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Class Meets: Weekdays 1:30-4:00pm @ 9B114

SKKU ISS3147
Myths and Mysteries of
Human Learning and Memory

Introduction / Syllabus & Approaches to Studying Memory

27 Jun 2016

1

Who am I?

In part…

Ph.D. (Psychology)

Washington University in St. Louis

Kathleen McDermott

Henry (Roddy) Roediger

David Balota

Post-doctoral researcher at University of California, San Diego

Hal Pashler

2

2012: Assistant Professor, Dept of Education, Dartmouth College
Lab website: www.dartmouth.edu/~cogedlab

Home   Research   People   Publications   Links

Cognition and Education Lab
Dartmouth College

About Us

Welcome to the Cognition & Education Laboratory, located in the Department of Education at Dartmouth College.

Our research addresses theoretical issues in the cognitive psychology of learning and memory that also have practical implications for education. We are especially interested in investigating study strategies and instructional manipulations that enhance the durability and/or efficiency of learning.

Click here for directions to the lab.

Opportunities for Students

3

Who are you?

Pair up and discuss:

1. Who are you?

2. Why are you here?

(You have 5 min)

Each member of a pair will then introduce his/her partner to the class.

4

Your (pre-existing) views (prior to taking this course)

Discuss:

1. What is learning / memory?

2. What are some of the factors that influence learning / memory?

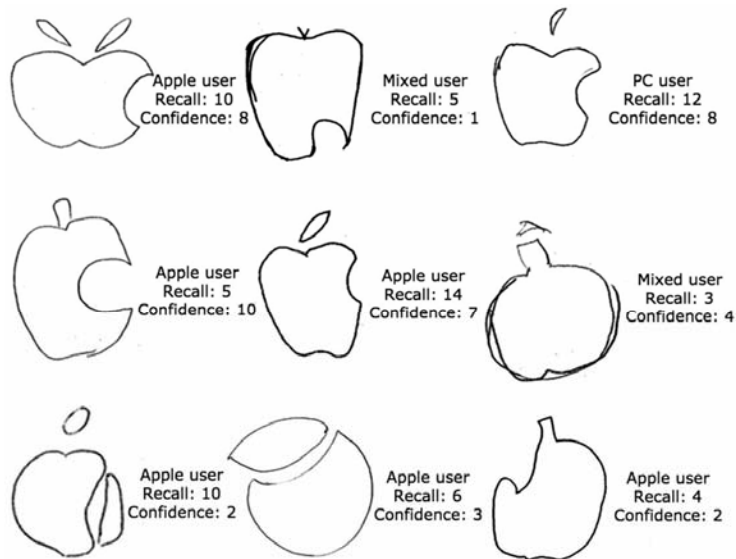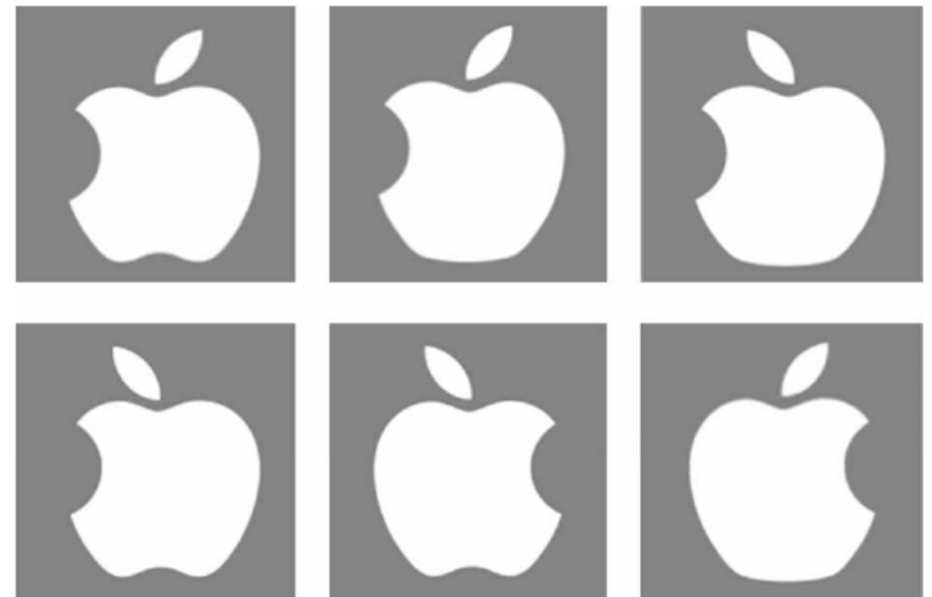3. What are some strategies you employ to improve your learning / memory?

DEMO

Figure 1. Examples of the Apple logo drawn from memory by participants in the present study, as well as the the user type, assigned score, and confidency judgement. The logo in the centre is the only one out of the 85 that received a perfect score of 14.

(Blake, Nazarian, & Castel, 2015)

The Apple of the mind's eye: Everyday attention, metamemory, and reconstructive memory for the Apple logo

Adam B. Blake, Meenely Nazarian, and Alan D. Castel

Department of Psychology, University of California, Los Angeles, CA, USA

People are regularly bombarded with logos in an attempt to improve brand recognition, and logos are often designed with the central purpose of memorability. The ubiquitous Apple logo is a simple design and is often referred to as one of the most recognizable logos in the world. The present study examined recall and recognition for this simple and pervasive logo and to what degree metamemory (confidence judgements) match memory performance. Participants showed surprisingly poor memory for the details of the logo as measured through recall (drawings) and forced-choice recognition. Only 1 participant out of 85 correctly recalled the Apple logo, and fewer than half of all participants correctly identified the logo. Importantly, participants indicated higher levels of confidence for both recall and recognition, and this overconfidence was reduced if participants made the judgements after, rather than before, drawing the logo. The general findings did not differ between Apple and PC users. The results provide novel support for theories of attentional saturation, inattentional amnesia, and reconstructive memory; additionally they show how an availability heuristic can lead to overconfidence in memory for logos.

Nickerson & Adams (1979)

FIG. 1. Examples of drawings obtained from people who tried to reproduce a penny from memory.

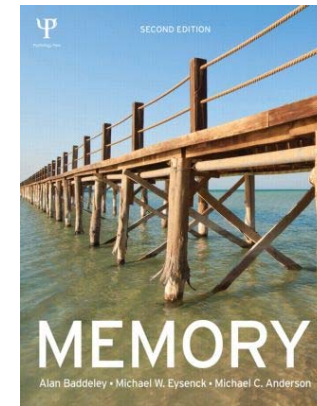## Nickerson & Adams (1979)
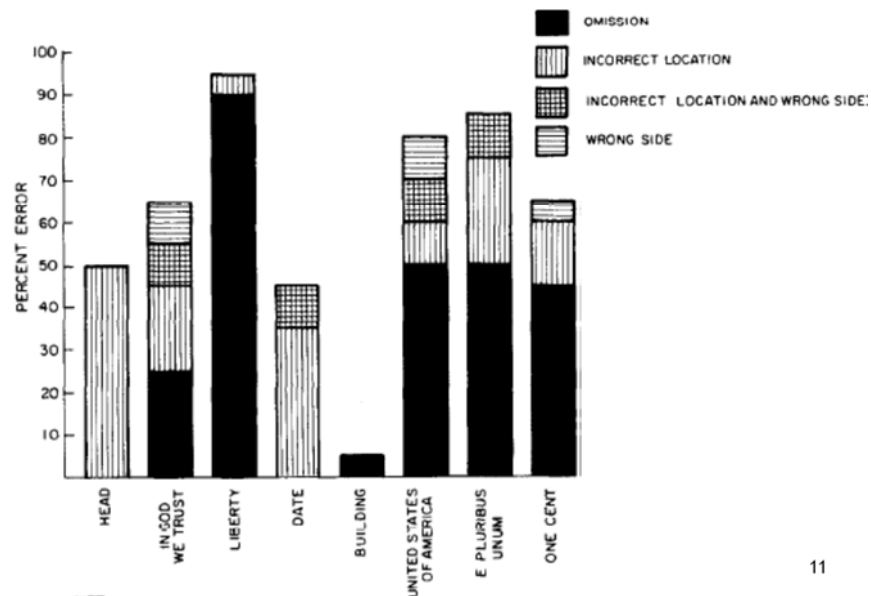
WHAT IS MEMORY?

- Everyone knows intuitively, yet it's hard to define
  - Many different definitions & types of memory

- Textbook:

- Additional readings: PDFs will be made available

14

EVALUATION CRITERIA:

Exam 1	25%
Exam 2	25%
Exam 3	25%
Class presentation	10%
Class participation	15%

TOTAL possible	100%

15

APPROACHES TO STUDYING MEMORY

- Philosophical tradition
- Literary tradition (autobiography)
- Historical tradition
- Human experimental psychology
- Neuropsychological studies
- Memory improvement "experts"
- Animal learning/animal cognition
- Behavioural neuroscience
- Computational theories of memory
- Everyday memory tradition
- Neurobiological approach
- Neuroimaging approach

16

APPROACHES TO STUDYING MEMORY

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The study of memory (like most subjects) begins with a series of questions.

- What causes forgetting?
- How can I improve my memory?
- etc.

Memory is difficult to study because it is not a physical object.

Our approach in experimental psychology is analogous to trying to figure out how a car engine works without being able to lift the hood.

TOPICS COVERED:

Jun 27 – Approaches to Studying Memory

Jun 28 – Short-term Memory & Working Memory

Jun 29 – Long-term Memory

Jun 30 – Learning

TOPICS COVERED:

Jul 1 – Implicit Memory

Jul 4 – Recognition Memory & Autobiographical Memory

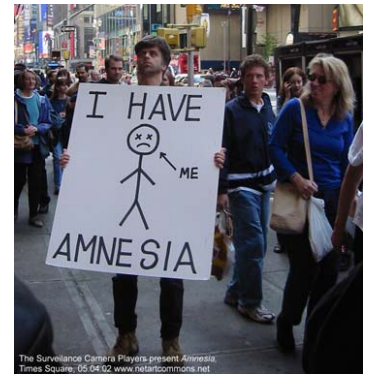Jul 5 – Forgetting (+ watch *Unknown White Male*)

Jul 6 – Semantic Memory

21

TOPICS COVERED:
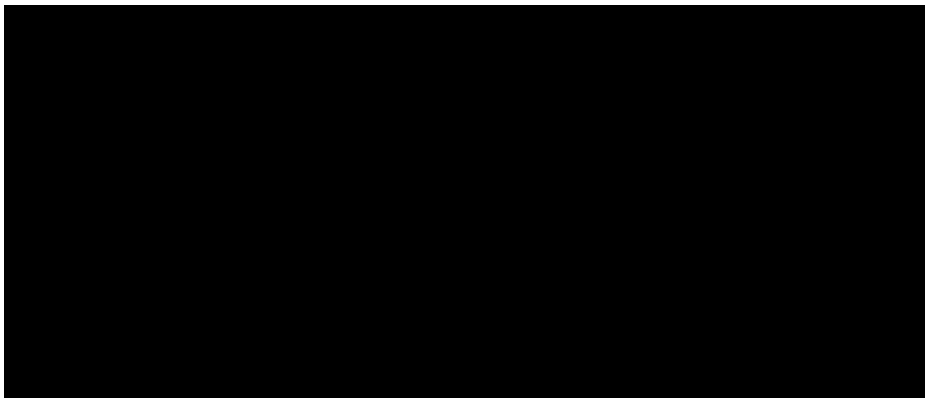
Jul 7 – Amnesia (+ watch *Memento*)

Jul 8 – Emotion & Memory

22

23

TOPICS COVERED:

Jul 11 – Reconstructive Memory &

Memory Distortions
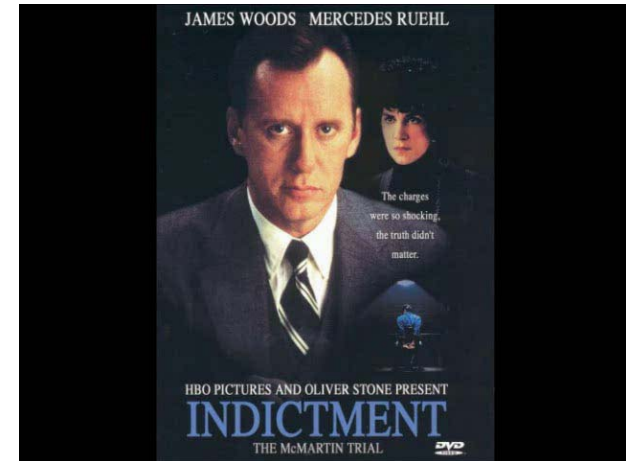
Jul 12 – Eyewitness Memory

24

TOPICS COVERED:

Jul 13 – Memory in Children (+ watch *Indictment*)

Jul 14 – Memory in Older Adults

   & Prospective Memory

TOPICS COVERED:

Jul 15 – Mnemonics

H uron
O ntario
M ichigan
E rie
S uperior
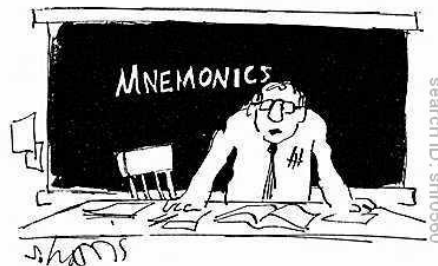
"YOU SIMPLY ASSOCIATE EACH NUMBER WITH A WORD, SUCH AS 'TABLE' AND 3,476,029."

APPROACHES TO STUDYING MEMORY

1. Metaphors and theories

2. Laboratory experiments

   a) Jenkins's tetrahedral model

   b) Ecological validity

   c) Ebbinghaus's early work

"Metaphors we live by"

Use of a familiar, concrete concept to understand the abstract. But language shapes our thought/understanding.

E.g., "Time is money"

> Spend, save, waste, cost, invest, budget, borrow, lose, run out of, spare, manage, find

METAPHORS WE LIVE BY

GEORGE LAKOFF AND MARK JOHNSON

WITH A NEW AFTERWORD

29

MEMORY AND SPATIAL METAPHORS

- The mind is a space and memories are objects in that space.
  - <u>Hold</u> ideas in mind
  - Bring memories to the <u>front/back</u> of mind
  - Ideas can be <u>grasped</u>
  - Minds can be <u>narrow</u>

- Mental operations are actions in this space
  - Storing, organising, losing, searching

30

MEMORY AND SPATIAL METAPHORS

- Spatial storage metaphor
  - Memories are discrete objects stored in particular locations of the mind space

- Search metaphor
  - To remember, it is necessary to search for and find the memories in the mind space

31

Memory as a wax tablet - Aristotle

32

Memory as an aviary- Plato

33

Memory as a library- Broadbent

34

METAPHORS USED TO DESCRIBE MEMORY

METAPHOR	EXAMPLES
Recorder of Experience	Wax tablet, record player, tape recorder, video camera
Storage locations	House, library, dictionary
Interconnections	Switchboard, network
Jumbled storage	Bird in an aviary, junk drawer, garbage can
Forgetting of details	Leaky bucket
Reconstruction	Building a dinosaur skeleton from fossils
Active processing	Computer

35

Metaphors often reflect latest technology

36

APPROACHES TO STUDYING MEMORY

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TYPICAL (LONG-TERM) MEMORY EXPERIMENT

ENCODING $\longrightarrow$ STORAGE $\longrightarrow$ RETRIEVAL

Study list of words:
Elephant
Chair
School
Doctor
Truck
Etc.

Write down all the words you can remember from earlier phase…

3 LOGICALLY SEPARABLE STAGES IN MEMORY

1. Encoding – initial registration of information

2. Storage – retaining information in the system over time

3. Retrieval – getting information out of the system

Availability vs. Accessibility

Available – it's in the system

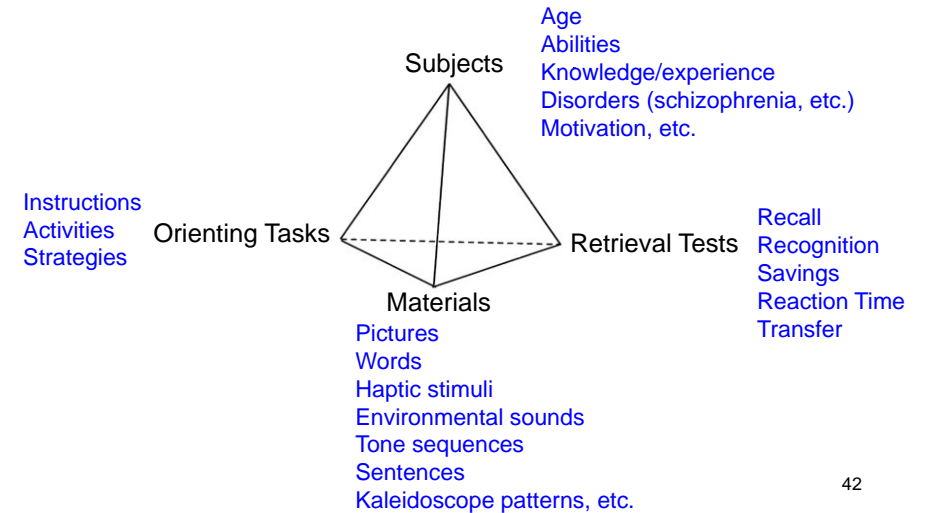Accessible – you've located it in the system

(Tulving & Pearlstone, 1966)

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41

JENKINS'S (1979) TETRAHEDRAL MODEL

Subjects
- Age
- Abilities
- Knowledge/experience
- Disorders (schizophrenia, etc.)
- Motivation, etc.

Orienting Tasks
- Instructions
- Activities
- Strategies

Retrieval Tests
- Recall
- Recognition
- Savings
- Reaction Time
- Transfer

Materials
- Pictures
- Words
- Haptic stimuli
- Environmental sounds
- Tone sequences
- Sentences
- Kaleidoscope patterns, etc.

42

Researchers typically manipulate 2 (or sometimes 3) aspects of the tetrahedron in an experiment.
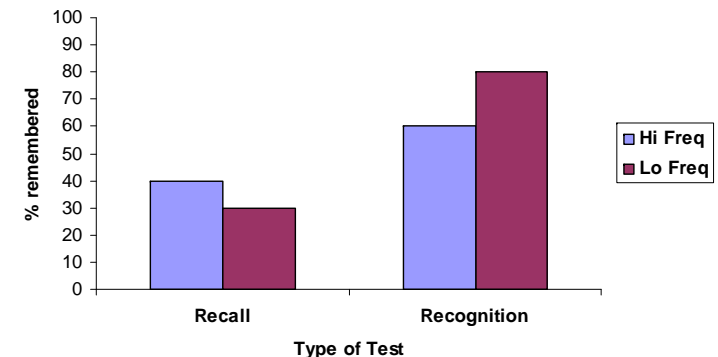
Example:

Materials x Test interaction

Hi-Freq/Lo-Freq words on Recall and Recognition

43

INTERACTION

Effect of one factor/variable depends upon another factor/variable.

The effect of word frequency depends upon the type of memory test used

44

CONTEXTUALISM

- The results are within the context of the particular experiment. Different pattern of results if the factors were varied.

- You cannot always describe laws of memory.

APPROACHES TO STUDYING MEMORY

1. Metaphors and theories

2. Laboratory experiments

   a) Jenkins's tetrahedral model

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HOW DOES AN EXPERIMENTAL PSYCHOLOGIST APPROACH THE STUDY OF MEMORY?

- Obvious answer: through experiments!

- Not-so-obvious answer:

  – Often they infer something about memory by

    - Examining errors

    - Examining memory for *word lists*

      (the *drosophilae* of the memory researcher, according to Tulving)

"Words to the memory researcher are what fruit flies are to the geneticist: a convenient medium through which the phenomena and processes of interest can be explored and elucidated…words are of no more intrinsic interest to the student of memory than *drosophilae* are to a scientist probing the mechanisms of heredity. …Words do have certain properties that render them uniquely suitable for studying memory."

well-defined boundaries
individuated items, discrete events
dated in time and place
discriminated from one another
clearly identified, even at a fast rate
have meaning
can be presented visually or auditorily
within a modality, they can be varied (e.g., vary voice)
can be grouped (conceptual categories, sentences, orthographic similarity)

Tulving, 1983, *Elements of Episodic Memory*, p. 146

"I know of no compelling reasons why the general principles that apply to remembering of mini-events in the laboratory should be greatly different from those governing the remembering of real-life experiences. Rememberers do not leave their brains and minds behind, or switch them off, when they enter the memory laboratory."

Tulving, 1983, *Elements of Episodic Memory*, p. 146

49

APPROACHES TO STUDYING MEMORY

1. Metaphors and theories

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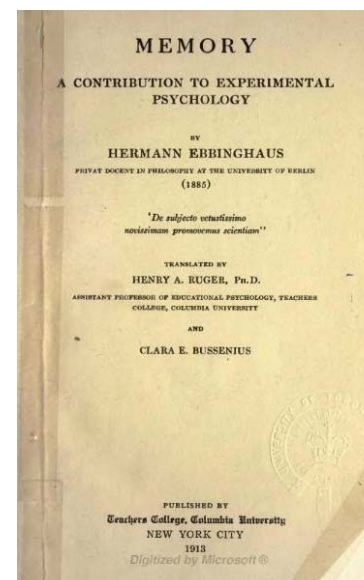   b) Ecological validity

    c) Ebbinghaus's early work

50

HERMANN EBBINGHAUS (1885)

- Founder of experimental research on memory

- The most frequently cited memory researcher

51

HERMANN EBBINGHAUS (1885)

MEMORY
A CONTRIBUTION TO EXPERIMENTAL PSYCHOLOGY
BY
HERMANN EBBINGHAUS
PRIVAT DOCENT IN PHILOSOPHY AT THE UNIVERSITY OF BERLIN
(1885)
'De subjecto vetustissimo novissimam promovemus scientiam'
TRANSLATED BY
HENRY A. RUGER, Ph.D.
ASSISTANT PROFESSOR OF EDUCATIONAL PSYCHOLOGY, TEACHERS COLLEGE, COLUMBIA UNIVERSITY
AND
CLARA E. BUSSENIUS
PUBLISHED BY
Teachers College, Columbia University
NEW YORK CITY
1913
Digitized by Microsoft ®

Original German title: *Über das Gedächtnis*

Definition of memory: The ability of the mind to bring back past experiences into consciousness

52

HERMANN EBBINGHAUS (1885)

- Method: Used himself as his only subject, but he was a very careful experimenter and discovered fundamental laws of memory.

- Materials-- intended to be devoid of meaning.

53

HERMANN EBBINGHAUS (1885)

- Method: Used himself as his only subject, but he was a very careful experimenter and discovered fundamental laws of memory.

- Materials-- intended to be devoid of meaning.
  - "Nonsense" syllables (CVC)
 - E.g., BAF, NUM, ROL, VOT, PEC, NUV

54

HERMANN EBBINGHAUS (1885)

- Learned lists of 13 nonsense syllables to criterion

- Manipulated the delay before he tried to re-learn each list

- Measured **savings in re-learning**
  - i.e., the decrease in the # of trials needed to re-learn the list to criterion

$$\frac{\# \text{ of trials (Original Learning) - } \# \text{ of trials (Re-learning)}}{\# \text{ of trials (Original Learning)}} \times 100 = \% \text{ savings}$$

55

FORGETTING CURVE
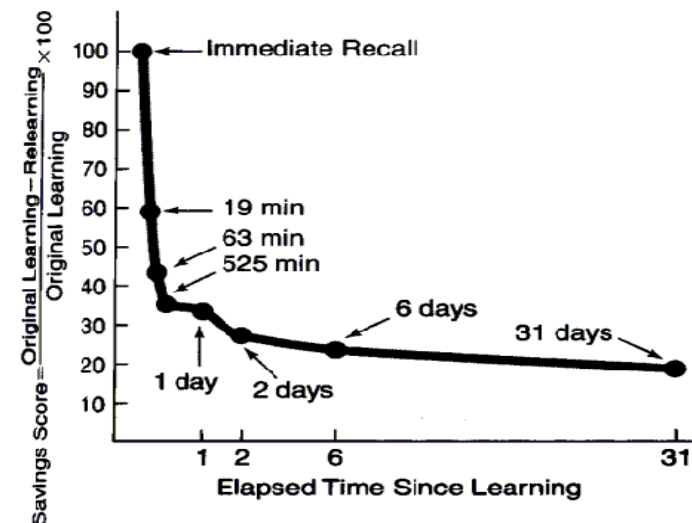
56

HERMANN EBBINGHAUS (1885)

Discovered many fundamental memory phenomena:
  – "The forgetting curve": rate of forgetting is quickest immediately after learning and then decreases.
  – the spacing effect
  – digit span
  – the list length effect
  – importance of meaning in memory
  – remote associations
 – serial position curve

57

REMOTE ASSOCIATIONS

"The associative threads, which hold together a remembered series, are spun not merely between each member and its immediate successor, but beyond intervening members to every member which stands to it in any close temporal relation. The strength of the threads varies with the distance of the members, but even the weaker of them must be considered as relatively of considerable significance." (p.94).
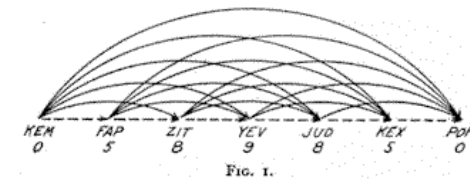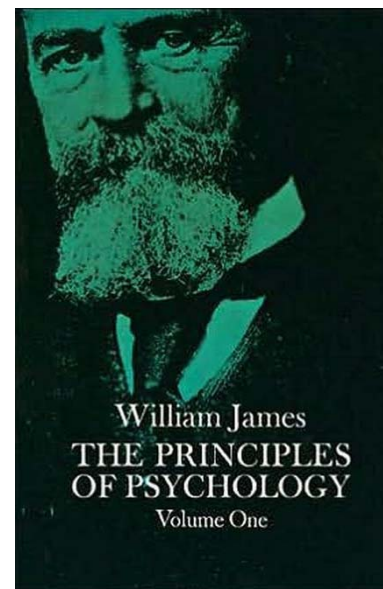

58

SERIAL POSITION CURVE

• Primacy effect – items at the beginning of the list are recalled well on a free recall test

• Recency effect – items at the end of the list are recalled well on a free recall test
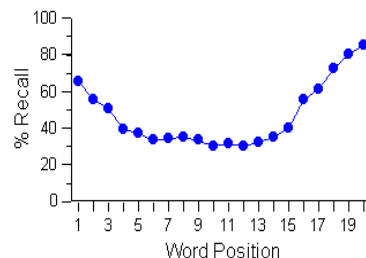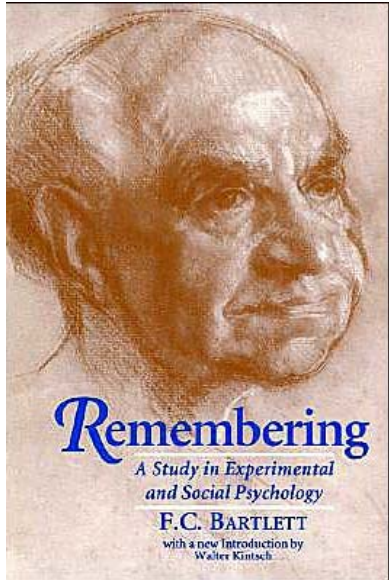

59

WILLIAM JAMES (1890)

• Primary memory – the immediate present—what is currently in consciousness

• Secondary memory – awareness of a "state of mind after it has already once dropped from consciousness" (James,1890, *Principles of Psychology*, p. 648).

60

Sir FREDERIC C. BARTLETT (1932)

The rememberer doesn't _reproduce_ the past but instead _reconstructs_ it. Emphasised the role of culture and experience in remembering.

61

Sir FREDERIC C. BARTLETT (1932)

"It has been shown that a great amount of what is said to be perceived is in fact inferred. Now in remembering we are dealing with objects and situations at a greater distance, and so it might be expected that the inferential element would here play a more important part…" (p.33)

62

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 warrior 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.

63

Sir FREDERIC C. BARTLETT (1932)

- The method of repeated reproduction:
  - "War of the Ghosts" tested repeatedly.
- Schemas

- Considerable shortening, omissions.
- Some transformations—e.g.,
  - The more familiar "boat" replaces "canoe"
  - "hunting seals" becomes "fishing"

64

ULRIC NEISSER (1967)

- Emphasised reconstruction (cf. reproduction)
  - Paleontologist metaphor

65

GEORGE SPERLING (1960)

THE INFORMATION AVAILABLE IN
BRIEF VISUAL PRESENTATIONS[1]

GEORGE SPERLING[2]

Harvard University

66

SPERLING (1960)

How much visual information can one apprehend from a single, brief presentation?

Tachistoscope – apparatus used for presenting visual stimuli for an extremely brief period

tachistos (most swift) + *skopein* (to look at)

67

SPERLING (1960)

Tachistoscopic presentation (e.g., 50 ms) of 3 x 4 matrix of random letters

T	**D**	**R**	**S**
L	**N**	**B**	**P**
G	**Z**	**M**	**Y**

68

SPERLING (1960)

Whole report:
- – i.e., Report all the items and their locations
- – Subjects could accurately report only 4–5 letters

But subjects reported 2 introspections:
- – they had *seen* the whole array, but "forgot" it while reporting
- – the array seemed to *fade* but was available to examine mentally even after it disappeared from the screen
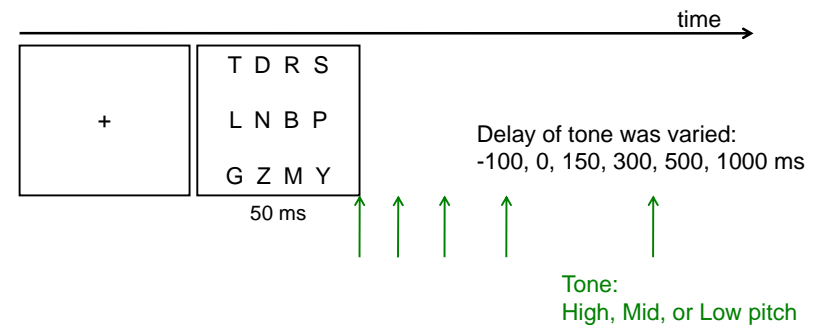
Sperling devised a way to test these introspections…
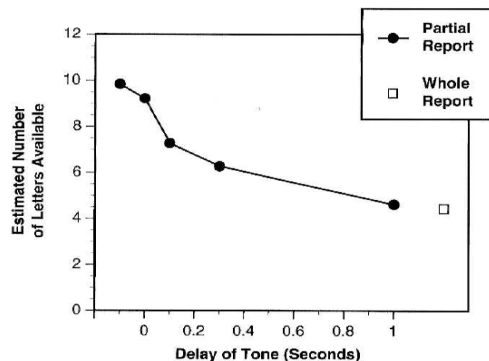
69

SPERLING (1960)

Partial report technique:
- – i.e., tone signals subject to report **one row** of the array

time

+

T D R S
L N B P
G Z M Y

50 ms

Delay of tone was varied:
-100, 0, 150, 300, 500, 1000 ms

Tone:
High, Mid, or Low pitch

70

SPERLING (1960)

The question: Would 3x partial report = whole report?

Answer: No. Advantage for partial report, but only if cue/signal provided within ~500 ms of offset of the array

71

ICONIC MEMORY

Sperling's (1960) results have been taken as evidence that visual information is briefly registered in a *sensory memory system*, and is almost totally available if accessed quickly enough.

"a single, visible, precategorical, high-capacity, quickly decaying memory that holds incoming visual stimulation for further processing"

72

Before tomorrow's class

- Read Chapters 3 & 4 of the textbook

- Complete questionnaire & bring it to class

- Decide on pairs/teams and research articles for class presentations

73