

Theories of Forgetting

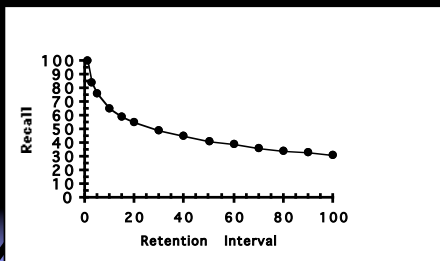
- I. Introduction
- II. Decay Theory
- III. Consolidation Theory
- IV. Interference Theory
- V. Retrieval Failure
- VI. Repression
- VII. Conclusions

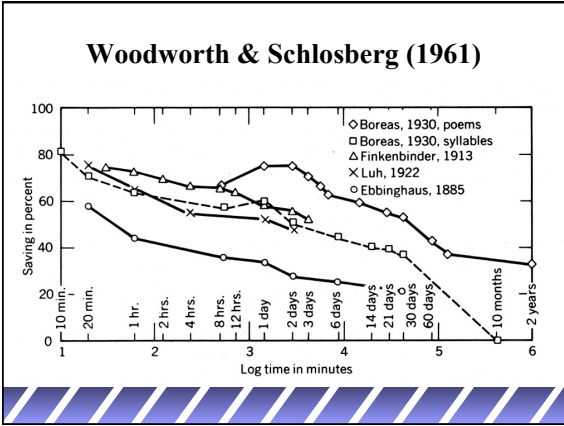
I. Introduction

- A. Focusing on Forgetting from LTS
Forgetting from SIS: decay, masking
Forgetting from STS: displacement
Forgetting from LTS?
- B. Multiple Factors

II. Decay Theory

- A. **Definition:** Spontaneous loss of information over time.
Classic Shape of the forgetting curve (Woodworth, 1938)

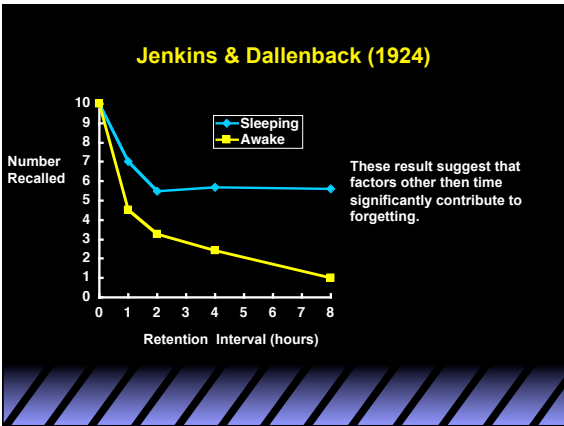




II. Decay Theory

B. Jenkins & Dallenbach (1924)
 Two subjects studied non-sense syllables
 They were tested either immediately, 1, 2, 4 or 8 hours later
 During the retention interval they either were **awake** doing daily activities, or they **slept**.

If decay is the primacy source of forgetting, then the rates of forgetting should be similar in the awake and the sleep conditions.



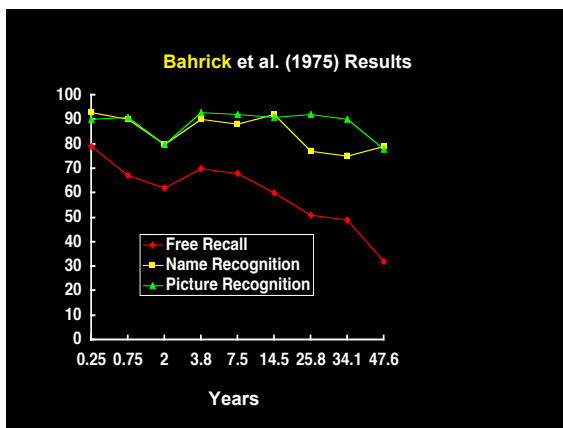
II. Decay Theory (cont)

C. Studies of Very-Long-Term Memory

Is there a permanent memory that doesn't decay?

1) Bahrick et al. (1975)

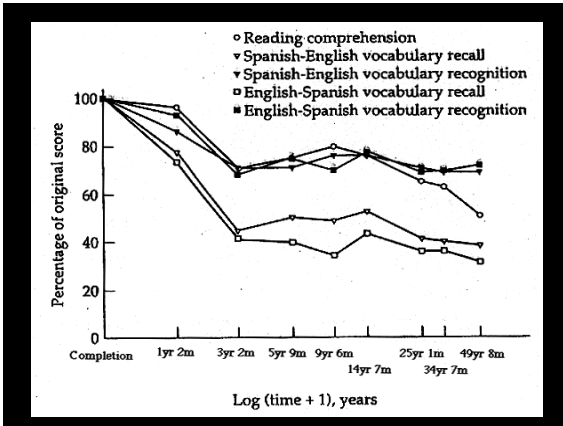
Studied retention of names and faces of high school classmates.



Studies of Very-Long Term Memory (cont)

2. Bahrick (1984)

Studied retention of Spanish Vocabulary



Studies of Very-Long Term Memory (cont)

Bahrick's research suggest that long-term memories are resistant to decay.

However, **Wixted** (2004), argued that Bahrick's (1984) results could be fit with a three parameter forgetting model, in which long-term memory decayed, but at a slower rate than sensory store and short-term memory.

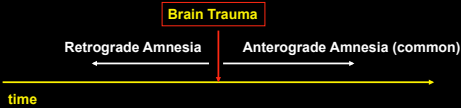
D. Conclusions of Decay

- 1) Shape of the forgetting curve is greatly influenced by the activities during the retention interval.
- 2) A simple, constant decay model, cannot fit the data.
- 3) Memories appear to be increasingly resistant to loss with increasing passage of time.

Jost's (1897) Law: If two memories are of equal strength but different ages, the older memory will be forgotten less quickly. (from Wixted, 2004)

III. Consolidation Theory

- A. **Consolidation:** As a result of experience, certain neural activities responsible for permanent memories are set into motion. Disruption of these activities leads to poorly formed memories, and thus, forgetting.
- B. Consolidation processes may continue for long periods of time, providing an explanation for Jost's law.
- C. **Evidence:** temporally graded retrograde amnesia (older memories are less likely to be disrupted)



III. Consolidation Theory

C. Retrograde Amnesia: Anecdotal Evidence

By NICOLAS MARMIE .c The Associated Press

PARIS (Sept. 19, 1997) - Bodyguard Trevor Rees-Jones, the sole survivor of the accident that killed Princess Diana, does not remember the circumstances of the crash, a judicial source said today.

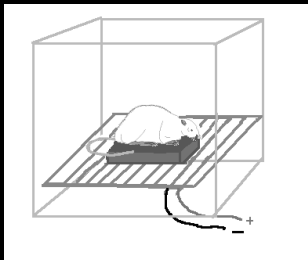
Doctors had said all along that the large doses of anesthesia given to Rees-Jones during surgery, along with the trauma of the accident, might affect his memory.

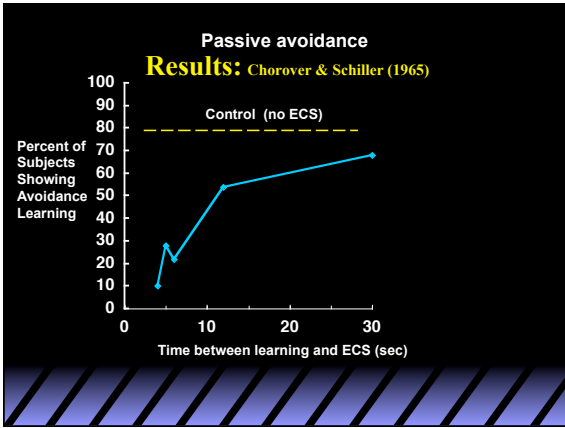
D. Retrograde Amnesia: Laboratory Evidence

Passive avoidance training - training animals not to make a response



Passive avoidance apparatus



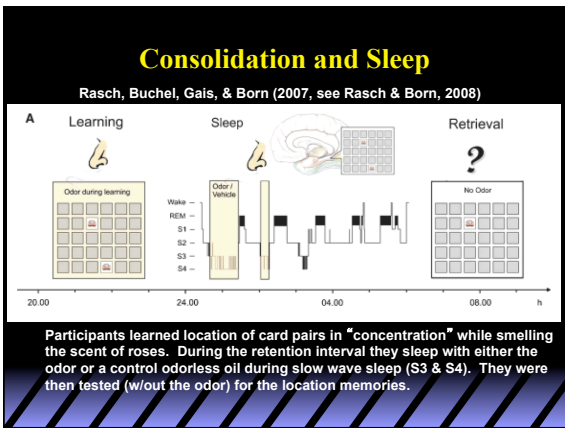


III. Consolidation Theory (cont)

E. Consolidation and Sleep
 Kelly, Kelly, & Clanton (2001)
 College GPA associated with self reported sleep
 Short sleepers (6 or fewer hours) gpa M = 2.74
 Long sleepers (9 or more hours) gpa M = 3.24

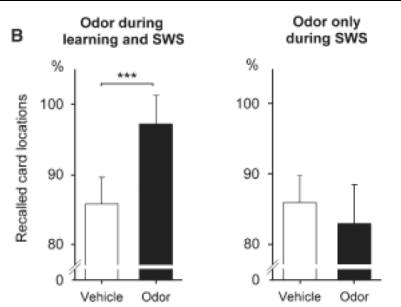
Stickgold et al (1999)
 Optimal learning of laboratory tasks required 6 hours of sleep

Plihal & Born (1997) Sleeping during a retention interval led to better memory than wakefulness:
 early sleep (non-REM slow wave sleep)
 aids declarative memory
 late sleep (REM)
 aids procedural memory



Consolidation and Sleep

The presence of odor during slow wave sleep improved memory for card location.



Consolidation and Sleep

Later fMRI study demonstrated that the odor during slow wave sleep activated the left hippocampus.



F. Conclusions on Consolidation theory

1. memory become increasingly resistant to loss with the passage of time
2. **trauma** - disrupts consolidation
3. **sleep** - aids consolidation
4. Problem: consolidation does not address the role of the "content" of the experiences during a retention interval.

IV. Interference Theory

A. Basic Assumptions

1. Forgetting is caused by interference between information being tested and other information that has been learned

2. Analysis of learning in terms of associations between stimulus and response terms.

$S \rightarrow R$

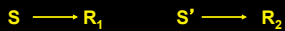
IV. Interference Theory (cont)

A. Assumptions (cont)

3. a) Interference occurs when the same stimulus is associated with more than one response.



b) or, when similar stimuli (S and S') are associated with different responses.



IV. Interference Theory (cont)

A. Assumptions (cont)

4. Two mechanisms are responsible for interference:

response competition: multiple responses are elicited by a stimulus

unlearning: new associations cause extinction of the previous responses



IV. Interference Theory (cont)

B. Examples of interference in action:

phone numbers
tennis

IV. Interference Theory (cont)

C. Experimental Designs for Studying Interference

Retroactive Interference:

Interference Group	Study A	Study B	Test A
Control Group	Study A	-	Test A

Proactive Interference:

Interference Group	Study A	Study B	Test B
Control Group	-	Study B	Test B

IV. Interference Theory (cont)

D. Illustrative Experiment: Barnes & Underwood (1959)

- Participants learned a list of eight paired-associates until perfect recall: (nonsense syllabols paired with adjectives)
A-B (e.g., dax-fruitless)
- Ss then studied a second list with the first terms paired with new words:
A-C (e.g., dax-double)
They studied this second list 1, 5, 10, or 20 times
- Ss then tested on memory for both response terms:
A- B, C (e.g., dax- fruitless, double)

IV. Interference Theory (cont)

D. Barnes & Underwood (1959)

Results:

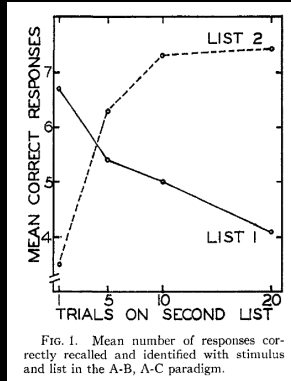


FIG. 1. Mean number of responses correctly recalled and identified with stimulus and list in the A-B, A-C paradigm.

IV. Interference Theory (cont)

E. Problems with Interference Theory

1. According to Interference Theory, **Proactive Interference (PI)** is the result of response competition. However, PI continues even when response competition is removed.
2. Interference theory did not satisfactorily explain **retrieval failures**.

V. Retrieval Failure Theory of Forgetting

A. Basic Assumption:

Forgetting is caused by the inability to access information that is represented in memory.

availability: the information is represented in memory

accessibility: the information that is available can be retrieved at a specific time/place.

V. Retrieval Failure Theory of Forgetting

B. Demonstration:

- | | |
|--------------------------------|-------------------------|
| 1. occupation | 7. a writing instrument |
| 2. dairy product | 8. a kind of animal |
| 3. circus performer | 9. a part of the house |
| 4. type of seafood | 10. a kind of flower |
| 5. part of the body | 11. an art form |
| 6. a kind of bedroom furniture | 12. a kind of vehicle |

V. Retrieval Failure Theory of Forgetting

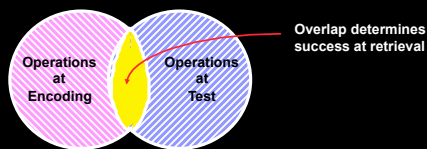
B. Demonstration:

- | | |
|------------|-----------|
| 1. lawyer | 7. pencil |
| 2. butter | 8. insect |
| 3. acrobat | 9. window |
| 4. shrimp | 10. daisy |
| 5. heart | 11. music |
| 6. mirror | 12. train |

V. Retrieval Failure Theory of Forgetting

C. Encoding Specificity Principle (Tulving)

Specific encoding operations determine the type of memory trace stored in memory. The type of memory trace determines what retrieval cues will be successful at gaining access to the memory trace.



V. Retrieval Failure Theory of Forgetting

D. **Generate Edit Theory:** An alternative explanation of retrieval processes:

Generate: retrieval cues used to generate associates

Edit: recognize items generated based on familiarity

E. **Encoding Specificity vs. Generate Edit** theories of retrieval.

encoding specificity: stresses study-test cue overlap

generate edit: stresses strength of cue-item association

Encoding Specificity vs. Generate Edit

Thomson & Tulving (1970) experiment:

a) Subjects studied either:

strong associates: e.g., white-black

or **weak associates:** e.g., train-black

b) memory test contained either:

strong cues: e.g. white

weak cues: e.g. train

Encoding Specificity vs. Generate Edit

Thomson & Tulving (1970) experiment (cont)

Results

		Test Cues	
		Strong (white ?)	Weak (train ?)
Study	Strong (white-black)	20.2	9.2
Cues	Weak (train-black)	13.9	15.7

V. Retrieval Failure Theory of Forgetting

E. Applications of Encoding Specificity

1) Context Effects on Memory

water
music
odor

2) State Dependent Effects on Memory

drugs
Mood

Look for **congruence** effects: when a match between study and test leads to best memory performance.

Context Effects

Godden & Baddeley (1975) wet/dry study

Contexts: Wet: under 20 ft water

Dry: sitting on the dock

Results

		Test Environment	
		Dry	Wet
Study	Dry	13.4	8.5
Environment	Wet	8.4	11.5

Context Effects (cont)

Smith (1985) music and memory

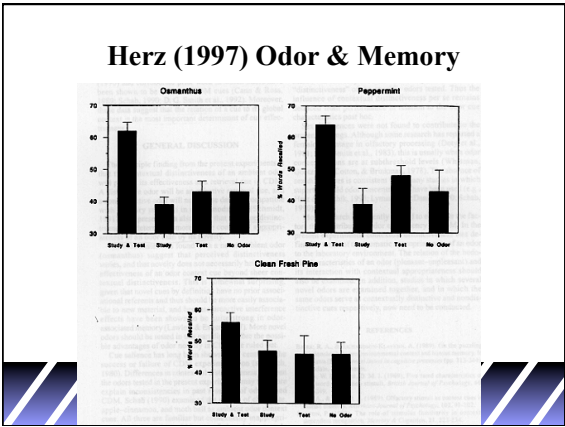
Results

		Music at Test		
		Mozart	Jazz	Quiet
Music	Mozart	18.2	12.7	13.3
at	Jazz	11.2	20.8	8.5
Study	Quiet	16.3	15.3	11.7

Context Effects (cont)
 Schab (1990) Chocolate Study
 Odors (chocolate, apple-cinnamon, moth ball)

Results

		Test Cues	
		Odor	No Odor
Study	Odor	.21	.17
Cues	No Odor	.13	.14



2) State Dependent Memory
 Eich et al (1975) marijuana study

Results

		Test	
		No Drug	Drug
Study	No Drug	11.5	9.9
	Drug	6.7	10.5

V. Retrieval Failure Theory of Forgetting

F. Conclusions:

Very rich description of memory failures

May be circular:

How could this theory be proved wrong?

VII. Conclusions on Forgetting

Four different explanations:

decay: minimal role in LTS forgetting

consolidation: disruption occurs under special circumstances

interference theory: explains some forgetting, but the mechanisms need work

retrieval failure: richest, most complete explanation, but may be circular.
