)
- We tend to remember or reconstruct memories based on our life experiences and our view of the world



# Episodic memory

- Memory that consists of events that people have experienced or witnessed
- Flash bulb memory-  
Able to recall great detail of the event



# Generic/Semantic Memory



- General knowledge usually not able to remember when we acquired the information
- E.g.. Washington was our first president



# Procedural/Implicit Memory



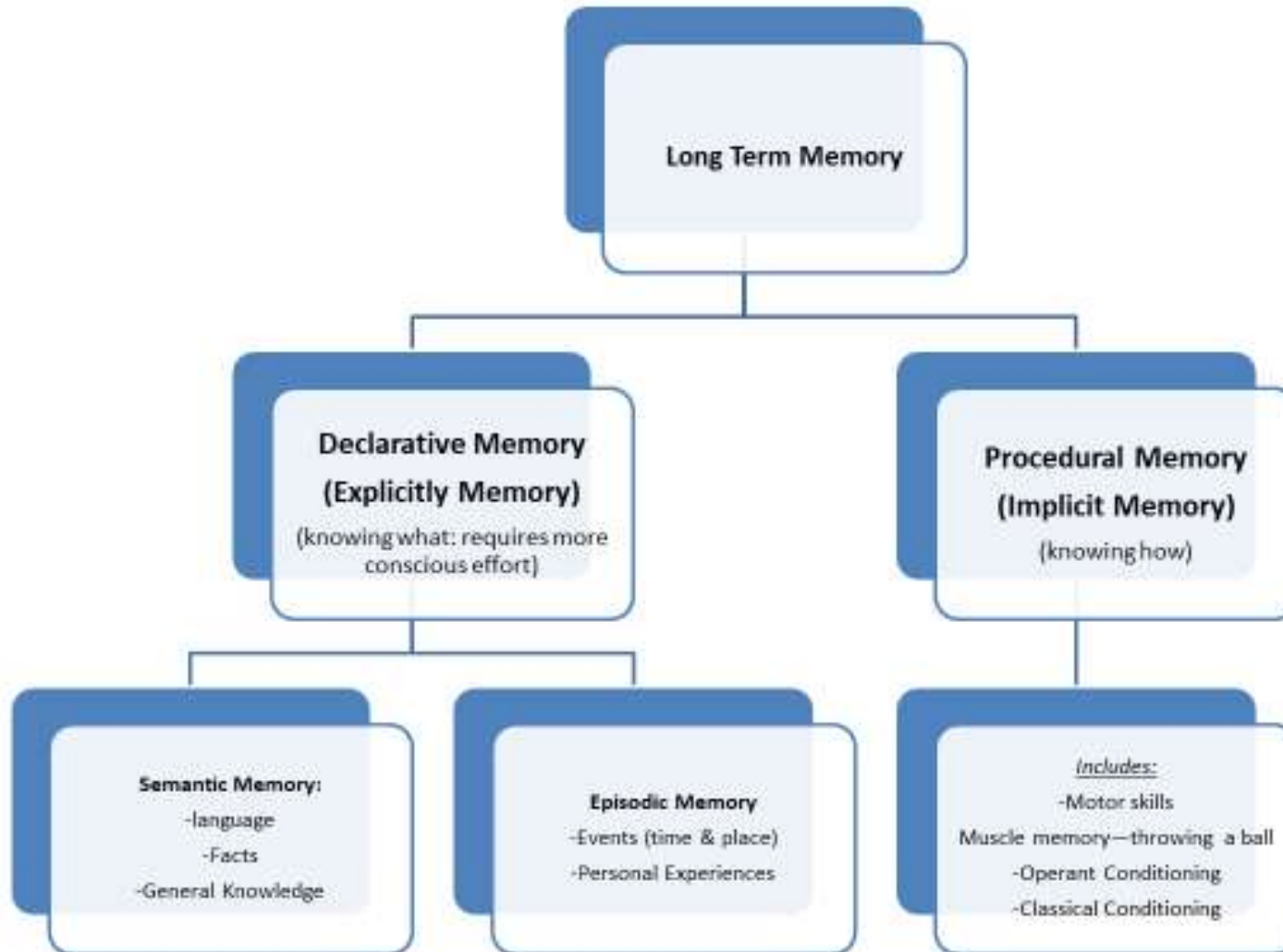
- Skills or procedures we have learned..once the skill has been learned it usually stays for many years
- E.g. How to make a sandwich or ride a bike or swimming

# Explicit-Memory

- Declarative
- Facts & experiences we consciously know or declare
- Usually what people are referring to when they refer to memory



# Structure and Function of LTM





## Studies: Implicit vs. Explicit

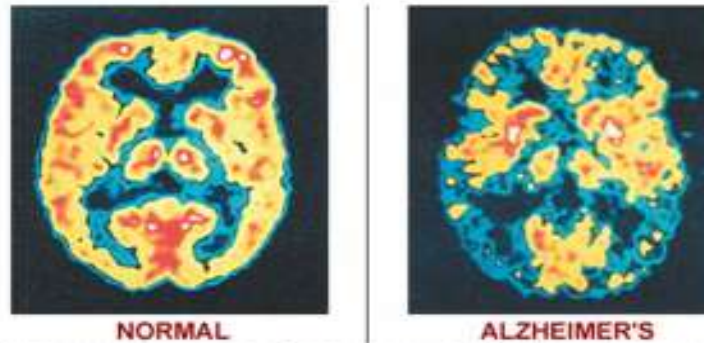
- People with amnesia who read a story once, will read it faster a second time, showing implicit memory.
  - There is no explicit memory though as they cannot recall having seen the text before
- People with Alzheimer's who are repeatedly shown the word *perfume* will not recall having seen it.
  - If asked the first word that comes to mind in response to the letters *per*, they say perfume readily displaying learning.
- **General rule: A memory is implicit if it can affect behavior or mental processes without becoming fully conscious. Explicit memories always involve consciousness.**



# Alzheimer's disease

- *Early stages*, the most commonly recognized symptom is partial loss of the semantic memory
- *Middle stages*, the individual has problems with her short term memory
- *Later stages*, the individuals' long term memory is severely impaired

BRAIN SCANS HELP IDENTIFY ALZHEIMER'S



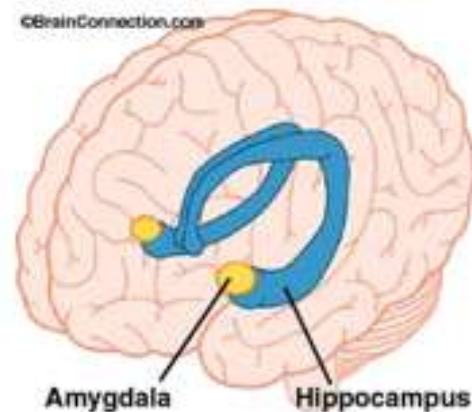
Brain scans done with Positron Emission Tomography (PET) show how Alzheimer's affects brain activity. The left image shows a normal brain, while the right is from a person with Alzheimer's. The blue and black areas in the right image indicate reduced brain activity resulting from the disease.

Images courtesy of Alzheimer's Disease Education and Referral Center, National Institute on Aging

[Alzheimer's 3 Minutes](#)

# Parts of the brain used in memory

- Two parts of the brain psychologists know for sure are involved in memory are:
  - hippocampus
  - amygdala
- **Consolidation**
  - information in the working memory is gradually changed over to long term memories.
- The amygdala seems to play a role in strengthening memories that have strong emotional connections.



# Schemas

- An idea or mental framework
- Organizing bits of information into knowledge





## Basic Memory tasks

- **Recognition**-Identifying objects or events that have been encountered before
- **Recall**-Bring back to mind
- **Relearning**-Relearn things forgotten e.g..  
Algebra 25 years later





*“Stock is Best!”*

## Forgetting

- Repression- Pushing painful, unwanted memories into the subconscious mind
- Amnesia- Severe memory loss due to brain damage

- Infantile Amnesia-forgetting early infancy memories are forgotten e.g. birth

## Alien Abduction

- Anterograde Amnesia Loss of the ability to create new memories after the event that caused the amnesia

## 10 Second Tom

- Retrograde Amnesia- Unable to recall events that occurred before the development of amnesia.

## Retrograde amnesia 5 min

**. NOTE: As memories form, neurotransmitters collect at the synapses, (before absolute threshold is crossed). These are called memory traces. A sharp blow to the head, or electric shock can prevent these traces from consolidating, making it hard to recall that information**

# Amnesias



# Forgetting

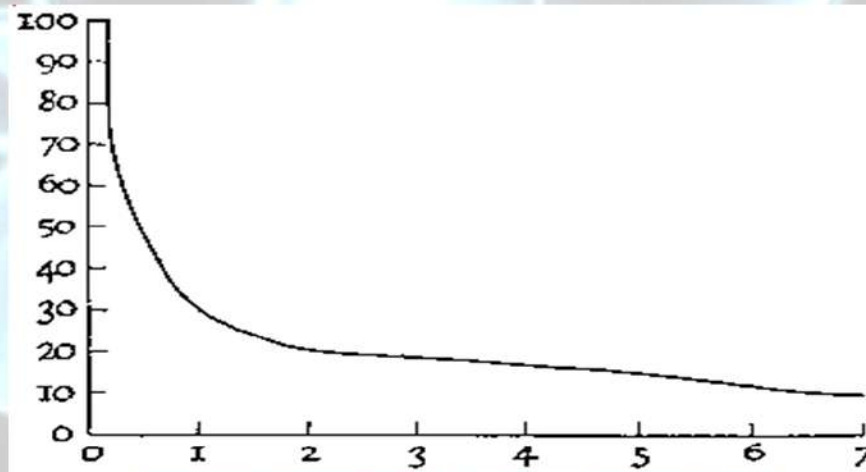
- As you know, not all the information you learn will stick in your brain.
- According to Daniel Schacter, this is the result of one of the “seven sins of memory:”

- Transience
- Absent-mindedness
- Blocking
- Misattribution
- Suggestibility
- Bias
- Persistence



# 1) transience

- **Transience:** the impermanence of long-term memories-based on the idea that memories gradually fade in strength over time-also known as “decay theory.”
  - Ebbinghaus’s Forgetting Curve



For most memories, there is a sharp decline in memory, followed by declining rate of loss

## 2) Absent-mindedness

- **Absent-mindedness:** forgetting caused by lapses in attention.
  - Ex. Forgetting where you parked; losing your keys



### 3) blocking



- **Blocking:** forgetting when a memory cannot be retrieved because of interference.
  - ***Proactive Interference:*** When an old memory disrupts the learning and remembering of a new memory.
    - Ex. Trying to put the dishes away at a new house
  - ***Retroactive Memory:*** When a new memory blocks the retrieval of an old memory.
    - Ex. Driving an automatic after driving a manual

## 4) misattribution



- **Misattribution:** Memory faults that occur when memories are retrieved, but are associated with the wrong time, place or person.
  - Ex. Psychologist Donald Thompson accused of rape. Alibi was airtight as he was giving a TV interview the victim had been watching just prior to the assault.

## 5) suggestibility

- **Suggestibility:** The process of memory distortion as the result of deliberate or inadvertent suggestion.



- » Eyewitness accounts are one a large part of our legal system. Unfortunately they can be incredibly faulty.
- » With the *misinformation effect*, memories can be embellished or even created by cues and suggestions.
- » [Eyewitness False memory video](#)



## 6) bias



- Bias: The influence of personal beliefs, attitudes and experiences on memory.
  - ***Expectancy Bias***: A memory tendency to distort recalled events to fit one's expectations.
  - ***Self-consistency Bias***: A commonly held idea that we are more consistent in our attitudes and beliefs, over time, than we actually are.
    - people mold their past memories in a way to sustain their ever changing presence. The belief that this changing present has actually been a stable self, even if the opposite is true, is a very important and natural part of us.

# 7) persistence

- Persistence: A memory problem where unwanted memories cannot be put out of our mind.
  - Depressed people cannot stop thinking about how bad their life is and how unhappy they are. It can create a self-fulfilling problem.
- Psychologists think that emotions **strengthen** the **physical changes in the synapses** that hold our memories, thus highly emotional memories can be harder to put out of mind.

# Forgetting isn't all bad

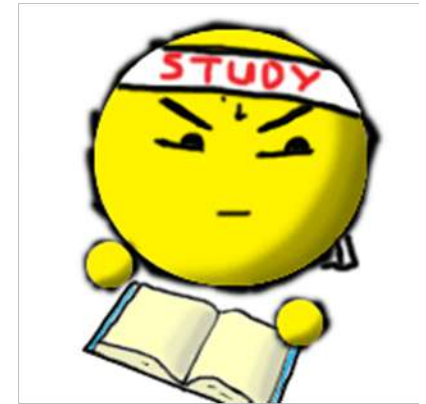
- According to Schacter, the “seven sins” are actually a normal part of human memory, and are the results of adaptive features in our memories.
- According to Schacter, each of the “sins” is for a reason:
  - *Transience*-to prevent memory overload
  - *Blocking*-to focus on task at hand
  - *Absent-mindedness*-ability to shift attention
  - *Misattribution/bias/suggestibility*-to focus on meaning and not detail
  - *Persistence*-to remember especially emotional memories

# Improve Your Memory

- Activate retrieval cues- mentally recreate situation and mood
- Recall events while they are fresh- write down before interference
- Minimize interference
- Test your own knowledge
  - rehearse
  - determine what you do not yet know



# Improve Your Memory



- Study repeatedly to boost recall
- Spend more time rehearsing or actively thinking about the material
- Make material personally meaningful
- Use mnemonic devices
  - associate with peg words- something already stored
  - make up story
  - chunk-acronyms



**Encoding through  
senses**

**Process**

**Storage**

**Process**

**Cognition  
Thinking**

20-30 seconds

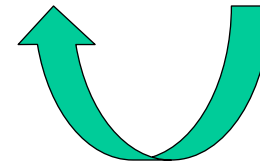
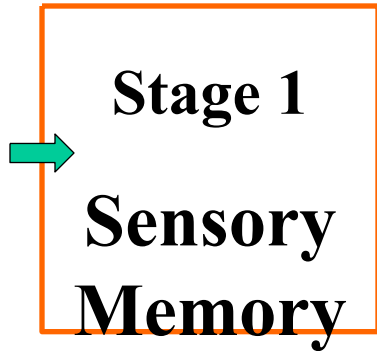
**Stage 2**

**Working  
(Short-  
term)  
Memory**

**Stage 3**

**Long-  
Term  
Memory**

**S  
E  
N  
S  
E  
S**



**Retrieval  
Process**