

# Memory Encoding and Storage

Theoretical Explanations

Practical Implications

## Short Term Memory

William James 1890 primary/secondary  
Hebb 1940's circuit activation  
Miller 1956 "the Magical Number Seven,  
Plus or Minus Two"  
memory span  
limited capacity

Peterson & Peterson, 1959  
eliminate rehearsal w  
distractor =>  
very fast forgetting

Atkinson & Shiffrin 1968 elaborate model

sensory stores  
attention

STM  
rehearsal  
LTM

limited capacity - memory span  
rehearsal -> storage

## Rehearsal

Shepard & Teghtsoonian 1961  
recognition of repetitions declines with number of  
intermediate three digit numbers

Rundus 1971  
rehearsal of list items correlates with recall

Craik & Loackhart 1972  
depth of processing, alternative to rehearsal  
passive or meaningless rehearsal doesn't help

## Working Memory

Baddeley 1986 articulatory loop  
word length effect  
visiospatial sketchpad

"Bible, animals, flood"

nodes and connections  
schemas / objects

a similar example / demo

Anderson Model

basic model: propositional network + activation

1. propositional network model

dynamics at single node

2. activation -> availability

3. strength -> availability

dynamics of network

4. spreading activation

explanations provided by model

5. elaboration -> more network structure  
-> more spreading activation

6. interference -> competing pathways  
-> diffused activation

7. inference -> elaboration & help w. (plausible) retrieval

8. inference and retrieval use schemas & default expectations

level of activation

1. recency of use:

Loftus 1974

instances of category beginning w letter  
1.53sec first time

0,	1,	2	intervening items
1.21,	1.28,	1.33	secs

.32 sec estimate of activation time

2. how much practice/use/learning

Anderson 1976 (recency+practice)

1. learn: sentences like:

The sailor is in the park

The lawyer is in the church

(varied study time)

2. recognition test

negatives were recombinations

repeated recognition tests at different intervals

degree of study time	intervening items		LTM activation
	0-2	3+	
less	1.11	1.53	.42
more	1.10	1.38	.28

Spreading Activation

Meyer & Schvaneveldt 1971

Associative Priming

word recognition task

2 words at a time

related words 85ms faster

Kaplan 1989

environmental cues to problem solving

meaningfulness of materials

depth of processing

elaborative processing

Anderson & Bower 1973

elaborations help in sentence memory (of object of S)

Stein & Bransford 1979

self generated?

"precise" / relevant

study techniques for textual material

Frase 1975

advanced organizers (questions)

relevant questions

Thomas & Robinson 1972 PQ4R method

Preview- identify sections, for each:

Questions

Read- try to answer questions

Reflect- think of examples, relate to prior knowledge

Recite- recall, answer questions, reread if problems

Review- recall main points

meaningful vs. nonmeaningful elaborations

method of loci

organization

using well learned organizational structure

meaningful processing of items

meaningful processing of connections

between items and framework

incidental vs. intentional learning

Hyde & Jenkins 1973

depth of processing

(pleasantness vs. letters)

novel vs textbook

flashbulb memories and self-reference effect

Brown & Kulik 1977

Kennedy assassination unverifiable

McCloskey, et al. 1988

Challenger explosion inaccurate

Palmer et al. 1991

SF earthquake 1989

in person - better memory

Is memory ever completely lost?

Penfield 1959

Nelson 1971, 1978      savings

### The Retention Function

Wickelgren 1975

negatively accelerated power function of  $d'$

signal detection measure of signal strength

Power Law of Forgetting

### Interference Effects

classical effects - implications?

Fan Effect

new and existing memories  
interference vs. redundancy

paradox of expertise

## Mental Models

Bransford, Barclay & Franks, 1972

"Three turtles rested {beside/on} a floating log, and a fish swam beneath them."

"Three turtles rested {beside/on} a floating log, and a fish swam beneath it."

background knowledge

Sulin & Dooling, 1974

Carol Harris vs. Helen Keller

"She was deaf, dumb and blind."

Dooling & Christiannsen, 1977

informed at test -> same intrusions

## Interaction of Elaboration and Inferential Reconstruction

Owens, Bower, & Black, 1979

elaboration -> more inferences  
and more actual recall

Harris, 1977

advertisement for Listerine

## Memory Errors

Eyewitness testimony

Loftus, 1975 etc.

passed a yield sign

"hit" vs. "smashed"

False memory syndrome

## Associative Structure and Retrieval

prompts can help

Tulving & Pearstone, 1966

memory for categorized lists  
better with categories

organization helps

Bower, Clark, Lesgold & Winzez, 1969

implications

## Encoding Context Effects

physical settings

Smith, Glenberg & Bjork, 1978

paired associate lists in two school settings

Godden & Baddeley, 1975

40 word lists  
shore vs. underwater  
interaction

some failures

emotional context

Bower, Monteiro & Gilligan, 1978

hypnotically induced emotion  
at learning and recall

some failures

mood congruence is stronger

Teasdale & Russel, 1983

learn in neutral state  
test in positive or negative states

Tulving & Thompson, 1973

cued recall  
an edifice            bridge  
a card game

later experiments:  
red                    apple  
food

recognition similar

Watkins & Tulving, 1975

study: train black  
generate:  
white -> snow, black, pure  
recognize which seen originally:  
(54% correct)  
cued recall: train -> ?  
(61% correct)  
(42% recalled not recognized)

### Implicit vs Explicit Memory

semantic vs. perceptual processing & memory

procedural vs. declarative memory  
typing

semantic vs. episodic memory