MEMORY

DEFINITION

- Encoding, storage and retrieval of what was learned earlier
- Memory has been compared to a computer and defined by an information-processing model in which information goes through three discrete stages: encoding, storage, and retrieval
- Atkinson and Shiffrin (1968) posited that information goes through three stages: sensory, short-term memory, and long-term memory
- Researchers have integrated this model with findings from cognitive neuroscience to include the idea that memory has been found to be created by a collection of systems, working interdependently. There is no one portion of the brain solely responsible for all memory, though there are certain regions related to specific memory subsystems.

PERVASIVE ROLE OF MEMORY IN EVERYDAY LIFE

- Write down everything they did yesterday that did NOT involve memory
- Defines who we are; informs what we will do

Famous cases:

- Clive Wearing

  Part I (http://www.youtube.com/watch?v=OmkiMlvLKto)

  Part II (http://www.youtube.com/watch?v=ymEn_YxZqZw&feature=related)
- Stephen Wiltshire (http://www.youtube.com/watch?v=a8YXZTIwTAU)

Cognition: processes through which information coming from the senses is transformed, reduced, recovered and used (Neisser, 1967)

Information: sensory input from the environment informing us about what is happening there

Cognitive processes: mental processes in knowing the world: perception, attention, thinking, problem solving, memory

Cognitive psychology: branch of psychology dealing with cognitive processes

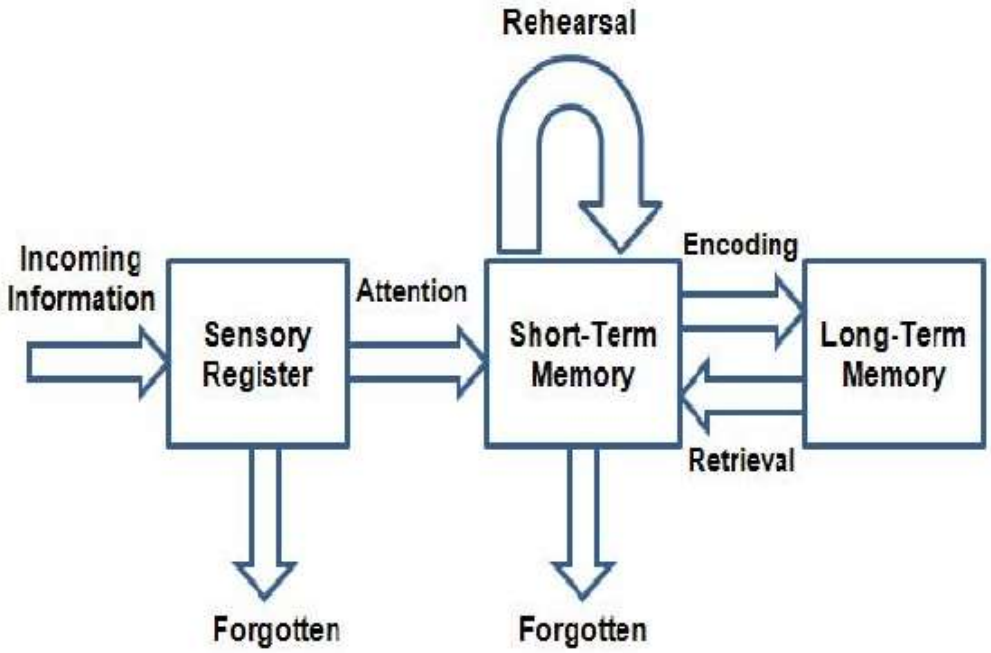
THEORIES

Encoding: process of receiving sensory input and transforming it into a form or code for storage

Storage: putting the coded information into memory

Retrieval: process of gaining access to stored, coded information when it is needed

ATKINSON SHIFFRIN MODEL



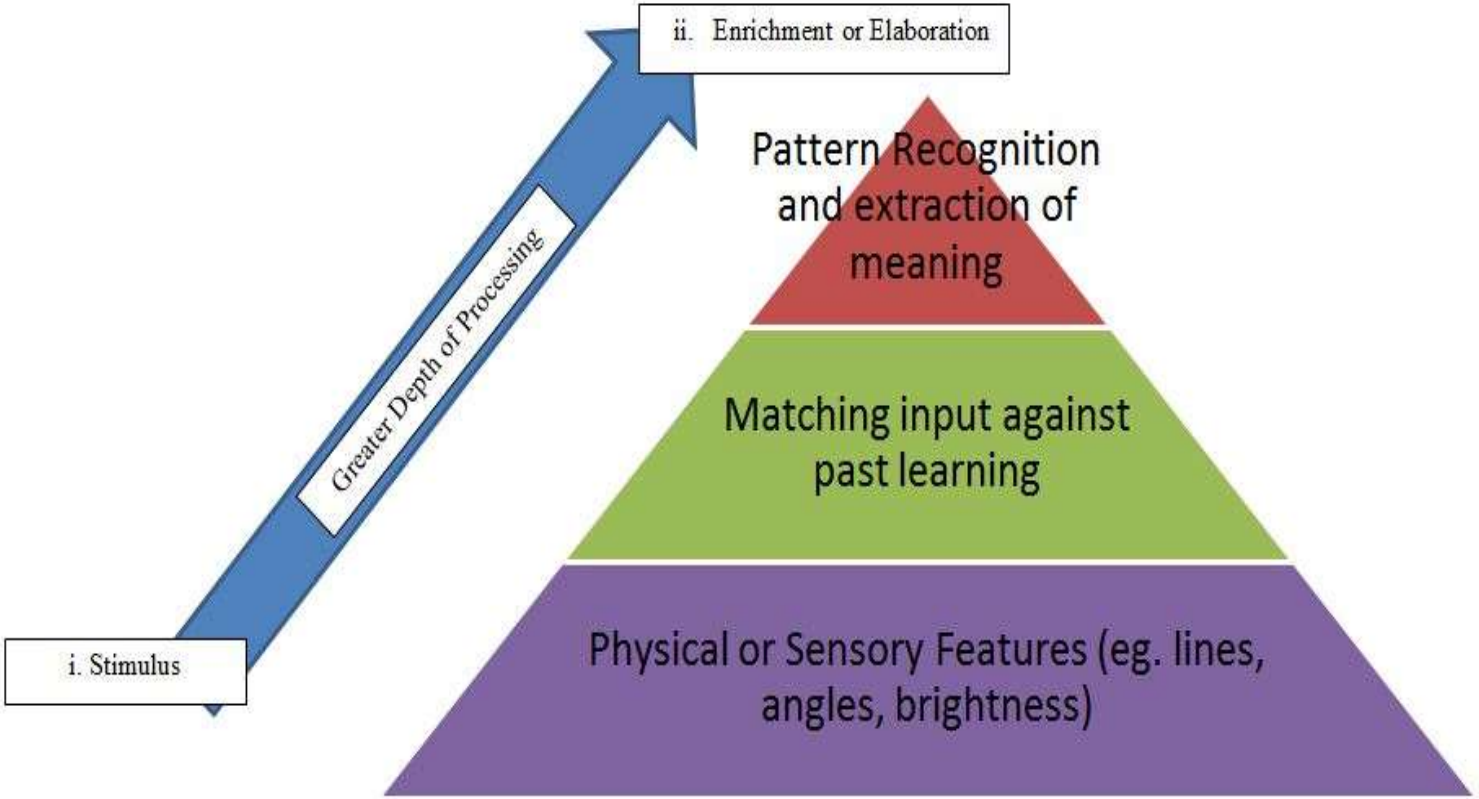
- Sensory register: storage function of the sensory channels- information held briefly-easy decay of information
- Attention and recognition of information: passed on to STM for further processing
- Sperling (1960): visual sensory register holds information for upto 1 second/ auditory, upto 4-5 seconds
- Visual memory: 11-16 items(iconic image)

- Short term memory: memory that holds information from the sensory register for upto 30 seconds (variable retention factors: eg: serial position/ primacy or recency effect)
- Limited storage capacity (Miller, 1956): 7 (+/- 2)
- Information stored in STM displaced by incoming information
- Has a rapid and thorough scanning process: Sternberg (1966, 1975)
- Rehearsal: keeping information in the centre of attention: decides transfer of information from STM to LTM: maintenance or elaborative rehearsal
- Long Term Memory (LTM): stored memory: capacity knows no limit, as well as time for which information is stored: semantic and episodic

Tip-of-the-tongue phenomenon: information is organized in LTM yet cannot quite recall a familiar word but can recall words of similar form and meaning

Semantic and episodic memory

LEVELS OF PROCESSING THEORY



Based on: Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671-684.

- Focuses on the depth of processing involved in memory, and predicts the deeper information is processed, the longer a memory trace will last

- Craik defined depth as: "the meaningfulness extracted from the stimulus rather than in terms of the number of analyses performed upon it." (1973, p. 48)

- Memory is just a by-product of the depth of processing of information, and there is no clear distinction between short term and long term memory: focus on the processes of memory

Shallow Processing: This takes two forms

1. **Structural processing** (appearance) which is when we encode only the physical qualities of something. E.g. the typeface of a word or how the letters look.

2. **Phonemic processing** – which is when we encode its sound.

Shallow processing only involves **maintenance rehearsal** (repetition to help us hold something in the STM) and leads to fairly short-term retention of information.

Deep Processing

3. **Semantic processing,** which happens when we encode the meaning of a word and relate it to similar words with similar meaning.

SCHACTER'S "SEVEN SINS OF MEMORY"

Memories are transient (fade with time)

We do not remember what we do not pay attention to
Our memories can be temporarily blocked

We can misattribute the source of memory

We are suggestible in our memories

We can show memory distortion (bias)

We often fail to forget the things we would like not to recall (persistence of memory)

Overcoming them:

Obtain information quickly after an event, when it is fresh in people's minds.

Use a prioritized task list.

Take notes from important events, including meeting minutes.

Record important events and milestones daily.

Use neutrally worded questions when soliciting information.

Understand the basis or perspective of the person providing the information.

Understand and recognize interferences (eg: Post Traumatic Stress).

BARTLETT'S (1932) GHOST STORY: THE RECONSTRUCTIVE NATURE OF MEMORY

- Impact of prior knowledge or schematic knowledge on memory

Changes occurred by

- **Omission**. Ghosts omitted early, wounds of the spirit become wounds of the flesh
- **Rationalization**. Growing more coherent
- "**Conventionalization**"
- **Temporal order**. Change in order of events

"No trace of an odd or supernatural element is left: we have a perfectly straightforward story of a fight and a death"

The War of the Ghosts

One night two young men from Egulac went down to the river to hunt seals, and while they were there it became foggy and calm. Then they heard war-cries, and they thought: "Maybe this is a war-party". They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said: "What do you think? We wish to take you along. We are going up the river to make war on the people".

One of the young men said: "I have no arrows". "Arrows are in the canoe", they said. "I will not go along. I might be killed. My relatives do not know where I have gone. But you", he said, turning to the other, "may go with them."

So one of the young men went, but the other returned home. And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water, and they began to fight, and many were killed. But presently the young man heard one of the warriors say: "Quick, let us go home: that Indian has been hit". Now he thought: "Oh, they are ghosts". He did not feel sick, but they said he had been shot. So the canoes went back to Egulac, and the young man went ashore to his house, and made a fire. And he told everybody and said: " Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick". He told it all, and then he became quiet. When the sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried.

He was dead.

Bartlett's Ghost Story: The Reconstructive Nature of Memory

Bartlett

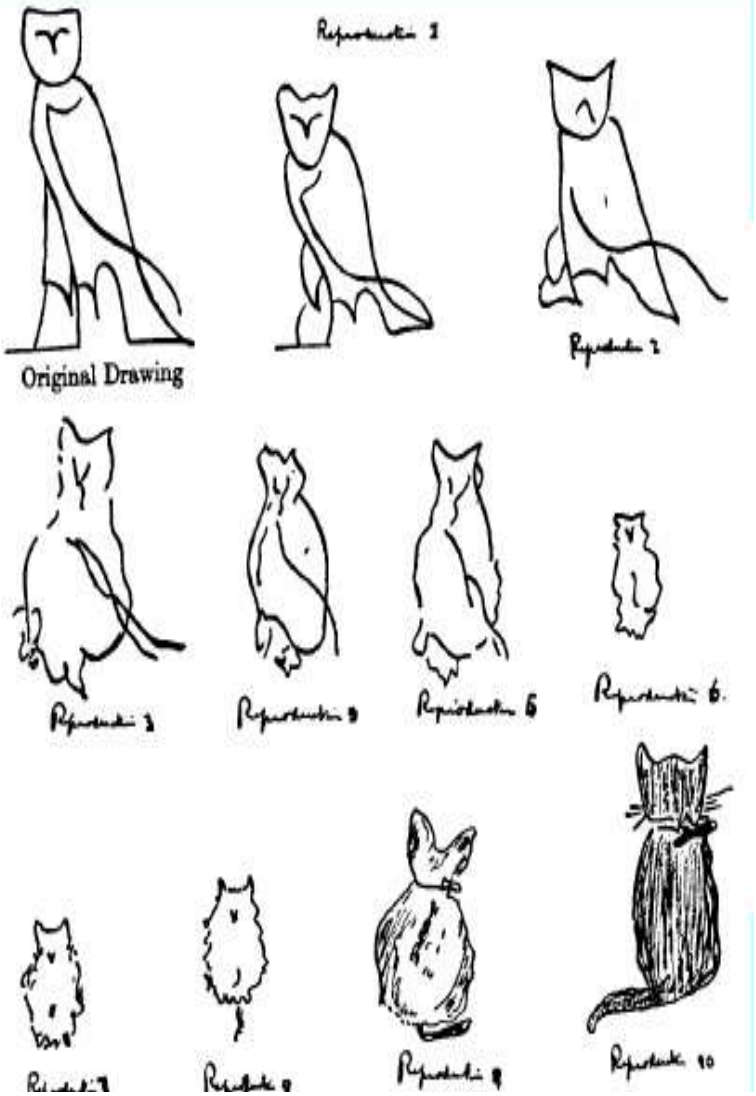
Recall distorted the content and style of the original story. The story was shortened, and the phrases, and often words, were changed to be similar to the English language and concepts (e.g., "boat" instead of "canoe"). He also found other kinds of errors, including flattening (failure to recall unfamiliar details) and sharpening (elaboration of certain details).

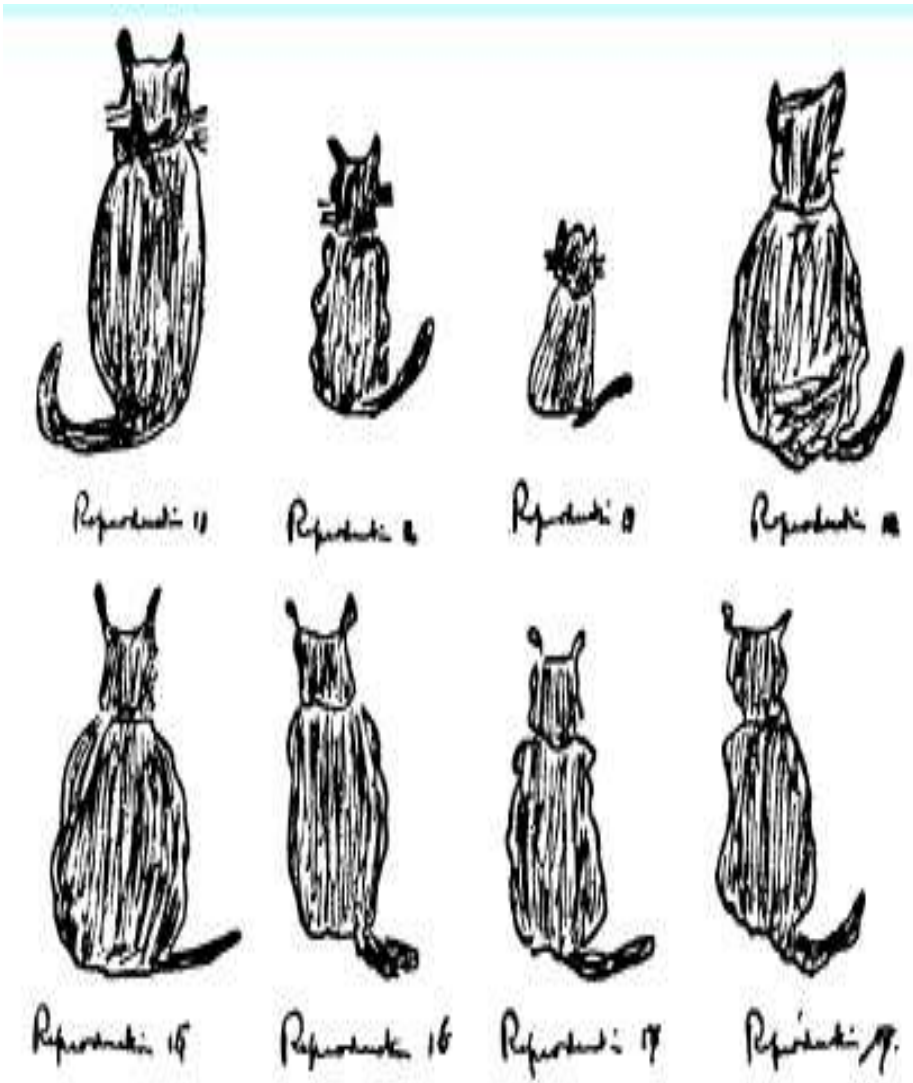
- Assigning a name influences the reproduction.
- The transformations are in the direction of conventional representations (highest frequency of exposure)
- Features that are not at first recognized are elaborated until recognition is produced
- Once a recognizable feature is produced, it is reduced to its most conventional simplification

- A criticism of Bartlett's work was that his approach to research lacked objectivity
- Bartlett's methods were somewhat casual. He simply asked his group of participants to recall the story at various intervals and there were no special conditions for this recall
- It is possible that other factors affected their performance, such as the conditions around them at the time they were recalling the story, or it could be that the distortions were simply guesses by participants who were trying to make their recall seem coherent and complete rather than genuine distortions in recall
- Alternatively, one could argue that his research is more ecologically valid than those studies that involve the recall of syllables or lists of words
- In recent years there has been an increase in the kind of research conducted by Bartlett, looking more at "everyday memory".

The Reconstruction: Not Just for Stories

Images, Too!


Original Drawing



MEMORY STAGES

- Encoding
  - Processes used to store information in memory
- Storage
  - Processes used to maintain information in memory
    - Rehearsal and elaboration
- Retrieval
  - Processes used to get information back out of memory

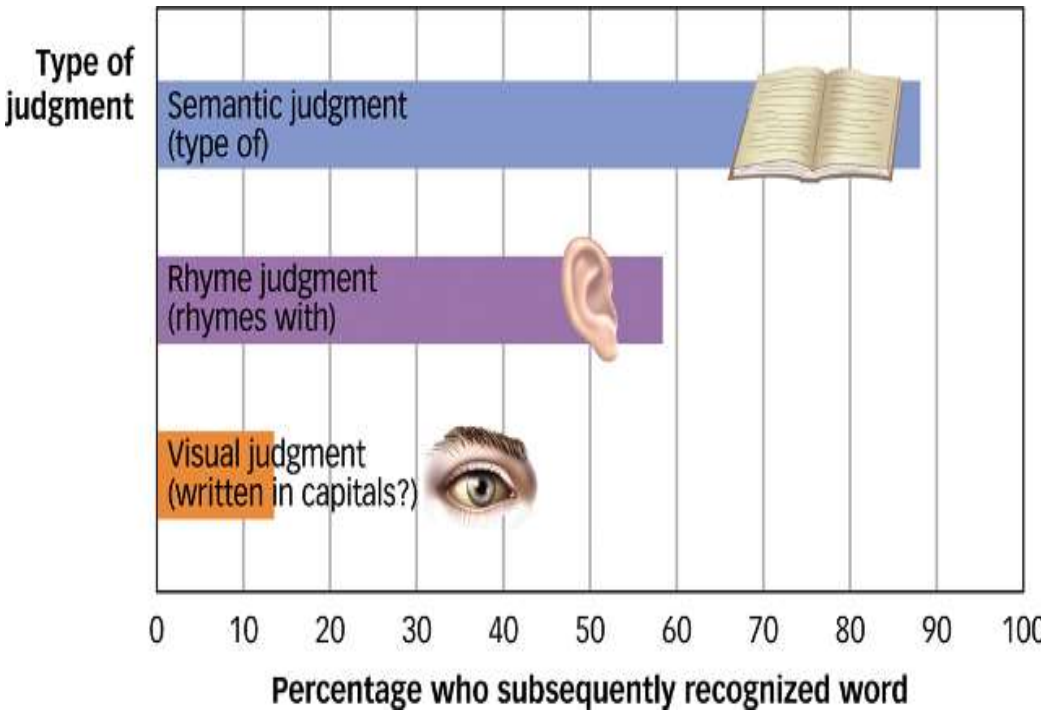
ENCODING

Memory is <u>not</u> a recording device

Levels of processing

- semantic judgments
- rhyme judgments
- visual judgments

Elaborative encoding



LEVELS OF PROCESSING

Craik & Lockhart

– Continuum of Processing
  - Shallow: surface, perceptual features
  - Deep: processed, meaningful interpretation

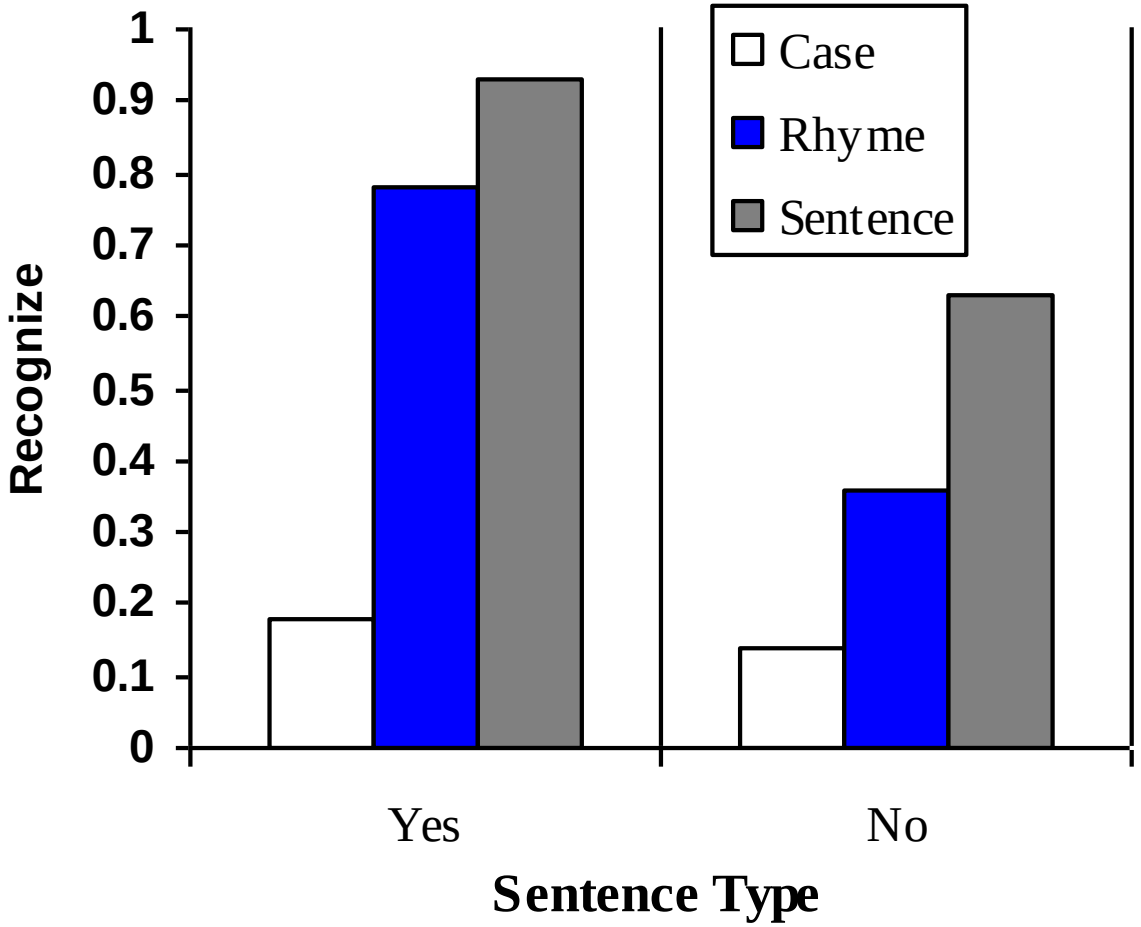
– Level or "depth" of processing affects its memorability
  – Deeper encoding produces more elaborate, longer-lasting memory

SUPPORT FOR LEVELS OF PROCESSING

Craik & Tulving (1975)

- Participants studied a list in 3 different ways
- Structural: Is the word in capital letters?
- Phonemic: Does the word rhyme with dog?
- Semantic: Does the word fit in this sentence? The _____ is delicious.
- A recognition test was given to see which type of processing led to the best memory

CRAIK & TULVING (1975) RESULTS



FORMS OF DEEP PROCESSING

The importance of organization

- Taxonomic, hierarchical, thematic

Self-relevant information

Self-generation

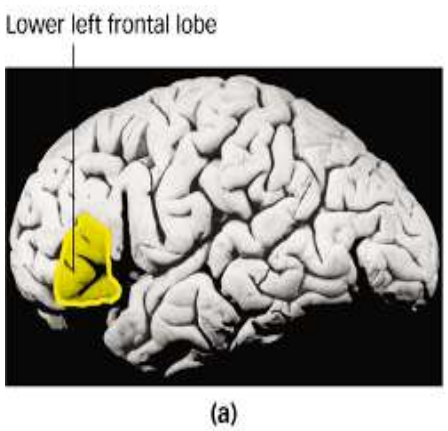
Elaboration

Distinctiveness

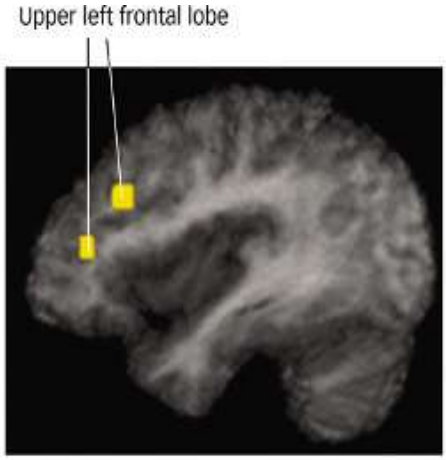
ENCODING

Where does this elaborative encoding take place?

- semantic (a)
- organizational—rhyme (b)
- visual (c)



(a)



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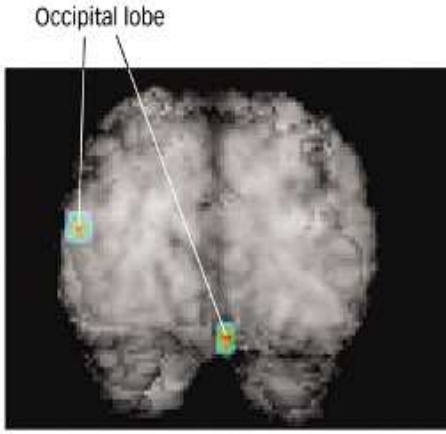
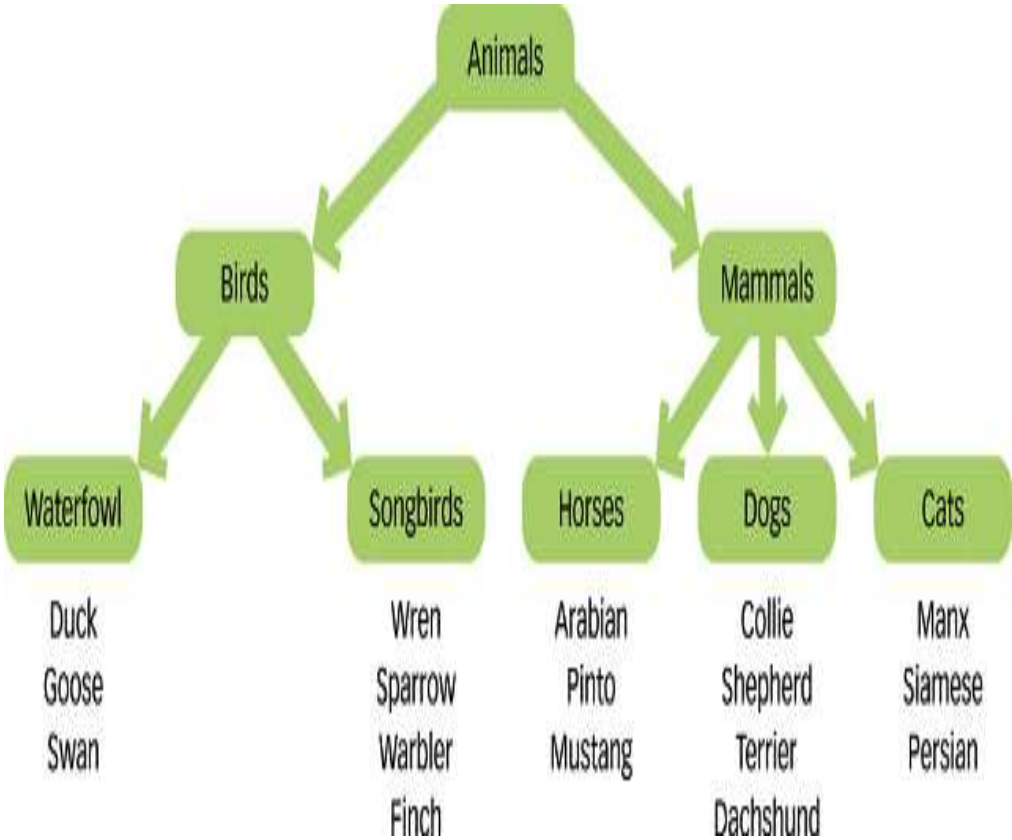


(c)

ORGNIZATIONAL ENCODING

Organizational encoding

- noticing relationships
- creating categories
- conceptual groups

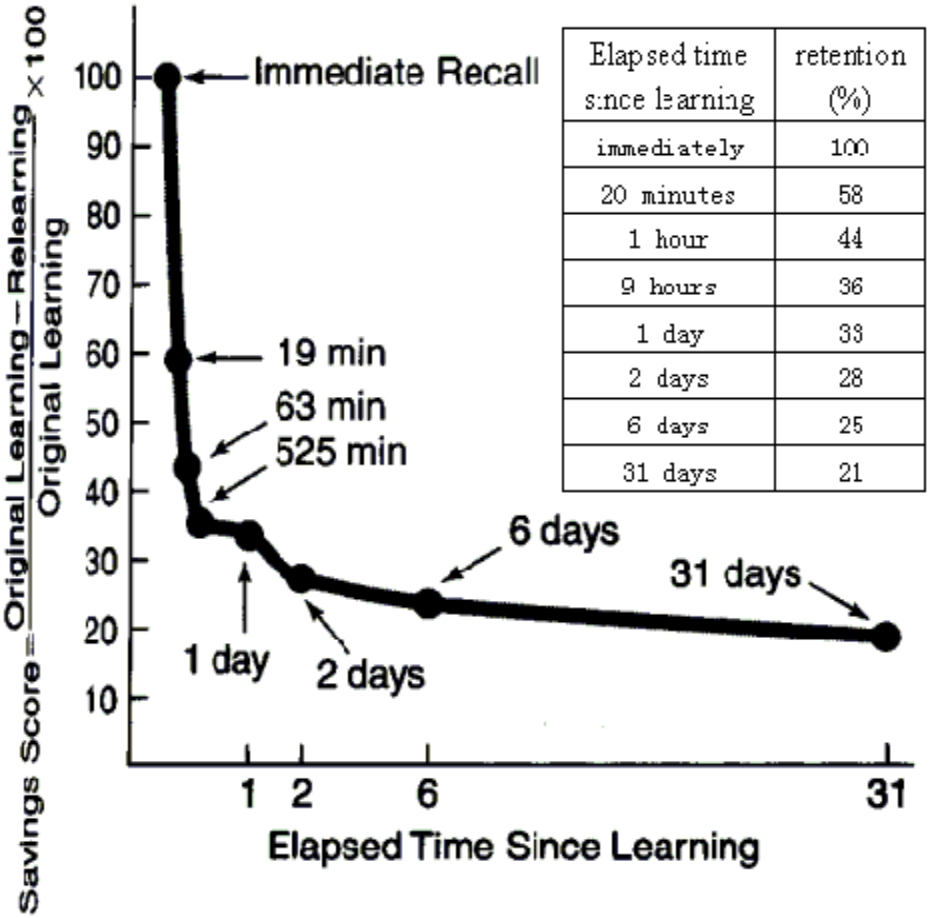


EBBINGHAUS

- Forgetting curve and memory strength
- $R = e^{-t/s}$
- Exponential in nature.
- Memory retention is 100% at the time of learning any particular piece of information. However, it drops rapidly to 40% within the first dew days. After which, the declination of memory retention slows down again
- *Overlearning effect:* practiced something more than what is usually required to memorize; the information is now stored much more strongly and thus the effects of forgetting curve for overlearned information is shallower

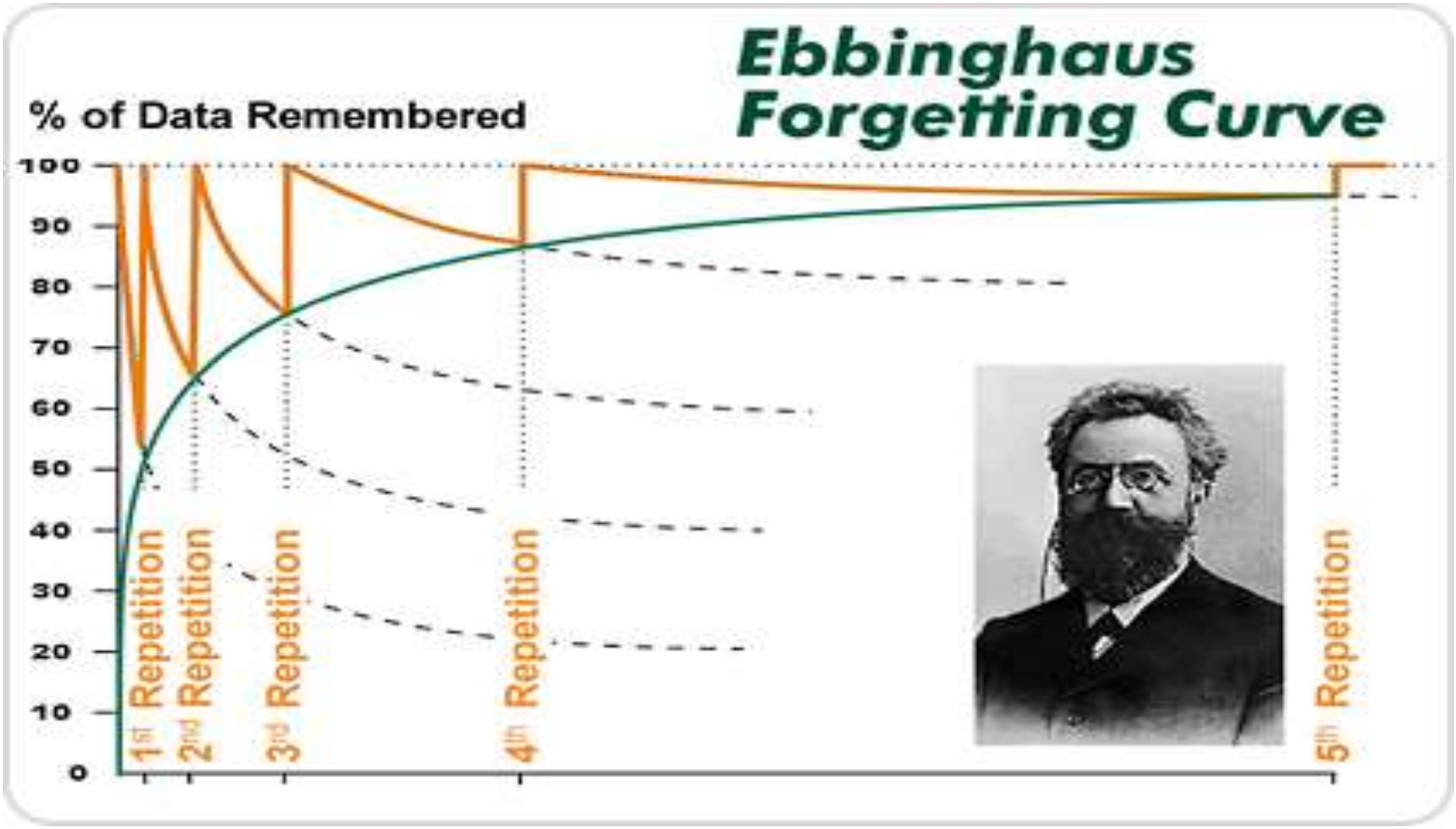
Nonsense Syllables:

wyx
ghe
jek
lsm



Elapsed time since learning	retention (%)
immediately	100
20 minutes	58
1 hour	44
9 hours	36
1 day	33
2 days	28
6 days	25
31 days	21

DISTRIBUTED STUDYING



Better memory representation (e.g. with mnemonic techniques)

Repetition based on active recall (esp. spaced repetition)

MEMORIES IN THE BRAIN

NMDA receptor

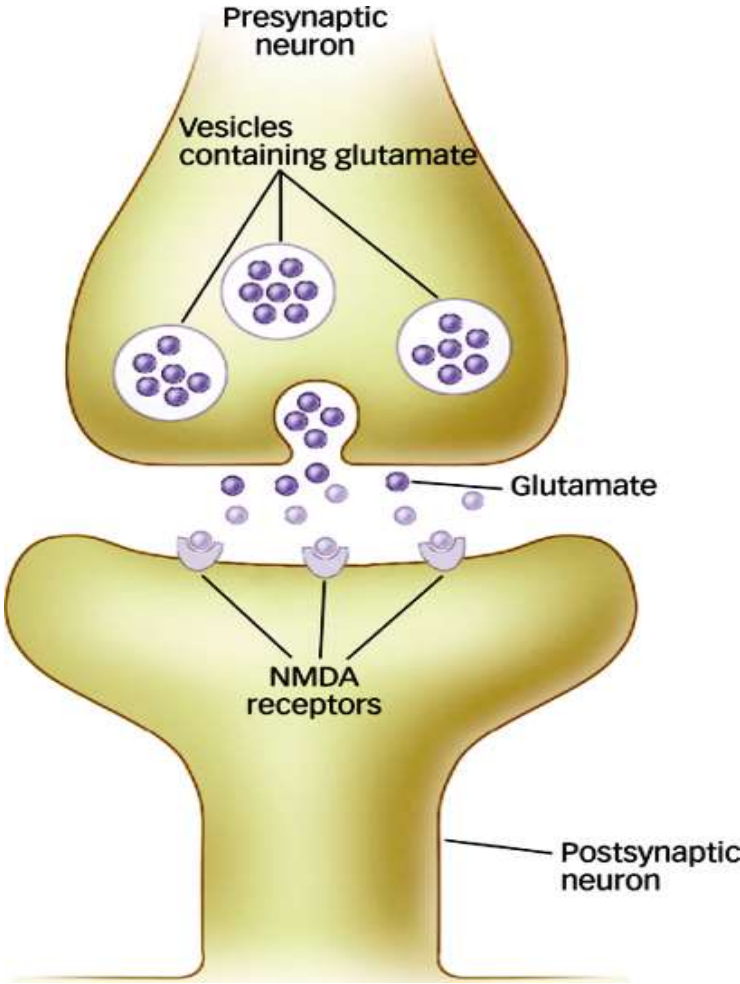
- flow of info. from one neuron to another

NMDA receptors become activated:

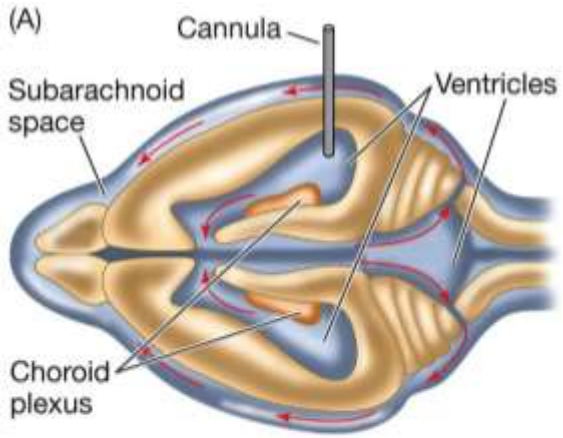
- "sending" neuron releases glutamate
- "receiving" neuron excited

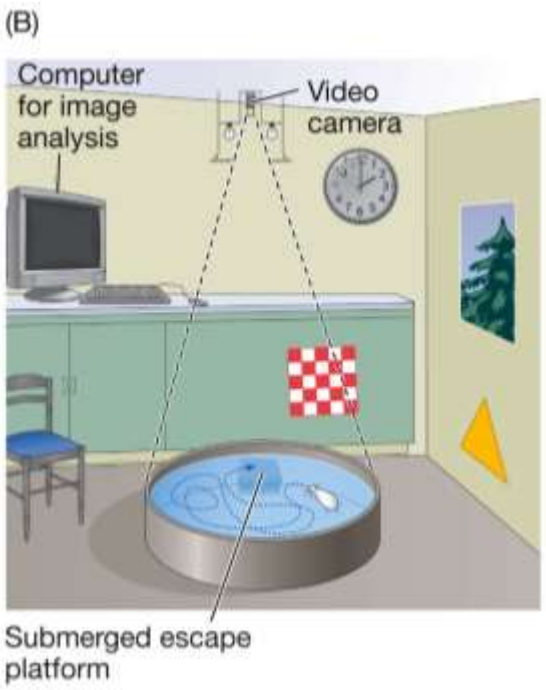
Long-term potentiation (LTP) results

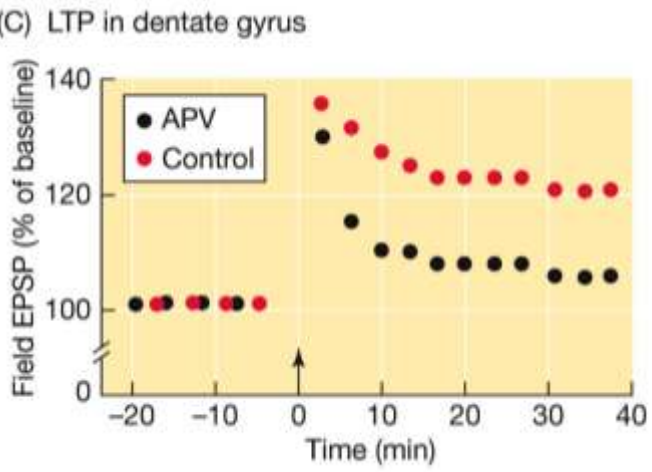
- enhanced neural processing

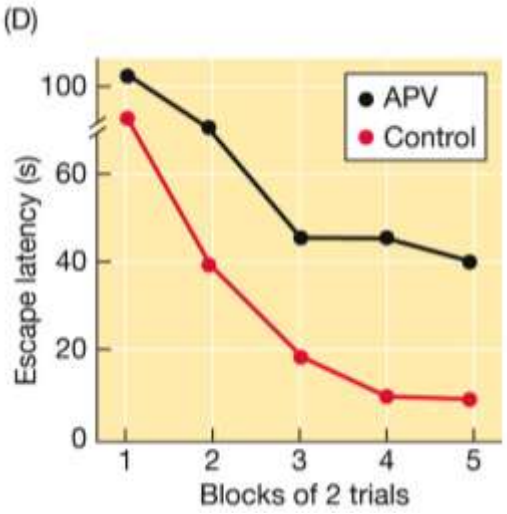


NMDA Receptors and Memory Function: The NMDA receptor and place learning









MEMORY: TRICKS WITH RETRIEVAL

How many animals of each kind did Moses take on the ark?

_____

How confident are you? (1=not at all, 7= very confident) ____

In the biblical story, what was Joshua swallowed by?

_____

How confident are you? (1=not at all, 7= very confident)

_____

ASPECTS OF MEMORY: RETRIEVAL

Moses didn't have an ark—Noah did

Joshua wasn't swallowed by a whale: Jonah was

ASPECTS OF MEMORY: RETRIEVAL

Retrieval Cues: reminders; directs memory search to appropriate part of LTM library

Help you remember items that feel 'out of reach'

Winter
Green
Foot
Pencil
Sweater
Jupiter
Chicago
Bible
French
Violin

ASPECTS OF MEMORY: RETRIEVAL

Subjective organization ('hund-hound')

State-dependent: situational influences affecting retrieval from LTM (eg: mood state)

Retrieval cues:

A season of the year:

A color:

A part of the body:

A writing instrument:

An article of clothing:

A planet:

A name of a city:

A type of book:

A language:

A musical instrument:

Reconstructive processes:

Constructive processes are involved at the coding stage of LTM

Reconstructive processes: modifications of already stored input

Eg: Confabulation: fill in memory gaps during retrieval

Eye-witness testimony

IMPLICIT / EXPLICIT MEMORY

Explicit memory: information that has to consciously be worked on to be remembered
Implicit memory: information remembered unconsciously and effortlessly

- **Standard measures**
  - *implicit measures*
    - *word stem*
    - *word fragment*
    - *perceptual identification*
    - *lexical decision*
    - *fame judgments (Jacoby et al, 1989)*
  - *explicit measures*
    - *recall*
    - *recognition*

Wo__ St___

W_rd Fra_gm___t

Perceptual identification

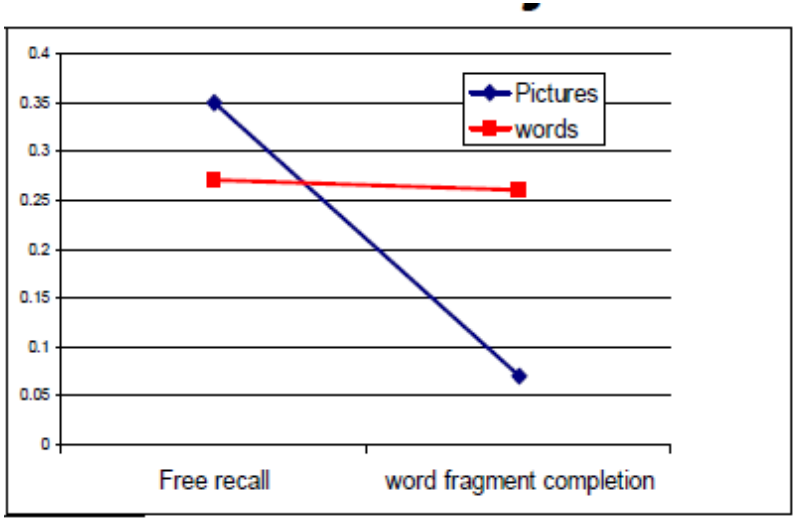
Lexical Decision or something else?

(Frame judgments) Are we studying Memory or Learning

METHODS IN STUDY OF MEMORY

Which type of memory test would you rather have?

- An essay or a multiple choice exam?
- The difference between these two types of tests captures the difference between a **recall task** (essay) and a **recognition test** (x-choice)



RETRIEVAL CUES

Retrieval cues—reinstating the past

Encoding specificity principle

State-dependent learning

RETRIEVAL CUES

Context

- Trouble recognizing somebody at work when you meet them on vacation
- Scuba divers learning a list of words under water will recall it better underwater than on land

State Dependent Recall

- Learning while happy or sad means better recall while happy or sad (drunk too, but general performance down)

MEMORY PROCESSES

One is Active: Rehearsal

One is Passive: Decay

Evidence:

- The serial position curve
- The task: I present you with a list and you recall it. You can recall the words in any order and try to recall as many as you can (called a free recall task).
- We graph the frequency of recall by serial position in the list (first word, second word, etc.).
- Looking at that curve can tell us something about memory stores.

BED

CLOCK

DREAM

NIGHT

TURN

MATTRESS

SNOOZE

NOD

TIRED

NIGHT

ARTICHOKE

INSOMNIA

REST

TOSS

NIGHT

ALARM

NAP

SNORE

PILLOW

Write down the words you saw

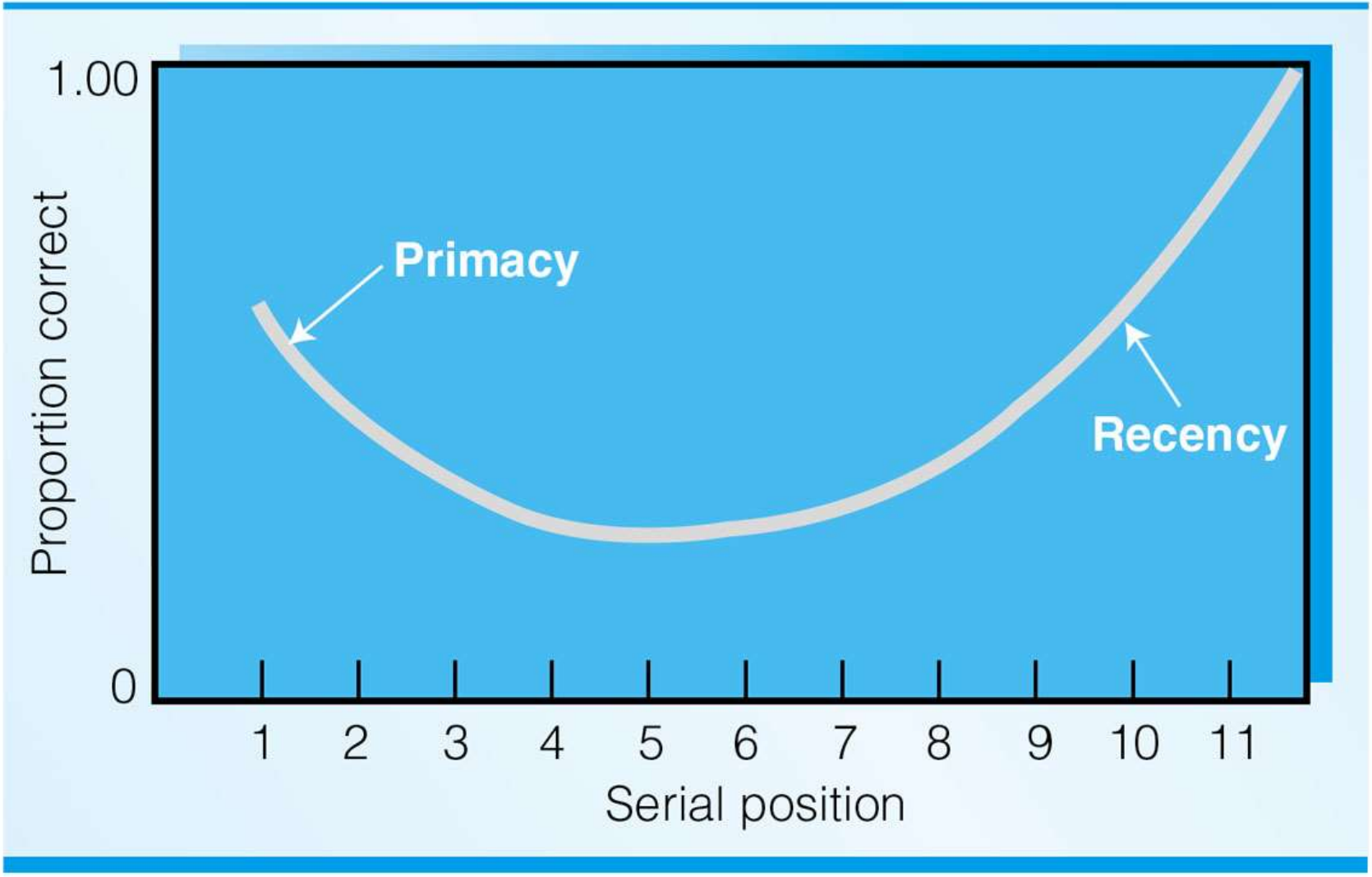
HERE ARE THE WORDS IN THE ORDER VIEWED

BED
CLOCK
DREAM
NIGHT
TURN
MATTRESS
SNOOZE
NOD
TIRED
NIGHT

ARTICHOKE
INSOMNIA
REST
TOSS
NIGHT
ALARM
NAP
SNORE
PILLOW

Did you recall?	Explanation
Bed? Clock?	Primacy Effect
Snore? Pillow?	Recency Effect
Night?	Spacing Effect
Artichoke?	Distinctiveness
Toss? Toss & Turn?	Clustering
Sleep?	False Memory

SERIAL POSITION CURVE



SERIAL POSITION EFFECT

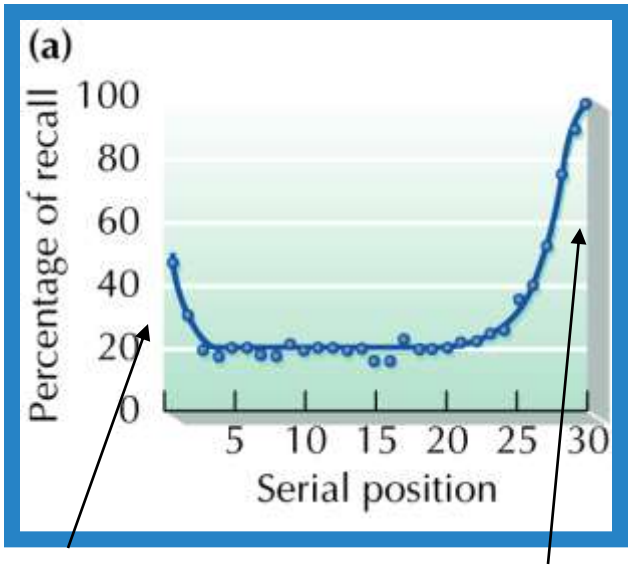
Primacy effect – remembering stuff at beginning of list better than middle because of Rehearsal

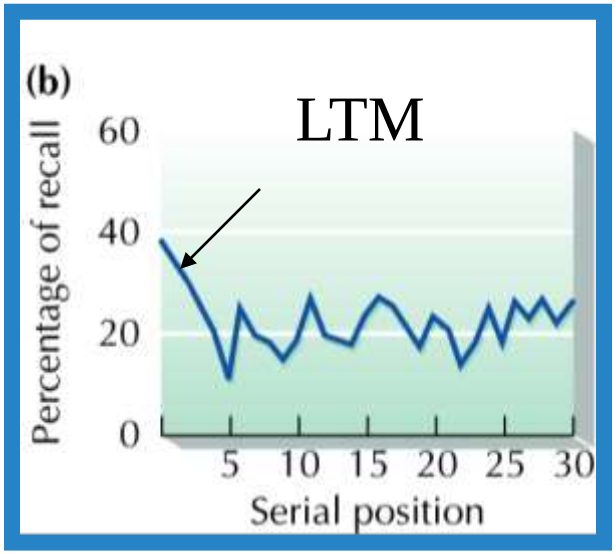
Recency Effect – remembering stuff at the end of list better than middle because of lack of Interference

SERIAL POSITION EFFECT

Recall immediately after learning

Recall several hours after learning





Recall from LTM

Recall from STM

Primacy effect – remembering stuff at beginning of list better than middle

Recency Effect – remembering stuff at the end of list better than middle

NICKERSON & ADAMS

Pennies for your thought

Participants in a 1979 experiment were shown these 15 drawings and asked to identify the correct penny design. Just more than 40 percent chose correctly (answer below).

Source: Raymond S. Nickerson and Marilyn Jager Adams, Cognitive Psychology

Answer: The correct penny design is in the bottom row, second from left.

New York Times News Service

NICKERSON & ADAMS

1 c

CONSOLIDATION:
GETTING INFO FROM STM TO LTM

Mnemonic devices are strategies to improve memory by organizing information

- **Method of Loci: ideas are associated with a place or part of a building**
- **Peg-Word system: peg words are associated with ideas (e.g. "one is a bun")**
- **Interactive Images : verbal associations are created for items to be learned**

RESEARCH ON SHORT-TERM MEMORY & CONSOLIDATION

Miller (1956)

- Examined memory capacity
- 7+/- 2 items or “chunks”

Chunking -- organize the input into larger units

- 1 9 8 0 1 9 9 8 2 0 0 3 - Exceeds capacity
- 1980 1998 2003 - Reorganize by chunking.

Short Term Memory Demo

1 4 9 1 6 2 5 3 6 4 9 6 4 8 1

1 4 9 16 25 36 49 64 81

MEMORY STRATEGIES: ORGANIZATION IS KEY

Try and remember these words

- Dog, bus, mouse, chair, tulip, train, table, horse, rose, petunia, airplane, goat, sofa, pig, bed, boat, daisy, truck, marigold, dresser

Is this easier??

- Dog, mouse, horse, goat, pig
- Chair, table, sofa, bed, dresser
- Tulip, rose, petunia, daisy, marigold

PEG WORD SYSTEM

Imagine the words interacting

- One is a bun,
- Two is a shoe,
- Three is a tree,
- Four is a door,
- Five is a hive,
- Six are sticks,
- Seven is heaven,
- Eight is a gate,
- Nine is a line
- Ten is a hen.

Keywords and images:

- Ashtray - bun
- Firewood – shoe
- Picture – tree
- Cigarette –door
- Table – hive
- Matchbook – sticks
- Glass – heaven
- Lamp – gate
- Dog – line
- Phonograph – hen

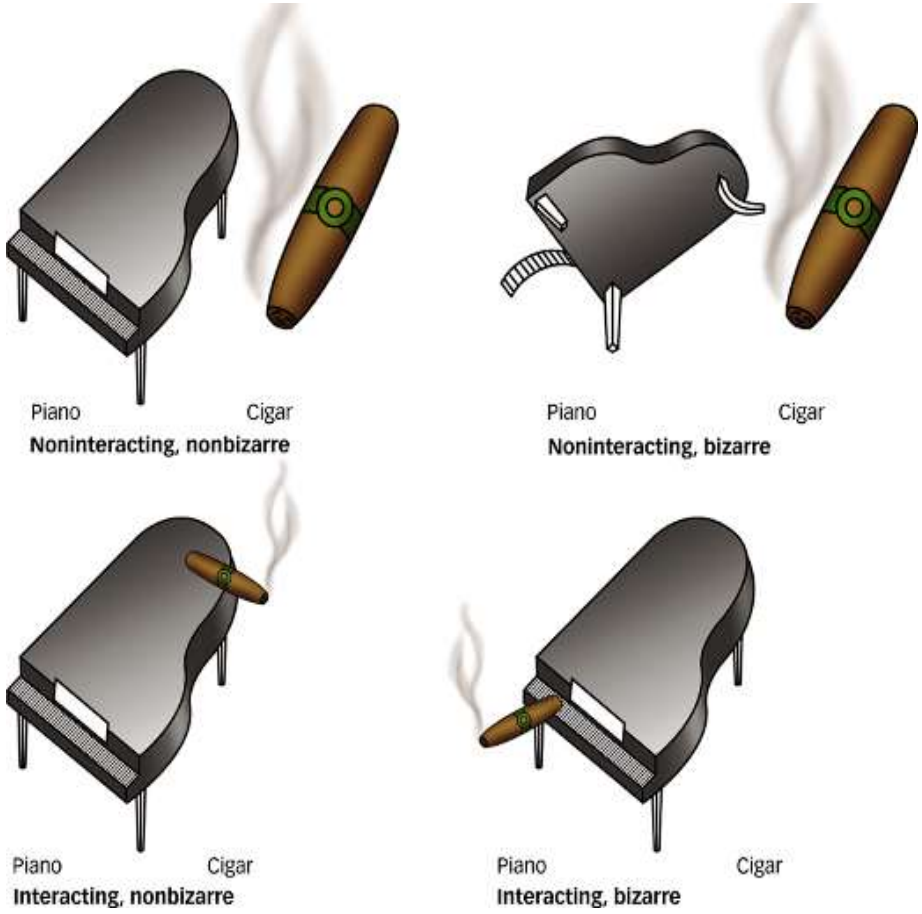
VISUAL IMAGERY ENCODING

Visual encoding: process of **encoding** images and **visual** sensory information. The creation of mental pictures is one way people use **visual encoding**. This type of information is temporarily stored in iconic memory, and then is moved to long-term memory for storage.

Visual imagery:

Simonides

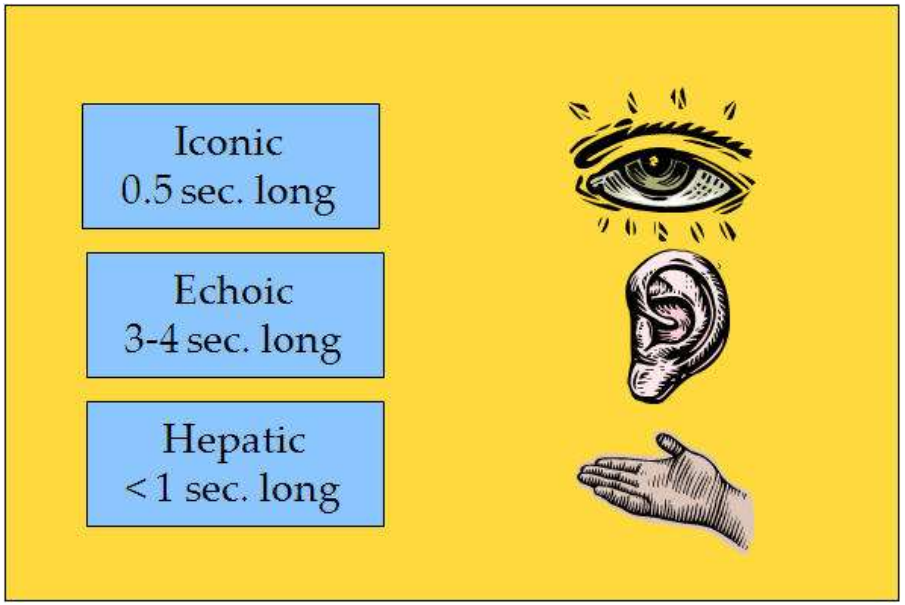
- Greek poet perfected visual imagery encoding



A TALE OF THREE MEMORIES

Feature	Sensory Memory	Working Memory	LTM
Encoding	Copy	Phonemic	Semantic
Capacity	Unlimited	7±2 Chunks	Very Large
Duration	0.25 sec.	20 sec.	Years

A Tale of Three Memories



Iconic memory

- large capacity
- Same modality as experience
- Very fast decay

Sperling Sensory Memory Demonstration

- A matrix of 12 letters and numbers will be briefly flashed on the next few slides
- As soon as you see the information, write down everything you can remember in its proper location

Whole Report

Here's where the letters and numbers will appear-- Keep your eyes on the "X" on the next slide

X X X X

X X X X

X X X X

X

B 5 Q T

2 H S 9

O 4 M Y

Partial Report – No Delay

For the next demonstration, report only the top, middle, or bottom row. The row to report will be identified by markers **IMMEDIATELY** after you see the letters.

X X X X

X X X X

X X X X

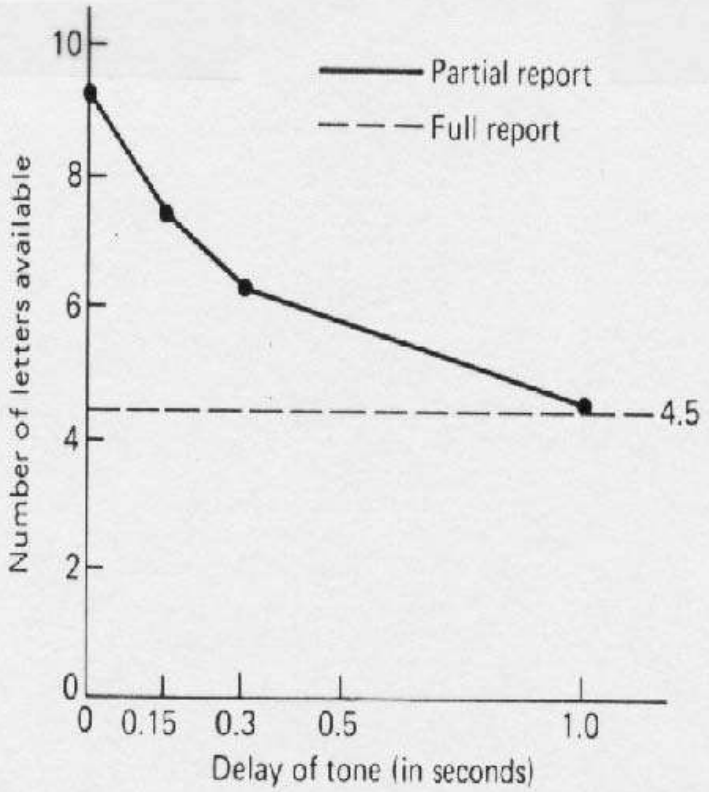
X

2 V 9 R

Q M 7 L

K H 5 F

THE EFFECT OF DELAY ON SENSORY MEMORY



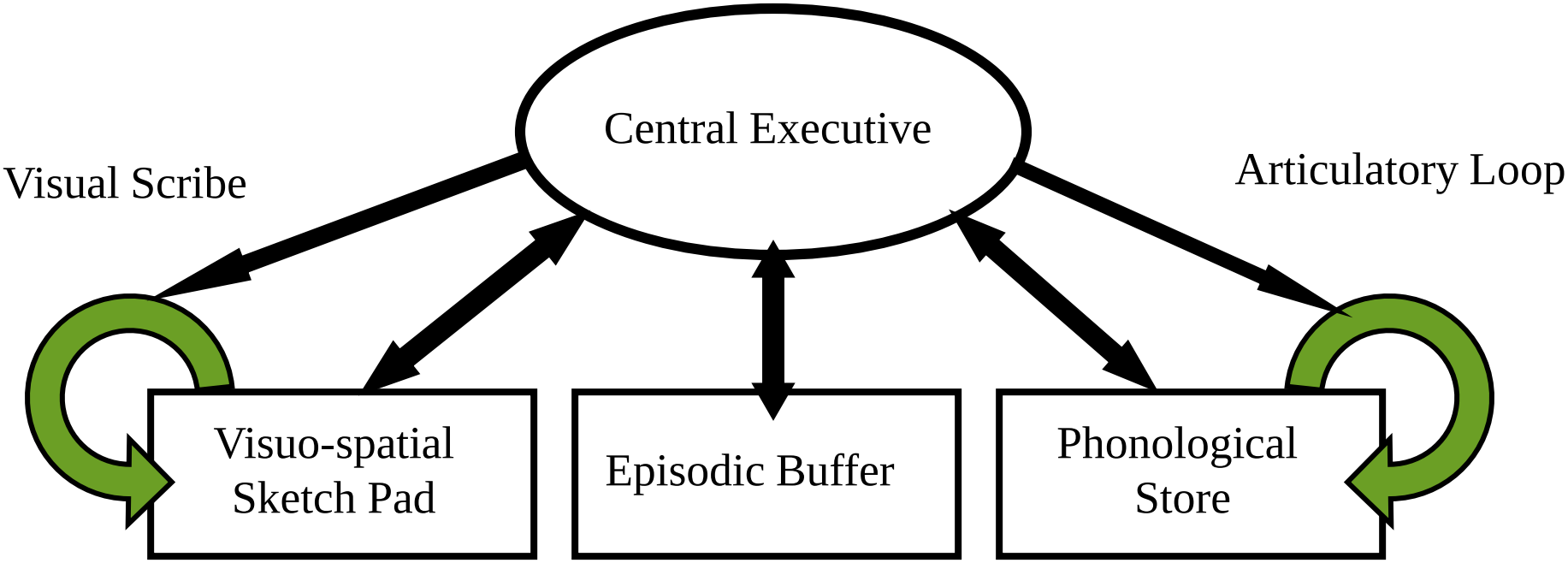
Number of letters available versus time. The number of letters available for the partial-report condition decreases with delay of the cue tone.

A Tale of Three Memories

Short Term Memory,

- Limited capacity
- Acoustic recoding
- Rehearsal maintains information
  - Probabilistic transfer into LTM
- information from LTM retrieved and used here

BADDELEYS' WORKING MEMORY MODEL



WORKING MEMORY MODEL

Central Executive

- Focuses attention on relevant items and inhibiting irrelevant ones
- Plans sequence of tasks to accomplish goals, schedules processes in complex tasks, often switches attention between different parts
- Updates and checks content to determine next step in sequence of parts
- Drives the whole system (e.g., the boss of working memory) and allocates data to the subsystems: the phonological loop and the visuospatial sketchpad. It also deals with cognitive tasks such as mental arithmetic and problem-solving.

SHORT-TERM MEMORY: WORKING MEMORY MODEL

Articulatory Loop

- Used to maintain information for a short time and for acoustic rehearsal

Visuo-spatial Sketch Pad

- Used for maintaining and processing visuo-spatial information
- The visuospatial sketchpad is a component of working memory model which stores and processes information in a visual or spatial form. The visuospatial sketchpad is used for navigation.

The phonological loop: deals with spoken and written material. It is subdivided into the phonological store (which holds information in a speech-based form) and the articulatory process (which allows us to repeat verbal information in a loop).

Phonological Store (inner ear) processes speech perception and stores spoken words we hear for 1-2 seconds.

Articulatory control process (inner voice) processes speech production, and rehearses and stores verbal information from the phonological store.

Episodic Buffer

- Used for storage of a multimodal code, holding an integrated episode between systems using different codes

EVIDENCE FOR PHONOLOGICAL LOOP

Phonological similarity effect:

- BBGTCD is harder to memorize than FKYWMR

Wordlength effect:

- Pay,wit,bar,hop,sum vs. helicopter, university, television, alligator,opportunity

Subvocal articulation, auditory noise, interferes with verbal memory

WORKING MEMORY

Context

- Trouble recognizing somebody at work when you meet them on vacation
- Scuba divers learning a list of words under water will recall it better underwater than on land

State Dependent Recall

- Learning while happy or sad means better recall while happy or sad (drunk too, but general performance down)

STATE DEPENDENT

Goodwin et al (1969) asked male volunteers to perform memory tasks that involved learning and remembering words while either sober or under the effects of alcohol at three times the legal drunk driving limit.

A Tale of Three Memories

- Long term memory
  - Unlimited capacity
  - Semantic coding
  - Little decay


Implicit
Motor and perceptual skills
Amygdala
Cerebellum
Reflex pathways
Explicit
Facts and events
Hippocampus
Medial temporal lobe

MULTIPLE FORMS OF LONG-TERM MEMORY

Implicit memory

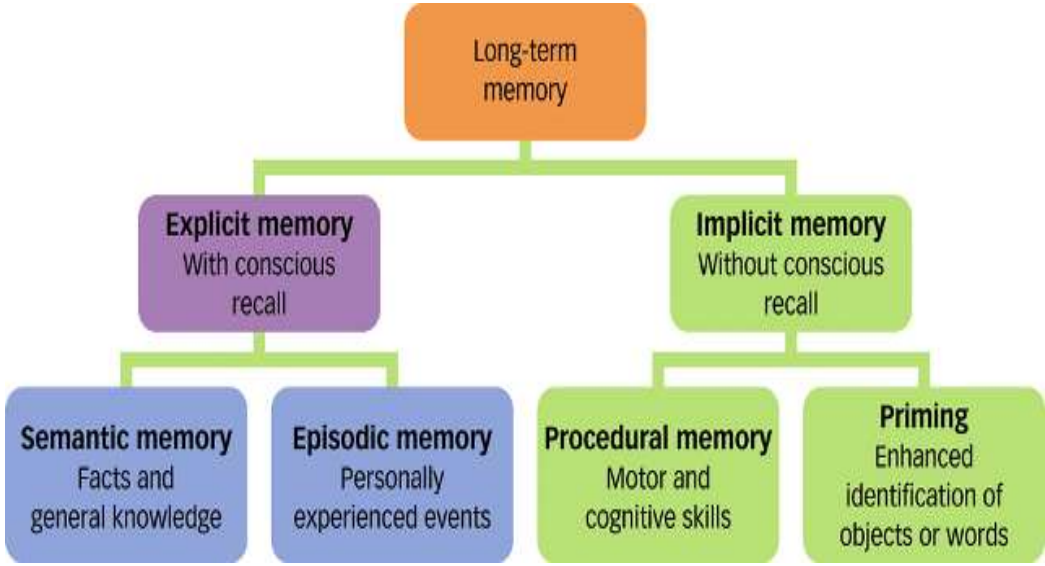
Explicit memory

Procedural memory

Semantic memory

Episodic memory

Priming



Implicit and Explicit Memory

- **Explicit** memory tasks
  - Recall is Voluntary, Conscious, Verbal (or demonstrable)
  - Also called **Declarative** memory
  - Recall or recognition

- **Implicit** memory tasks
  - Involuntary and Unconscious
  - Require participants to complete a task (the completion of the task indirectly indicates memory)
  - Also Called **Non-declarative** memory
  - Word stem, word fragment, perceptual degradation

- **explicit performance improved by**
  - *generation*
  - *elaboration / levels of processing*
  - *load at encoding or test impairs explicit performance*
- **implicit**
  - ***changes in modality*** *(Jacoby & Dallas, 1981)*
    - *auditory to visual – much larger effects on implicit than explicit*
  - ***decay***
    - *word identification less susceptible to delay than explicit (Jacoby & Dallas)*
    - *but word stem and lexical decision very fast decay (Graf & Mandler, 1984).*
  - ***priming and word stem unaffected by interference*** *(Graf & Schacter, 1987)*

EXAMPLES OF TYPES OF MEMORIES

Episodic: "I bumped into a friend today at the diner whom I hadn't seen since last year."

Semantic: "George Washington was the first President of the U.S."

Procedural Memory: Riding a bike

Classical conditioning: Reflexes

Priming: Jingles

AMNESIA

Profound memory deficit due to either loss of what has been stored or due to inability to form new memories

Psychological amnesias: childhood amnesia, dream amnesia, defensive amnesia

Biological amnesias:

Transient global amnesia

Marijuana, alcohol and amnesia

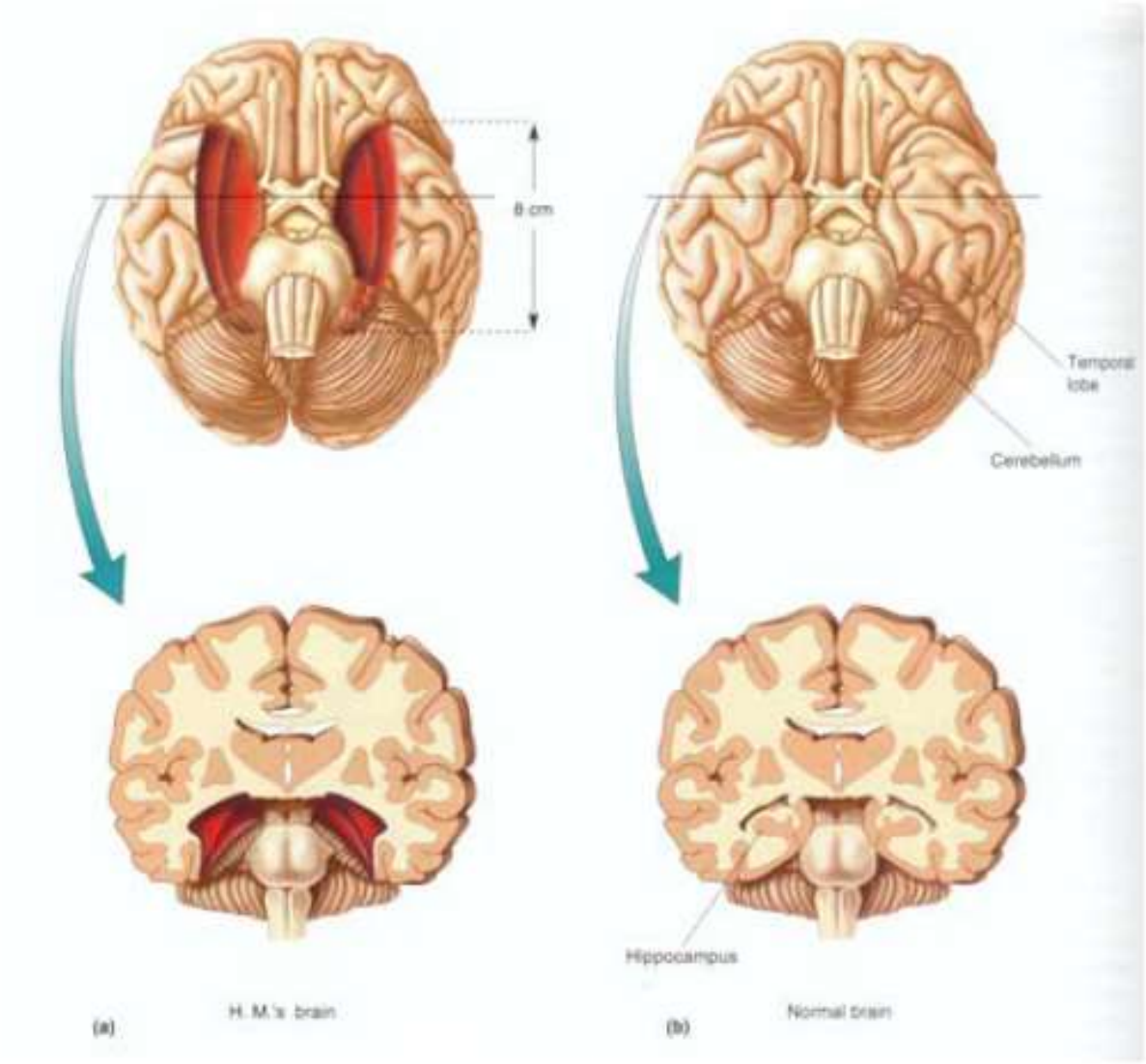
Diseases of the brain

Improving memory: Mnemonics, The method of Loci, number and letter peg systems,

In 1933, a 7-year-old boy fell from his bicycle, hit his head and was unconscious for 5 minutes. this event is thought to have been the precipitating event that ultimately led to some of our greatest insights into memory processing by the brain. this boy was, of course, HM. Soon after that incident, he began developing minor seizures, followed by his first major seizure on his 16th birthday. Because of these seizures, his education was sporadic, but he eventually graduated high school with a technical focus at age 21. Subsequently he worked on an assembly line as a motor winder. His seizures soon increased to around 10 a day and he was unable to perform his job. Attempts to control his seizures with drugs were unsuccessful and led to a brain operation. EEG was unable to localize the source of the seizures, but because of theknown epileptogenic qualities of the MTL, an experimental surgery was conducted in an effort to ameliorate the seizures. In 1953, when HM was 27, the neurosurgeon William Scolville performed a bilateral medial temporal lobe resection.

The operation reduced the frequency of seizures to a point where they were now largely prevented by medication, although minor attacks persisted. However, one striking and totally unexpected consequence of the surgery was a grave loss of the ability to form new declarative memories. HM is probably the most examined and best known neurological patient ever studied, largely because of the combination of the unusual purity of the ensuing memory disorder, the static nature of his condition, his cooperative nature and the skill of the researchers who protected and worked with him. The other patients who received bilateral lobectomies were not followed up as well because they were psychotic. Those described w/o memory deficits had lobectomy either unilaterally, or only the temporal pole was removed, sparing the HC.

The famous case of H.M.



Types of memory loss

- Serious memory loss, or amnesia, is usually caused by disease or brain trauma.
- 2 main types of memory loss: anterograde and retrograde:

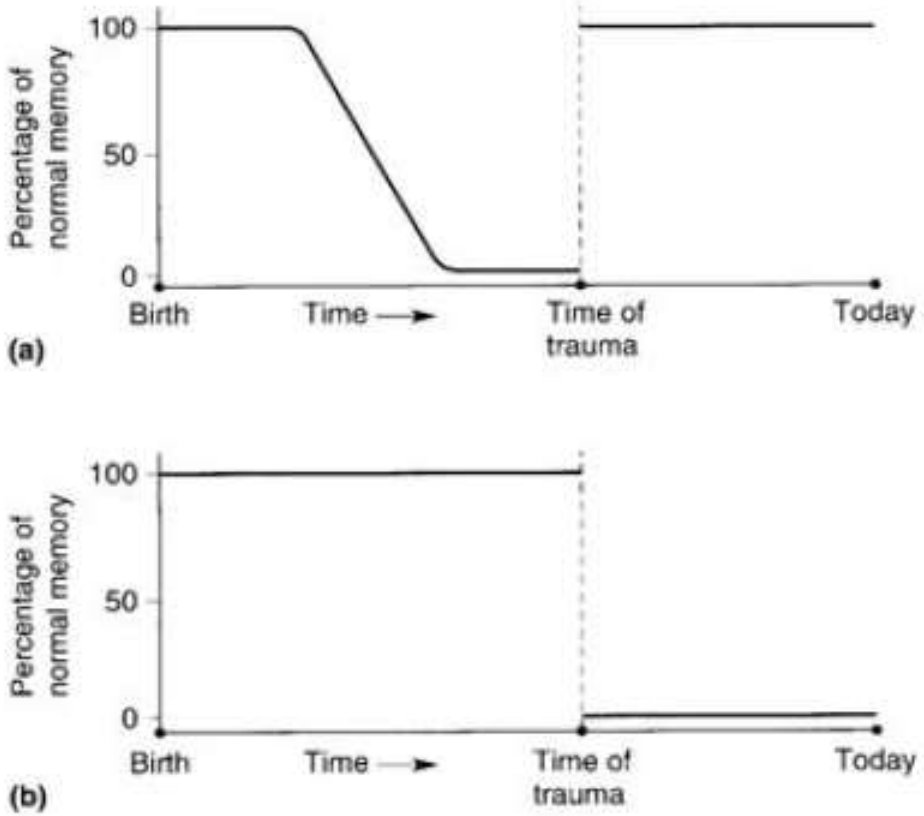
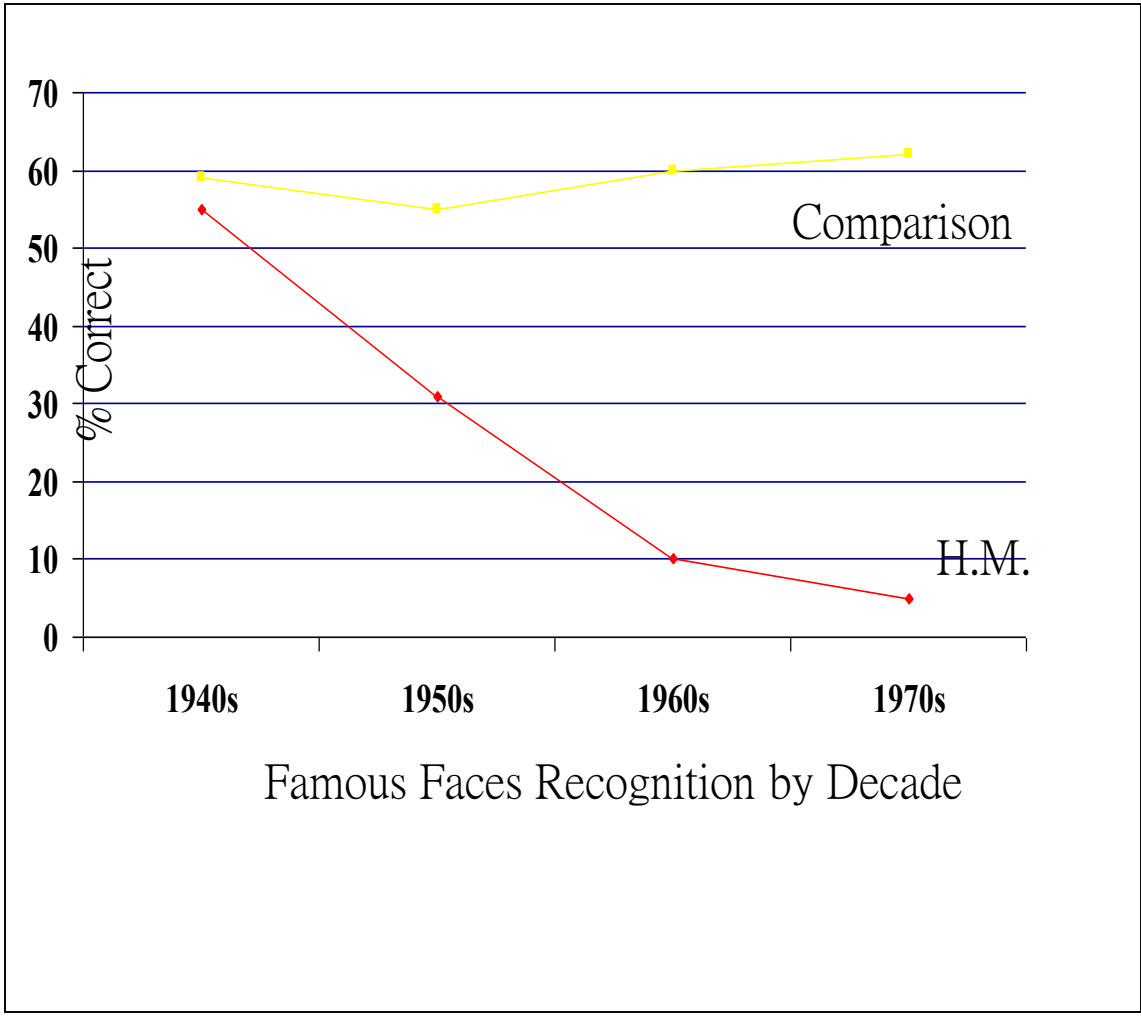


Figure 23.3
Amnesia produced by trauma to the brain. (a) In retrograde amnesia, events for a period prior to the trauma are forgotten, but memories from the distant past and the period following the trauma are intact. **(b)** In anterograde amnesia, events prior to the trauma can be remembered, but there are no memories for the period following the trauma.

H.M.' S RETROGRADE AMNESIA

-H.M.s RA extends back ~11 years pre-surgery

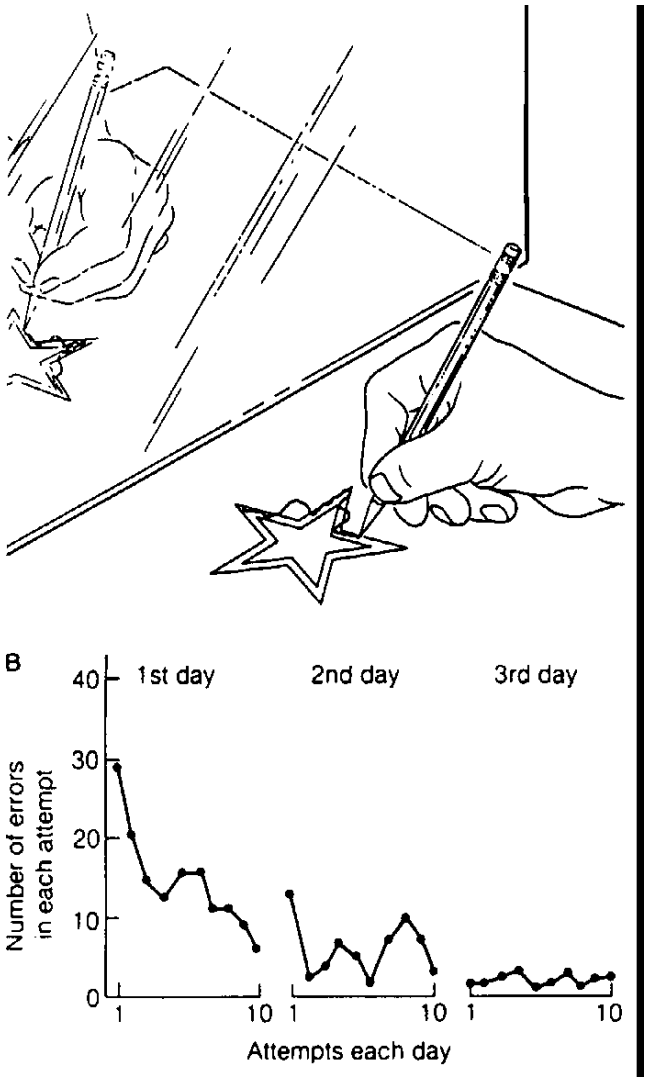
-Famous Faces performance is normal for 40s, then below normal for 50s, then severely impaired in the 60s & 70s



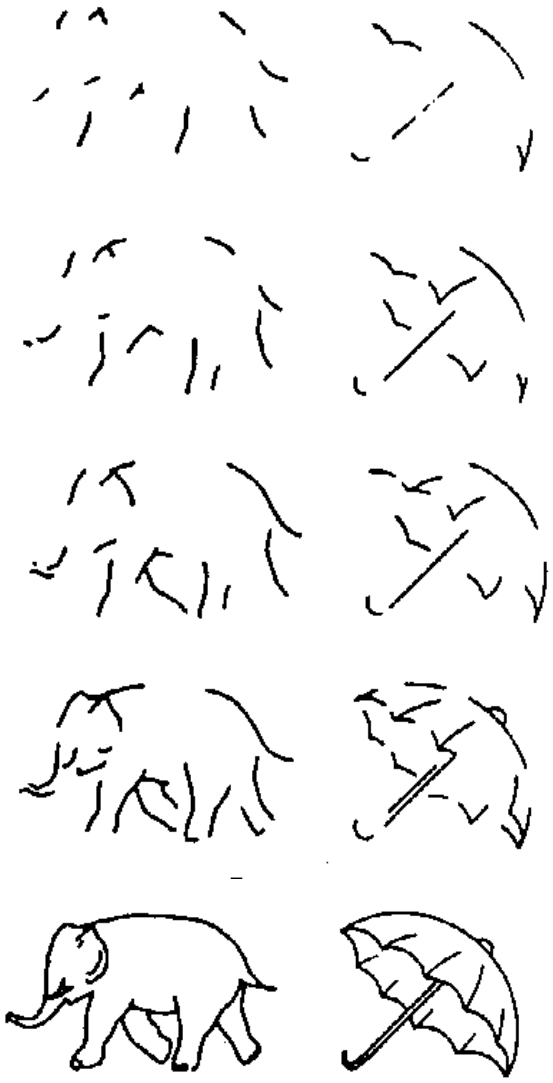
INTACT DOMAINS OF MEMORY IN AMNESIA

-Working memory: HM’ s digit span is normal

-Skill and Perceptual learning



PERCEPTUAL LEARNING



Gollins partial pictures test

COMMON INACCURACIES IN LONG-TERM MEMORY

Reasons for inaccuracy of memory:

- **Source amnesia**: attribution of a memory to the wrong source (e.g. a dream is recalled as an actual event; age correlates with a decrease in source memory; infantile memories are from a third person perspective)
- **Sleeper effect**: a piece of information from an unreliable source is initially discounted, but is recalled after the source has been forgotten
- **Misinformation effect**: we incorporate outside information into our own memories

THE RECONSTRUCTIVE NATURE OF MEMORY

WRITE DOWN WHAT YOU SAW

Factors that affect Eye Witness Testimony

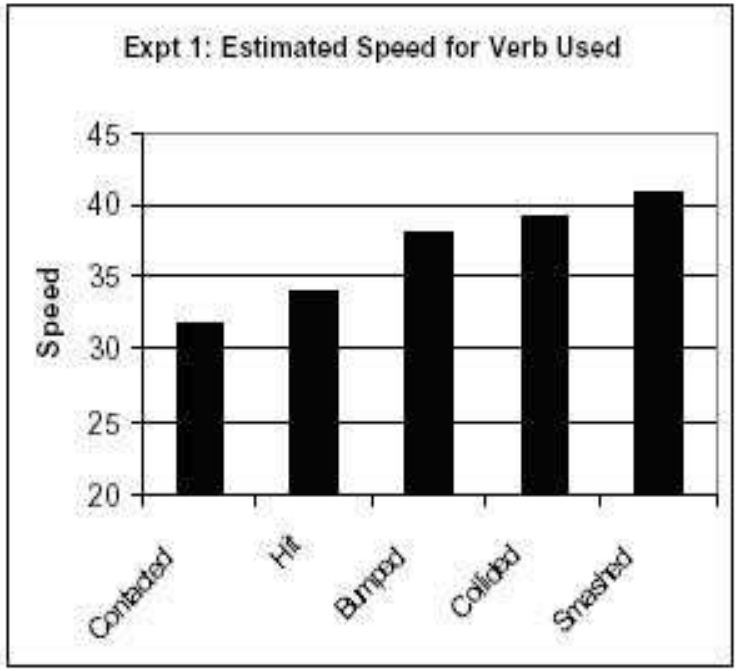
- **Stereotypes** - Allport and Postman (1947) Participants shown a cartoon of a black and a white man on a subway train. Most recalled that the black man had the razor in his hand. The razor was actually in the white man's hand. (stereotype – more prone to violence).
- Conclusion: When an actual perceptual fact doesn't match our expectations, we trust our expectation more than the real situation.
- We see what we expect to see and this forms the basis for the memory for an event.

THE RECONSTRUCTIVE NATURE OF MEMORY

- Loftus & Palmer (1974)
  - Participants viewed a film of a car accident
  - IV – question content
    - "About how fast were the cars going when they (smashed, hit, contacted) each other?"

THE RECONSTRUCTIVE NATURE OF MEMORY

Question	Verb	Estimated M
About how fast were the cars goings when they _____ each other?	smashed	40.8
	hit	34.0
	contacted	30.8



THE RECONSTRUCTIVE NATURE OF MEMORY

Constructing False Memories of One's Childhood

Loftus and Pickrell asked 24 subjects, 18 to 53, to try to remember childhood events provided by a parent, an older sibling or another close relative.

- Three paragraphs related events that had actually happened to the subject
- A fourth paragraph related an event of being lost in a mall that had not occurred but was constructed using information about a plausible shopping trip provided by a relative. The relative also verified that the participant had not in fact been lost at about the age of five
- The false event involved being lost for an extended period, crying, aid and comfort by an elderly woman and, finally, reunion with the family.

68% recall of the true memories, 29% of subjects remembered the false memory

Replicated on a group of people

- What memories did people remember?
  - 7 out of 24 remembered the false event
- How are the events remembered?
  - True memories described more
  - True memories rated more clear
  - False memories' clarity increased over time
- Can they choose the false memory?
  - 19 out of 24 figured out which was false
  - Process of elimination?

Individual Differences

- Some people are more susceptible to misinformation than others
  - 7 out of 24 participants
- People high at risk for misinformation acceptance have
  - Poor general memory
  - High scores on imagery vividness
  - High empathy scores

MEMORY FOR GENERAL KNOWLEDGE

- Scripts
  - For routine events
  - Restaurant example
  - Allows inferences, problem of intrusions

SCHEMAS

We reconstruct memories according to a “map” of behaviors that are highly related to one another, and form a set.

- Prior knowledge influences memory
- Interpretation of details
- Reductions in ambiguity
- Makes unusual things stand out

Schemas in action

- Prior knowledge influences memory

  Chase & Simon (1973) – chess experts

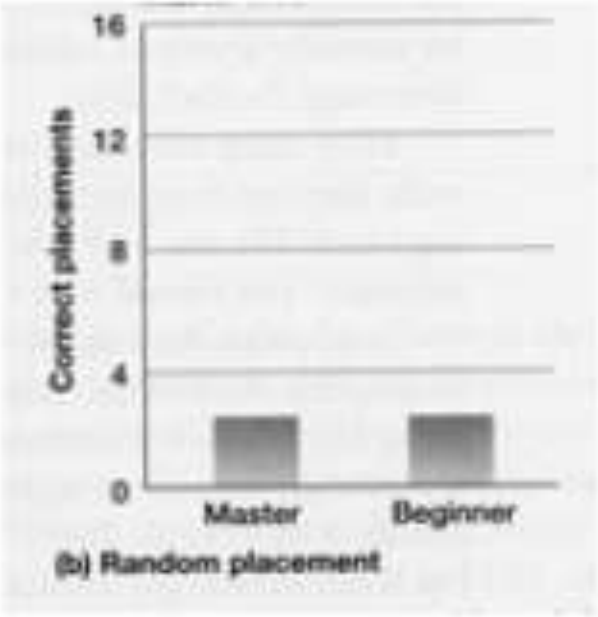
master players vs. beginners

Stimuli: chess board 20 moves into play for 5 seconds

Task: chess pieces removed & Ss had to replace the pieces as shown

results: superior performance for experts

confound with IQ or just better memory per se?



when pieces were arranged randomly, chess master performed as poorly as the beginner

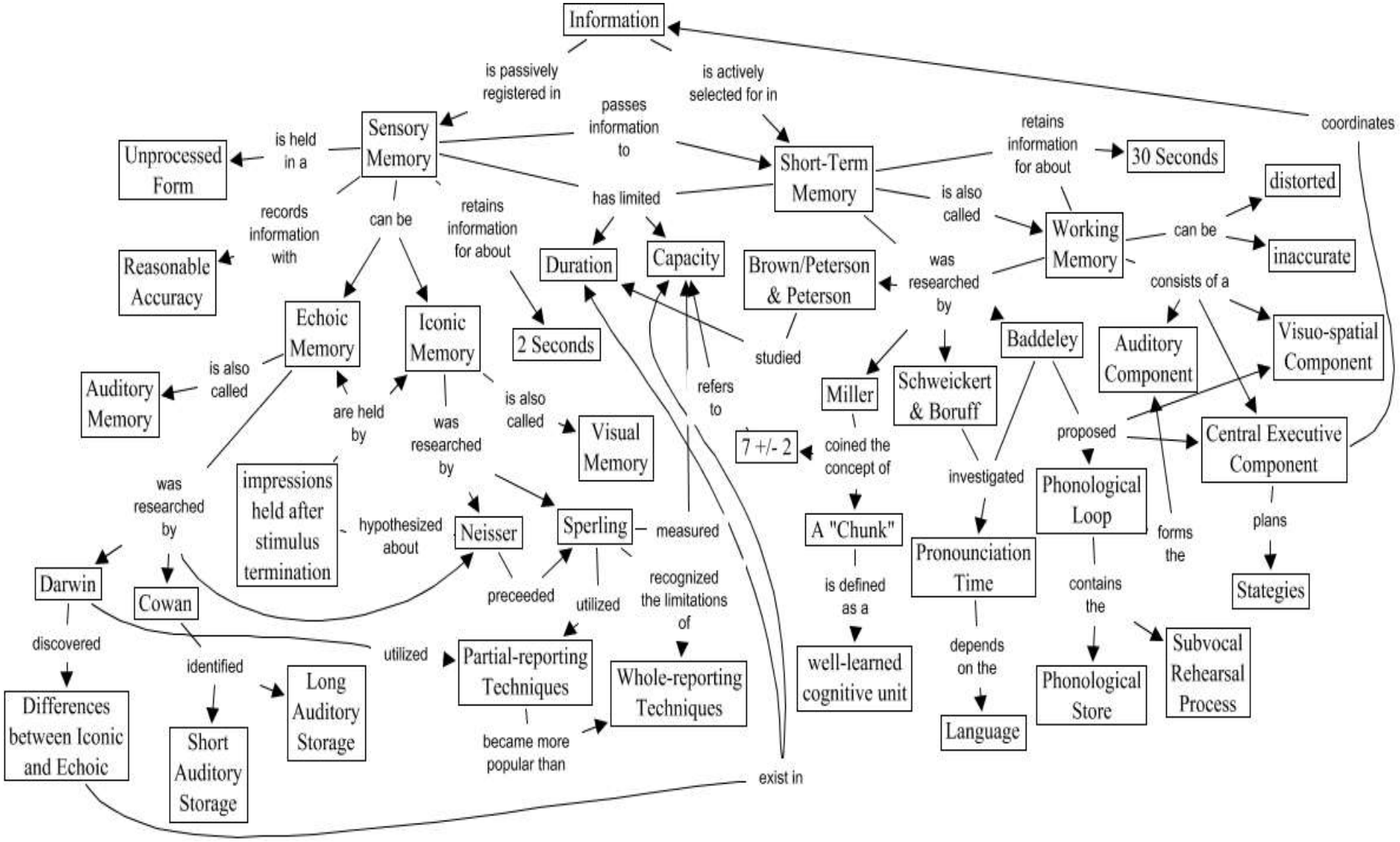
chess master's advantage is due to his ability to group the chess pieces into meaningful **chunks**

(There is no meaningful difference between chunks and schemas)

CONNECTIONIST PERSPECTIVE

Parallel distributed processing model

- Memory uses a network
- Meaning comes from patterns of activation across the entire network
- Spreading Activation Network Model
- Supported by priming effects


Information
is passively registered in
is actively selected for in
coordinates
Sensory Memory
passes information to
Short-Term Memory
retains information for about
30 Seconds
Unprocessed Form
is held in a
has limited
is also called
Working Memory
distorted
can be
inaccurate
records information with
Reasonable Accuracy
can be
retains information for about
Duration
Capacity
Brown/Peterson & Peterson
was researched by
consists of a
Visuo-spatial Component
Echoic Memory
Iconic Memory
2 Seconds
studied
Baddeley
Auditory Component
Auditory Memory
is also called
refers to
Miller
Schweickert & Boruff
are held by
was researched by
is also called
Visual Memory
7 +/- 2
coined the concept of
proposed
Central Executive Component
was researched by
impressions held after stimulus termination
hypothesized about
Neisser
Sperling
measured
investigated
Phonological Loop
forms the
plans
Darwin
Cowan
preceeded
utilized
recognized the limitations of
A "Chunk"
Pronounciation Time
Stategies
discovered
utilized
Partial-reporting Techniques
is defined as a
contains the
Subvocal Rehearsal Process
identified
Long Auditory Storage
Whole-reporting Techniques
well-learned cognitive unit
depends on the
Phonological Store
Differences between Iconic and Echoic
Short Auditory Storage
became more popular than
Language
exist in

IF YOU DO NOT RETRIEVE FROM LTM…

Has the memory disappeared?

or

Is the memory still there but cannot retrieve it (available, but not accessible)?

EVIDENCE SUPPORTING "STILL THERE" THEORY
NELSON (1971)

Paired associate List

43-house

67-dog

38-dress

77-scissors

Cued recall test

43- _____

67- _____

Two week delay

Subjects recalled 75% of items on list

But focus was on 25% they forgot.

NELSON (1971) CRITICAL MANIPULATION

If participants forgot "38-dress" and "77-scissors" then participants relearned either same pairs or changed pairs

	25% "forgot"	Relearned	Results
Same	38-dress 77-scissors	38-dress 77-scissors	78%
Changed	38-dress 77-scissors	38-apple 77-kettle	43%

The better performance of participants in the same condition indicate that there was some memory left for "forgotten" items. Otherwise both groups would remember the same amount.

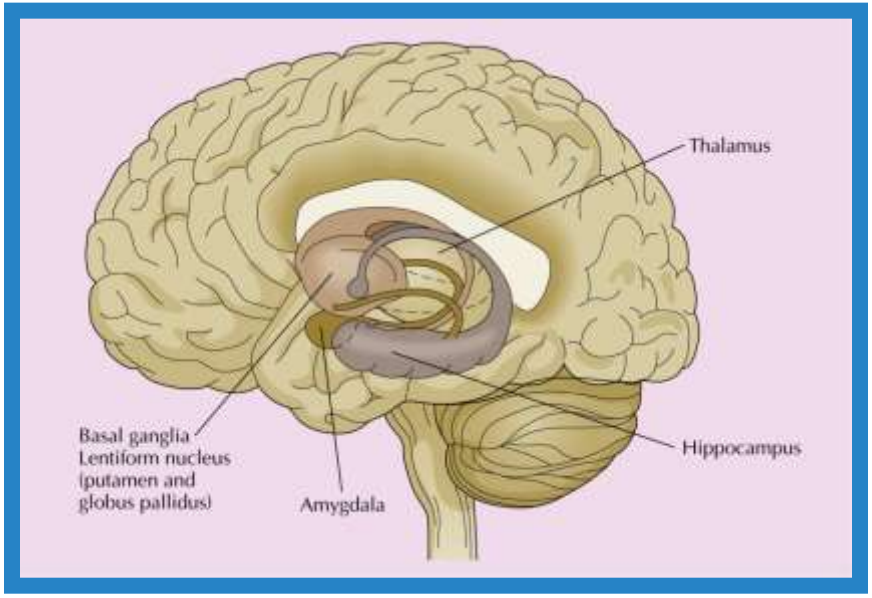
THE NEURO-ANATOMY OF MEMORY

Hippocampus

Amygdala

HIPPOCAMPUS

Anatomy of Memory



Amygdala: emotional memory and memory consolidation
Basal ganglia & **cerebellum**: memory for skills, habits and CC responses
Hippocampus: memory recognition, spatial, episodic memory, laying down new declarative long-term memories
Thalamus, formation of new memories and working memories
Cortical Areas: encoding of factual memories, storage of episodic and semantic memories, skill learning, priming.

WHAT DOES THE HIPPOCAMPUS DO?

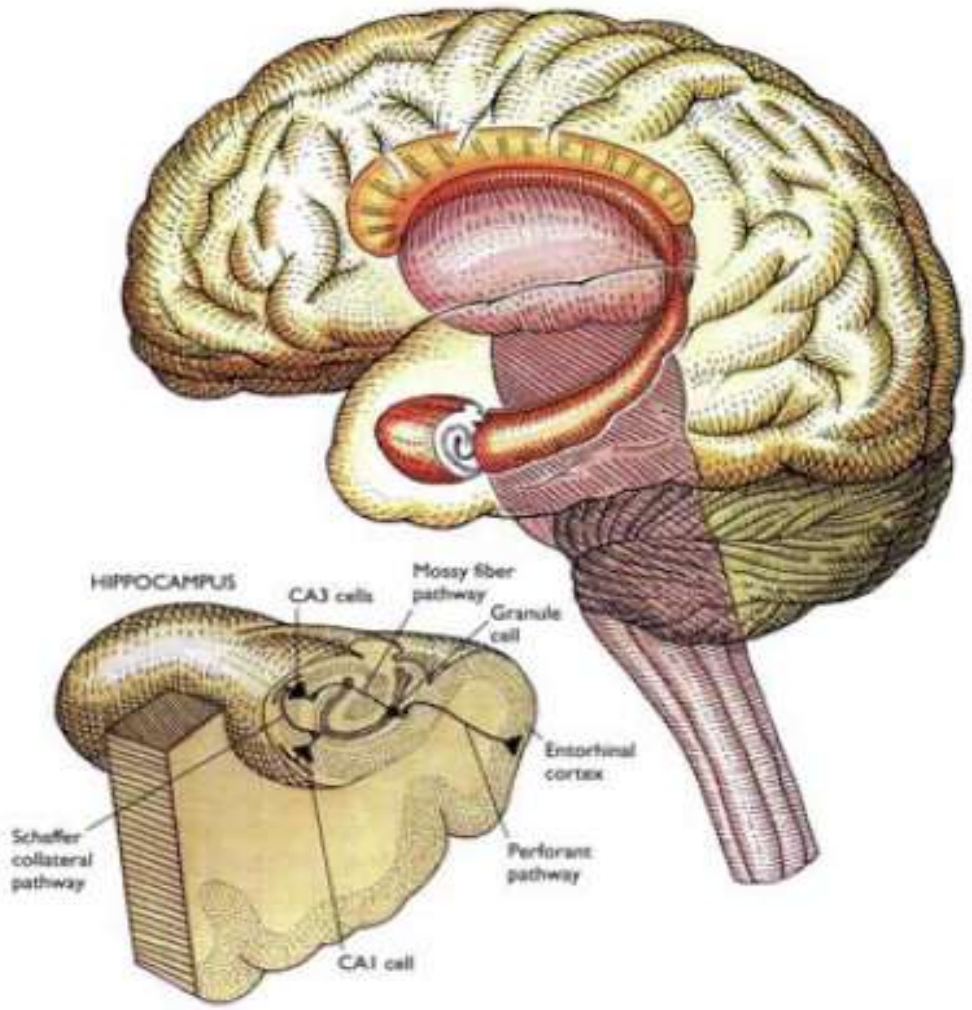
Place cells neurons that respond when you are in a specific place, in the *place field* of the neuron. So a place cell would fire when you are in your bedroom or house, etc. Each hippocampal neuron has a place field in many different environments. Eg: At first when you put the rat in the new environment, no neurons fire. Then as the rat becomes familiar with the room, neurons fire for particular parts of the room.

WHAT DOES THE HIPPOCAMPUS DO?

Configural Association Theory The theory that the hippocampus retains the interrelation among cues, spatially and temporally. So it remembers the relationship between a visual cue and a location as signaling food.

Path Integration Theory the hippocampus calculates current location, past location, and future location from one's own movement.

The Amygdal: Fear and Memory



AMYGDALA

• The amygdala modulates the formation of memories in other brain structures, such as the hippocampus. Information or events of particular emotional / motivational significance are better remembered than those of little importance (c.f. flashbulb memory).

Lesions in humans and primates reveal a role for the amygdala in the perception of emotional cues and the generation of emotional responses, particularly those associated with negative emotions such as fear.

AMYGDALA

• Amygdala lesions before retention testing disrupt conditioned fear. Hence, the amygdala may be the site of storage of fear memories.

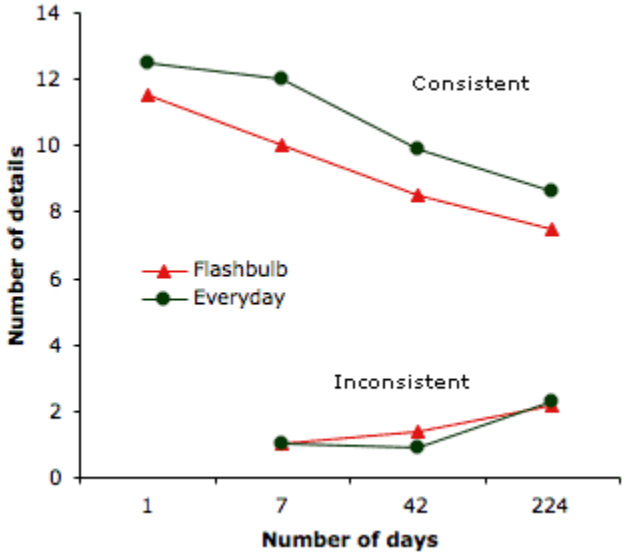
Temporary inactivation by drugs during acquisition has the same effect, suggesting a genuine role in memory encoding.

THE CHOWCHILLA KIDNAPPING

Officials unearth the underground Livermore dungeon in which 26 schoolchildren and their bus driver were held captive in 1976.

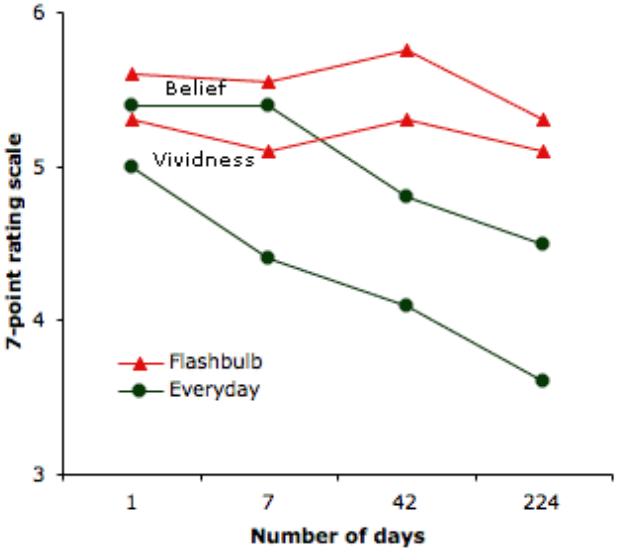
Credit: James Palmer / Associated Press 1976

FLASHBULB MEMORY



The number of details remembered about September 11 and the everyday event were statistically indistinguishable. Most memories were consistent, and over time, the number of consistent details participants were able to recall did decline, but there was no difference in the decline for ordinary memories and for memories of September 11. The number of inconsistent details (e.g. "I was with Fred" changing to "I was with Mary") increased similarly for both ordinary events and September 11.

FLASHBULB MEMORY



What *was different* was the confidence and vividness of the memories: Participants were more likely to *believe* their memories of September 11 were accurate than their ordinary memories, and they reported those memories as being equally vivid, even months after the event. Meanwhile, they reported the ordinary memories becoming less and less vivid and reliable, even though objectively they could remember no more details about September 11.

FORGETTING IS A PROCESS, TOO!

Apparent loss of information already coded and stored in LTM

Inattention, inadequate encoding, rehearsal, decay of memory trace (engram) over time

Not 'faulty remembering'

Proactive interference: old information interferes with recall of new information

Retroactive interference: new information interferes with recall of old information

Decay theory: memory trace fades with time

Motivated forgetting: involves the loss of painful memories (protective memory loss): ? Repression: The active elimination from consciousness of memories or experiences we find threatening

Intentional Forgetting: Efforts to remove, or at least ignore, information in long-term memory that is inaccurate or no longer useful

Retrieval failure: the information is still within LTM, but cannot be recalled because the retrieval cue is absent

Infantile Amnesia: Our inability to remember experiences during the first two or three years of life, probably because we do not possess a well-developed self-concept during this period