Encoding, Storage and Retrieval

Memory is the mental processes that enable us to retain and use information over time that involve three fundamental processes: encoding, storage and retrieval

- **Encoding**: The processing of transforming information into a form that can be entered into and retained by the memory system (page 208).
- **Storage**: The process of retaining information in memory so that it can be used at a later time (page 208).
- **Retrieval**: The process of recovering information stored in memory so that we can consciously be aware of it (page 208).
The biggest lie I tell myself is
“I don’t need to write that down, I’ll remember it.”
**THINKING ABOUT PSYCHOLOGY AND LIFE: Memory and Study Strategies**

Candidly respond to the following items about your own memory and study strategies. Rate yourself on the following questions and then total your points.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Some</td>
<td>Moderate</td>
<td>Almost always</td>
<td>always</td>
</tr>
</tbody>
</table>

1. I’m good at focusing my attention and minimizing distractions.  
2. I study for understanding rather than rote memorizing material.  
3. I organize information hierarchically as part of my memory strategy.  
4. I use mnemonic strategies when I have to memorize lists or specific facts.  
5. I ask myself questions about what I have read or about class activities.  
6. I spread out my studying and consolidate my learning.  
7. I cognitively monitor what I read and study.  
8. I am a good time manager and planner.  
9. I have a good note-taking system.  
10. I regularly review my notes.  
11. I use the SQ3R* or similar systematic study system.  

Total:_______

- If you scored 50 to 55 points, you likely use good memory and study strategies.  
- If you scored 45 to 49 points, you likely have some reasonably good memory and study strategies.  
- If you scored below 45, spend some time working on improving your memory and study strategies. Most colleges and universities have a study skills center where specialists can help you. If you are concerned about your study skills, visit Academic Learning Services.  

*SQ3R (Survey, Question, Read, Recite, Review)
Encoding Long-Term Memory?

We are going to look at some efficient and less efficient strategies to encode information.

• Practice, Feedback and distribute your learning
• Deeper levels of processing and elaboration
The type of judgment task influences how you think about each word and what you remember. Putting meaning to the word, it makes it more likely that your memory will endure.

- What do these results suggest about bad strategies for studying information?
- What do these results suggest about good strategies for studying information?

Image Source: Myers, Psychology
Encoding: Elaborative Encoding

If you can elaborate on the information and connect it with information you already know that is relevant, it increases the likelihood you will remember the information.
Encoding: Elaborative Encoding (types of Rehearsal)

Rehearsal or Maintenance Rehearsal: The process of keeping information in short term memory by mentally repeating it (page 279).

- hypothalamus, hippocampus, amygdala are all parts of the limbic system*
- hypothalamus, hippocampus, amygdala are all parts of the limbic system*
- hypothalamus, hippocampus, amygdala are all parts of the limbic system*

*your book breaks the limbic system down differently

Elaborative Encoding or Elaborative rehearsal: Encoding by actively relating new information to knowledge that is already in memory (page 279).

- “I knew it was lunchtime because my hypothalamus told me I was hungry, thirsty and cold. My hippocampus helped me remember a new restaurant on campus, but I got there and had to wait in line, which my amygdala made me angry.

1. What are other examples of these rehearsal strategies?
2. Why does elaborative rehearsal work better than maintenance rehearsal for remembering information?
## Maintenance Rehearsal vs. Elaborative Rehearsal for Networking Success

<table>
<thead>
<tr>
<th>Maintenance Rehearsal</th>
<th>Elaborative Rehearsal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. polite greeting</td>
<td>HELLO. MY NAME IS INIGO MONToya. YOU KILLED MY FATHER. PREPARE TO DIE.</td>
</tr>
<tr>
<td>2. state your name</td>
<td>INIGO’S GUIDE TO NETWORKING SUCCESS</td>
</tr>
<tr>
<td>3. relevant personal link</td>
<td>1. POLITE GREETING</td>
</tr>
<tr>
<td>4. manage expectations</td>
<td>2. NAME</td>
</tr>
<tr>
<td></td>
<td>3. RELEVANT PERSONAL LINK</td>
</tr>
<tr>
<td></td>
<td>4. MANAGE EXPECTATIONS</td>
</tr>
</tbody>
</table>
Encoding Memories: Organizational Encoding

The main theme is ORGANIZATION. How you organize information affects your ability to encode, store and recall the information. If you can find some way of organizing information, it increases the chance that you will remember the information.

The more you practice your organizational skills, the more you will be able to use these skills efficiently and automatically while recalling information at a faster rate.
Encoding: Organizational Encoding

Organizational Encoding: The process of categorizing information according to the relationships among a series of items (page 223, Schacter, Gilbert and Wegner).

If you can find a way to organize information, it increases the likelihood that you will remember the information.

Examples are

<table>
<thead>
<tr>
<th>Categories</th>
<th>Hierarchies</th>
<th>Semantic networks or associative networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A♠ 6♥ K♦ 8♠</td>
<td>Animals</td>
<td>Red</td>
</tr>
<tr>
<td>8♠ 3♥ 5♦ 4♣</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5♠ 2♥ 2♣ 7♥</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Encoding: Clustering or Categorize

Another way to help you organize information is to cluster similar items together. Concepts, ideas, items, words, etc. are grouped or categorized by similarity. Note that similarity is not “objective” and can depend on the individual and goal.

Examples:
- Demonstration of lists
- Harvey Korman in Blazing Saddles
- When I memorize my shopping list or “to do” list, I cluster my groceries or errands in “clusters” that are similar.

<table>
<thead>
<tr>
<th>Fruits/Vegetables</th>
<th>Canned/Box</th>
<th>Meat/Deli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spades</td>
<td>Hearts</td>
<td>Diamonds</td>
</tr>
<tr>
<td>A♠</td>
<td>6♥</td>
<td>K♦</td>
</tr>
<tr>
<td>8♠</td>
<td>3♥</td>
<td>5♦</td>
</tr>
<tr>
<td>5♣</td>
<td>2♥</td>
<td>4♦</td>
</tr>
</tbody>
</table>

- When playing cards (such as bridge, hearts, pinochle), it is easier to remember the cards you have if you organize it by suit and then by number.
• When studying vocabulary/chapter key terms, organize by clusters
Serial position effect

The serial position effect is the tendency to remember items at the beginning (primacy effect) or the end (recency effect) of a list better than items at the middle.
Serial position effect

From the movie **Blazing Saddles**: I want you to gather the most vicious criminals and gunslingers in the West.

- rustlers
- cut throats
- murderers
- bounty hunters
- desperadoes
- mugs
- bugs
- thugs
- nitwits
- half-wits
- dimwits

- vipers
- snipers
- con-men
- indian agents
- Mexican bandits
- muggers
- buglers

- bushwackers
- horn swaggers
- horse thieves
- bull dikes
- train robbers
- bank robbers
- ass kickers
- shit kickers, and
- Methodist
• What is it called when people tend to remember the items “ass kickers, shit kickers, and Methodists”?
• What is it called when people tend to remember the items “rustlers, cutthroats and murders”?
Encoding: Hierarchies

Example #1:

Example #2:

Learning

<table>
<thead>
<tr>
<th>Classical Conditioning</th>
<th>Operant Conditioning</th>
<th>Observational Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Example #3:**

The Brain

<table>
<thead>
<tr>
<th>Hindbrain</th>
<th>Midbrain</th>
<th>Forebrain Cerebral Cortex</th>
<th>Forebrain Limbic System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medulla</td>
<td>Substantia Nigra</td>
<td>Corpus callosum</td>
<td>Hippocampus</td>
</tr>
<tr>
<td>Pons</td>
<td></td>
<td>Cerebral cortex</td>
<td>Thalamus</td>
</tr>
<tr>
<td>Cerebellum</td>
<td></td>
<td>Temporal lobe</td>
<td>Hypothalamus</td>
</tr>
<tr>
<td>Reticular formation</td>
<td></td>
<td>Occipital lobe</td>
<td>Amygdala</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parietal lobe</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frontal lobe</td>
<td></td>
</tr>
</tbody>
</table>
Encoding: Hierarchies

Organize these minerals in a way that make it easier to remember these minerals. There are different many different ways to organize the information.

- emerald
- marble
- slate
- ruby

- silver
- limestone
- diamond
- aluminum

- steel
- brass
- bronze
- iron

- granite
- sapphire
- gold
- lead

- platinum
- copper
Role of organization in memory (from Baron, Psychology, p226)
Recall as many of the words from the list as possible.

<table>
<thead>
<tr>
<th>Street</th>
<th>Orange</th>
<th>Apples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>Yellow</td>
<td>Cherries</td>
</tr>
<tr>
<td>Vehicle</td>
<td>Green</td>
<td>Pears</td>
</tr>
<tr>
<td>Bus</td>
<td>Red</td>
<td>Sunsets</td>
</tr>
<tr>
<td>Fire engine</td>
<td>Violets</td>
<td>Sunrises</td>
</tr>
<tr>
<td>Ambulance</td>
<td>Flowers</td>
<td></td>
</tr>
<tr>
<td>Car</td>
<td>Roses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire</td>
<td></td>
</tr>
<tr>
<td></td>
<td>house</td>
<td></td>
</tr>
</tbody>
</table>
**Organization of Long-Term Memory: Semantic Network Model**

Semantic network model: A model that describes units of information in long term memory as being organized in a complex network of associations. Notice the relation to elaborative rehearsal (page 218).

![Semantic Network Diagram]

*Image credit: Psychological Science, 4/e, Figure 7.17 © 2013 W. W. Norton & Company, Inc.*
Broken Associations Make Retrieval Difficult

An item's characteristics and associates are linked to it.

The closer the nodes, the stronger the association will be.

Activating one node increases the likelihood that closely associated nodes will also be activated.
To make your own semantic network, visit http://vue.tufts.edu/
The Implicit Attitude Test

Many prejudicial attitudes and associations are unconscious. The implicit attitude association measures the reaction time in how long it takes you to make a judgment between the color of a person’s skin and positive or negative words.

Image source: Lillenfeld
Associative Networks and the Implicit Attitude Test
Associative Networks and the Implicit Attitude Test
Associative Networks and the Implicit Attitude Test
The Implicit Attitude Test

FIGURE 12.13 Scientific Method: Payne’s Experiments on Stereotypes and Perception

Hypothesis: Social attitudes can influence basic perceptual processes.

Research Method:
1. White participants were shown a white or black face.
2. Immediately after viewing a face, participants were shown an object and asked to classify it as a gun or a tool as quickly as possible.

Results: Participants primed by seeing black faces identified guns more quickly and mistook tools for guns.

Conclusion: Implicit stereotypes affect perception.
Encoding: Mnemonics and Acronyms

A mnemonic and acronym are memory strategies for placing information in an organized context to facilitate memory.

<table>
<thead>
<tr>
<th>Question</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the Great Lakes?</td>
<td>HOMES</td>
</tr>
<tr>
<td>Do you add acid to water, or water to acid? (do you add hydrofluoric acid (HF) to the water, or the other way around?)</td>
<td>AAA</td>
</tr>
<tr>
<td>When checking vital signs, what is the sequence in which you check?</td>
<td>ABC</td>
</tr>
<tr>
<td>What are the five personality factors in “The Big Five” model of personality?</td>
<td>OCEAN or CANOE</td>
</tr>
<tr>
<td>What is the relationship between sine, cosine, tangent and the length of each side of a triangle?</td>
<td>SOH CAH TOA</td>
</tr>
<tr>
<td>What are the nine “planets”?</td>
<td>My Very Earnest Mother Just Showed Us Nine Planets</td>
</tr>
<tr>
<td>What are the colors of the spectrum?</td>
<td>ROY G. BIV</td>
</tr>
<tr>
<td>What are the color codes for resistors?</td>
<td>BBROYGBVGW</td>
</tr>
</tbody>
</table>
**Mnemonics**

*May I have a large container of coffee?*

3. 1 4 1 5 9 2 6

\[ \pi = 3.1415926 \]

Area = \( \pi r^2 \)

Circumference = \( \pi d \)
Encoding: Visual Imagery Encoding

Visual imagery encoding: The process of storing new information by converting it into mental pictures (page 223, Schacter, Gilbert and Wegner).

If you can visually imagine the material to remember, it increases the likelihood that you are going to remember the information. Therefore, pay attention to the images in the text or lecture or generate your own visual images.
Visual Organization
Strategies to Encoding Information--Getting Information into Memory

Before we can have a memory to retrieve, it needs to be encoded and stored. If you don’t effectively encode information, it will be more difficult to retrieve that information.

Effective strategies:
- Elaboration,
  - elaborative rehearsal
  - encode with “depth” or semantic meaning
- Visual imagery,
- Organization
  - hierarchies
  - categories
  - associative networks
  - mnemonics

Less Effective strategies:
- Encode with superficial characteristics
- Maintenance rehearsal (extends short-term memory)
Reasons why me might forget:

• Encoding failure
• Multitasking

• What were examples of these strategies?
• How can you use these strategies?
• Why is understanding these strategies important?