Memory

• “Dichotomania”
  – Iconic vs. short term vs. long term memory
  – Procedural vs. declarative
  – Episodic vs. semantic
  – Implicit vs. explicit

• How is memory distorted

• How if information organized in memory?

• How to improve memory
Memory

• “Dichotomania”
  – Iconic vs. short term vs. long term memory
  – Procedural vs. declarative
  – Episodic vs. semantic
  – Implicit vs. explicit
Iconic vs. Short-term vs. Long-term

• **Iconic**
  – Sensory memory
  – Large capacity but short-lasting

• **Short-term memory**
  – Working memory
  – Small capacity and requires rehearsal to last

• **Long-term memory**
  – Large capacity and long-lasting
  – Not much makes it to long-term memory
<table>
<thead>
<tr>
<th>Feature</th>
<th>Sensory Registers</th>
<th>Short-term Store</th>
<th>Long-term Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry of information</td>
<td>Preattentive</td>
<td>Requires attention</td>
<td>Rehearsal</td>
</tr>
<tr>
<td>Maintenance of information</td>
<td>Not possible</td>
<td>Continued attention</td>
<td>Repetition</td>
</tr>
<tr>
<td>Format of information</td>
<td>Literal copy of input</td>
<td>Largely phonemic</td>
<td>Largely semantic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some semantic and visual</td>
<td>Some auditory and visual</td>
</tr>
<tr>
<td>Capacity</td>
<td>Large</td>
<td>Small</td>
<td>No known limit</td>
</tr>
<tr>
<td>Information loss</td>
<td>Decay</td>
<td>Displacement</td>
<td>Possibly no loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Possibly decay</td>
<td>Loss of accessibility or discriminability by interference</td>
</tr>
<tr>
<td>Trace duration</td>
<td>.25–2 sec</td>
<td>Up to 30 sec (without rehearsal)</td>
<td>Minutes to years</td>
</tr>
<tr>
<td>Retrieval</td>
<td>Direct readout</td>
<td>Probably automatic</td>
<td>Retrieval cues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Items in consciousness</td>
<td>Possibly search process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temporal/phonemic cues</td>
<td></td>
</tr>
</tbody>
</table>
Capacity

- Iconic (sensory) memory - large
  - Partial and full report (Sperling, 1969)
    - Memory for any one of 16 items is good (partial report)
    - Memory for all 16 items is poor (full report) because delay
  - Rapid serial visual presentation

- Short term memory - 7±2 chunks

- Long term - indefinitely large
Iconic (sensory) memory storage capacity is large
Iconic (sensory) memory storage capacity is large
Iconic (sensory) memory storage capacity is large
Chunks in short-term memory

A R N C B N E R G I B F M B I

IBM FBI GRE NBC NRA

CBS ABC NBC CIA FBI KGB
MON FRI TUE
Short-term memory is auditory

FRANCE GREECE CUBA
MALTA CHAD

CZECHOSLOVAKIA ETHIOPIA
VENEZUELA NICARAGUA
YUGOSLAVIA
Serial Position Curve

• Plot percent recall against order (first, second, third, etc.) of item in list

• Primacy effect
  – Relatively good memory for first items
  – Due to long-term memory and greater rehearsal

• Recency effect
  – Relatively good memory for last items
  – Due to short-term memory
Different length lists

Different delays after list

Different presentation rates

Figure 5-4
A, Serial position curves showing recall accuracy across the original positions in the learned list. Rate of presentation was one item per second.
B, Serial position curves showing the decrease in recency when 10 or 30 s of backward counting is interpolated between study and recall.
C, Three different rates of presentation: single (3 s), double (6 s), and triple (9 s).
H.M. and Korsakoff’s patients

• Bilateral temporal lobe lesions, including hippocampus
• Profound anterograde amnesia
  – Anterograde amnesia = lack of memory for events after trauma
  – Retrograde amnesia = lack of memory for events before trauma
• Difficulty creating new memories, even for events repeated many times
• Short-term memory is preserved
• Dissociation: hippocampus is part of the long-term memory creation system, but is not required for short-term memory
Procedural vs. Declarative

• Procedural: Knowing how
  – Swimming, sewing, mirror reading, mirror tracing

• Declarative: Knowing that
  – “Bush is president”, “zebra is an animal”

• H.M. and Korsakoff’s can learn new procedural but not declarative memories
  – H.M. and motor pursuit
  – Tower of Hanoi puzzle
The existence of perinatal organization in the mammalian fetuses implies that many of the motor, sensory, and learning abilities that are typically associated with the behavior of mature mammals have their origins in the prenatal period.
Episodic vs. Semantic

• Episodic: Autobiographical
  – Storage of specific event, with time and location “tag”
  – Flashbulb memories for emotional events

• Semantic: General world knowledge
  – “Grass is green”, “zebra is an animal”
  – We don’t remember when we learned these facts
Implicit vs. Explicit

- **Explicit**
  - Conscious memory, accessible to awareness
  - Recall - “Recall all of the list words that you can”
  - Recognition - “Is X an old or new word?”
    - Old = was on previously studied list
    - New = never studied before

- **Implicit**
  - Evidence that previous information is stored, but information is not consciously available
  - Indirect measure of memory, often more sensitive than explicit measures
Implicit measures of memory

• Savings
  – Once exposed to something, relearning it is easier

• Word fragment completion
  – Fill in the blanks to form a word: D _ C A _
  – More likely to fill in word with previously seen word

• Perceptual identification
  – Briefly present a word
  – More likely to identify it if it was previously seen

• These measures often reveal memory even when subject does not recall or recognize word

• Amnesics often show implicit without explicit memory
Distortions to memory

- Memory for an event influenced by information that comes after the event
- Information added to fit knowledge/schema
- Gist is remembered, but not details
Memory for an event is influenced by information that comes after the event

• Statements during questioning influence memory
• Lost in the mall study (Loftus)
  – Asked to recall details of an event that didn’t occur
  – If dream is interpreted as suggesting that the dreamer was lost, dreamer has more memories of being lost
• Simply imagining an event makes people think that it is more likely that the event did occur
• Subjects view a movie of a car accident
• Different expressions used to describe car contact
• Subjects estimate speed of a car at time of contact

<table>
<thead>
<tr>
<th>VERB</th>
<th>MEAN SPEED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smashed</td>
<td>40.8</td>
</tr>
<tr>
<td>Collided</td>
<td>39.3</td>
</tr>
<tr>
<td>Bumped</td>
<td>38.1</td>
</tr>
<tr>
<td>Hit</td>
<td>34.0</td>
</tr>
<tr>
<td>Contacted</td>
<td>31.8</td>
</tr>
</tbody>
</table>

"Did another car pass the red Datsun while it was stopped at the stop sign?"

"Did another car pass the red Datsun while it was at the street sign?"

"Did another car pass the red Datsun while it was at the yield sign?"
Lost in the mall study

![Bar chart showing the percentage of subjects remembered true events and false events across three sessions.](Image)
Imagining an event makes people think it happened.
Improving eye-witness testimony

• Don’t describe face before looking through a mug book
  – Verbal overshadowing: description interferes with perceptual memory
  – Better able to pick out hard-to-describe colors if you don’t describe them first

• Include all details, no matter how trivial

• Imagine yourself at the scene
Memories are influenced by schemas

- Schemas
  - Organized thought structures
  - Carry expectations
- Waiting room study
  - Unexpected objects forgotten, expected objects falsely remembered
- Giving subjects schemas improves memory
- Retelling “War of the ghosts” (Barlett)
  - Omit unexpected details
  - Substitute expected for unexpected details
- Perceptual memory distorted by accompanying label
- False recall of words consistent with schema
An example of a schema: The restaurant script

<table>
<thead>
<tr>
<th>Script:</th>
<th>Restaurant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roles:</td>
<td>Customer</td>
</tr>
<tr>
<td>Track:</td>
<td>-</td>
</tr>
<tr>
<td>Props:</td>
<td>Tables</td>
</tr>
<tr>
<td></td>
<td>Menu</td>
</tr>
<tr>
<td></td>
<td>Food</td>
</tr>
<tr>
<td></td>
<td>Check</td>
</tr>
<tr>
<td></td>
<td>Money</td>
</tr>
</tbody>
</table>

Entry conditions: Cust. is hungry, has money
Exit conditions: Cust. not hungry, has less money
Owner has more money

SCENE 1: Entering → Cust. into restaurant
To table
Sit down

SCENE 2: Ordering → Menu on table
or
Asks for menu—waiter brings menu
Cust. reads menu
Cust. places order
Cust. waits for food → cook prepares food

SCENE 3: Eating → Waiter gets food from cook,
brings to Cust.
Cust. eats food → options
Cust. returns food
Cust. orders more

SCENE 4: Exiting → Waiter brings check
Cust. pays cashier, leaves tip for waiter
Cust. leaves restaurant
If the balloons popped, the sound wouldn’t be able to carry, since everything would be too far away from the correct floor. A closed window would also prevent the sound from carrying, since most buildings tend to be well insulated. Since the whole operation depends on a steady flow of electricity, a break in the middle of the wire would also cause problems. Of course, the fellow could shout, but the human voice is not loud enough to carry that far. An additional problem is that a string could break on the instrument. Then there could be no accompaniment to the message. It is clear that the best situation would involve less distance. Then there would be fewer potential problems. With face to face contact, the least number of things could go wrong. (p. 392)
Read the following, then attempt to reproduce the story by writing it down from memory.

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.
Table 8-3 TWO RETELLINGS OF BARTLETT'S (1932) "THE WAR OF THE GHOSTS"

First recall, attempted about 15 min after hearing the story:

Two young men from Egulac went out to hunt seals. They thought they heard war-cries, and a little later they heard the noise of the paddling of canoes. One of these canoes, in which there were five natives, came forward towards them. One of the natives shouted out: "Come with us: we are going to make war on some natives up the river." The two young men answered: "We have no arrows." "There are arrows in our canoes," came the reply. One of the young men then said: "My folk will not know where I have gone"; but, turning to the other, he said: "But you could go." So the one returned whilst the other joined the natives.

The party went up the river as far as a town opposite Kalama, where they got on land. The natives of that part came down to the river to meet them. There was some severe fighting, and many on both sides were slain. Then one of the natives that had made the expedition up the river shouted: "Let us return: the Indian has fallen." Then they endeavored to persuade the young man to return, telling him that he was sick, but he did not feel as if he were. Then he thought he saw ghosts all round him.

When they returned, the young man told all his friends of what had happened. He described how many had been slain on both sides.

It was nearly dawn when the young man became very ill; and at sunrise a black substance rushed out of his mouth, and the natives said one to another: "He is dead."

Second recall, attempted about 4 months later:

There were two men in a boat, sailing towards an island. When they approached the island, some natives came running towards them, and informed them that there was fighting going on on the island, and invited them to join. One said to the other: "You had better go. I cannot very well, because I have relatives expecting me, and they will not know what has become of me. But you have no one to expect you." So one accompanied the natives, but the other returned.

Here there is a part I can't remember. What I don't know is how the man got to the fight. However, anyhow the man was in the midst of the fighting, and was wounded. The natives endeavored to persuade the man to return, but he assured them that he had not been wounded.

I have an idea that his fighting won the admiration of the natives.

The wounded man ultimately fell unconscious. He was taken from the fighting by the natives.

Then, I think it is, the natives describe what happened, and they seem to have imagined seeing a ghost coming out of his mouth. Really it was kind of materialisation of his breath. I know this phrase was not in the story, but that is the idea I have. Ultimately the man died at dawn the next day."
Gist is remembered, not details

- Gist = essential, important structures
- Gist for stories
- Gist for pictures
- Gist for coins
There is an interesting story about the telescope. In Holland, a man named Lippershey was an eye-glass maker. One day his children were playing with some lenses. They discovered that things seemed very close if two lenses were held about a foot apart. Lippershey began experimenting and his “spy glass” attracted much attention. He sent a letter about it Galileo, the great Italian scientist. Galileo at once realized the importance of the discovery and set about to build an instrument of his own. He used an old organ pipe with one lens curved out and the other in. On the first clear night he pointed the glass towards the sky. He was amazed to find the empty dark spaces filled with brightly gleaming stars.
Which sentence appeared in the story?

1. He sent a letter about it to Galileo, the great Italian scientist.
2. Galileo, the great Italian scientist, sent him a letter about it.
3. A letter about it was sent to Galileo, the great Italian scientist.

Immediate test: 90% correct

When delayed by one minute: 60% correct

Almost all errors are made by choosing sentences that are semantically similar to the correct sentence.

If unrelated sentences are used, superficial recalls improves. Natural reading promotes extraction of the gist.
Figure 8-11

Which penny drawing is accurate? From Nickerson and Adams (1979).
Information is organized by categories in memory

- During free recall, people list words by category
- Presenting words by category improves memory
- Release from proactive interference (PI)
  - Retroactive interference:
    - Learn List A, then List B, then recall List A.
    - Recall of List A worse than if List B hadn’t been given
  - Proactive interference
    - Learn List A, then List B, then recall List B.
    - Recall of List B worse than if List A hadn’t been given
  - If List B is categorically dissimilar to List A, then no PI
Figure 6-5
One of the hierarchies presented by Bower et al. (1969).

Table 6-5  AVERAGE PERCENTAGE OF WORDS RECALLED OVER FOUR TRIALS AS A FUNCTION OF ORGANIZATION

<table>
<thead>
<tr>
<th>Conditions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized</td>
<td>65%</td>
<td>94.7%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Random</td>
<td>18.3</td>
<td>34.7</td>
<td>47.1</td>
<td>62.5</td>
</tr>
</tbody>
</table>
Methods of improving memory (mneumonics)

- **Peg Method**
  - Associate peg words with numbers based on rhyming
  - Associate these peg words to words to remember

- **Method of loci**
  - Associate words with familiar locations
  - Recall by imagining visiting locations

- **Imagery**
  - Interactive imagery is the best

- **Form a story, make a rhyme or song**

- **Commonality:** use an existing structure to organize less structured information
<table>
<thead>
<tr>
<th>Numbered Pegs</th>
<th>Word to Be Learned</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>One is a bun</td>
<td>Cup</td>
<td>Hamburger bun with smashed cup</td>
</tr>
<tr>
<td>Two is a shoe</td>
<td>Flag</td>
<td>Running shoes with flag</td>
</tr>
<tr>
<td>Three is a tree</td>
<td>Horse</td>
<td>Horse stranded in top of tree</td>
</tr>
<tr>
<td>Four is a door</td>
<td>Dollar</td>
<td>Dollar bill tacked to front door</td>
</tr>
<tr>
<td>Five is a hive</td>
<td>Brush</td>
<td>Queen bee brushing her hair</td>
</tr>
<tr>
<td>Six is sticks</td>
<td>Pan</td>
<td>Boiling a pan full of cinnamon sticks</td>
</tr>
<tr>
<td>Seven is Heaven</td>
<td>Clock</td>
<td>St. Peter checking the clock at the gates of Heaven</td>
</tr>
<tr>
<td>Eight is a gate</td>
<td>Pen</td>
<td>A picket fence gate with ballpoint pens as pickets</td>
</tr>
<tr>
<td>Nine is a vine</td>
<td>Paper</td>
<td>Honeysuckle vine with newspapers instead of blossoms</td>
</tr>
<tr>
<td>Ten is a hen</td>
<td>Shirt</td>
<td>A steaming baked hen on the platter wearing a flannel shirt</td>
</tr>
</tbody>
</table>
Walrus
Scissors
Pitcher
Orange
Rock
Balloon
Pan
Barrel
Rug
Dime
People were required to memorize word pairs (for example, the pair PIANO and CIGAR). The pairs were accompanied by drawings that were either non-bizarre (left column) or bizarre (right column), and that involved the two items either not interacting in any way (top row) or interacting (bottom row). Memory was improved if the two items were shown as interacting; bizarreness had no effect. [After Wollen, Weber & Lowry, 1972.]
Other ways to improve your memory

- **Elaboration**
  - Levels of processing - information processed to deeper levels is better memorized
  - Semantic processing is better than physical processing

- **Reinstate context and method of encoding**
  - Best memory if study and testing situations are similar
  - Context-dependent recall (including mood)