Chapter Seven

Memory

• The retention of information over time

• Our memories are surprisingly good in some situations, and surprisingly bad in others
  – The paradox of memory

Paradox of Memory

• The same mechanisms that serve us well most of the time can cause us problems in others

• Amazing feats of memory
  – Kim Peek, the real “Rain Man”
  – Rajan and pi

• But memory is also surprisingly malleable
Put down your pen and read these lists:

Sour  Nice  Candy
Honey  Sugar  Soda
Bitter  Chocolate  Good
Heart  Taste  Cake
Tooth  Tart  Pie

Write down all the words you can remember

Paradox of Memory

• Did you include the word “sweet”?

• If so, this is a memory illusion

• Our brains will often go beyond the available information to make sense of the world
  — Generally adaptive, but makes us prone to errors
Reconstructive Memory

• When remembering, we actively reconstruct memories, not passively reproduce them

• Remembering yourself taking a walk and observer memory vs. field memory

• So how can we explain this?

Three Systems of Memory

• Sensory, short-term, and long-term memory

• Differ in terms of span and duration

• Moves from sensory to STM to LTM, and then back to STM
Sensory Memory

- Brief storage of perceptual information before it is passed to short-term memory
- Each sense has its own form of memory
- **Iconic** (visual) lasts only 1 second; **echoic** (auditory) can last 5-10 seconds

Short-term Memory

- Memory system that retains information for limited durations
- Related to *working memory*
- Very brief in duration, 5-20 seconds

Short-term Memory

- We can lose information in our STM due to two different processes
  - **Decay** – fades over time
  - **Interference** – loss of information due competition of new incoming information
Types of Interference

- **Retroactive** happens when learning new information hampers earlier learning
- **Proactive** happens when earlier learning gets in the way of new learning
- Both are more likely to occur when old and new stimuli are similar

Short-term Memory

- The span of STM in adults is $7 \pm 2$ pieces of information
- Can extend our STM span by using **chunking**
  
  K A C F J N A B I S B C F U I
  vs.
  C I A U S A F B I N B C J F K

- **Rehearsal**, repeating information in STM, extends the duration of it
- **Maintenance rehearsal** is simply repeating the stimuli in the same form
- **Elaborative rehearsal** links stimuli to each other in a meaningful way
Short-term Memory

- Elaborative is usually more effective, consistent with levels-of-processing model
- Three levels: visual, phonological (sound-related), and semantic (meaning-related)
- Visual is the most shallow, phonological somewhat less, and semantic the deepest

Long-term Memory

- Relatively enduring store of information
- Includes facts, experiences, and skills we’ve developed over lifetime
- Differs from STM in several ways

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<tr>
<th>SHORT-TERM MEMORY</th>
<th>LONG-TERM MEMORY</th>
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<tr>
<td>Capacity is...</td>
<td>7-9 stimuli</td>
</tr>
<tr>
<td>Duration is...</td>
<td>20 seconds at most</td>
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<tr>
<td>Mistakes are...</td>
<td>Acoustic</td>
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Predicting What We Remember

- **Primacy effect** shows up in remembering stimuli that were presented first (LTM)
- **Recency effect** shows up in remembering stimuli that were presented most recently (STM)
- Also more likely to remember stimuli that are odd or distinctive
Types of LTM

• **Explicit memory** is the process of recalling information intentionally

• Divided into
  – **Semantic memory** (knowledge of facts)
  – **Episodic memory** (events in our lives)

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Read this list of words to yourself

House
Throw
Sleep
Queen
Tires
Guitar
Swim

---

Types of LTM

• **Implicit memory** is recalling information that we don’t remember deliberately
  – Unlocking our front door
  – Tying our shoelaces

• Includes habituation, classical conditioning, and other forms of learning
Types of Implicit Memory

• **Procedural memory** refers to motor skills and habits
  – Riding a bicycle, touch typing

• **Priming** is our ability to identify a stimulus more easily or more quickly after we’ve encountered similar stimuli

Fill in the blanks:

**K_ _ _**

Remember *Queen* from the word list? If you said *King*, you demonstrated a priming effect
Three Processes of Memory

- **Encoding** is getting information into memory
- **Storage** is keeping information in memory
- **Retrieval** is the reactivation or reconstruction of information from memory

Encoding

- To encode it, we must first attend to it
- Most events we experience are never encoded in the first place
- The *next-in-line* effect and memory for common objects
**Encoding**

- **Mnemonics** are learning aid that enhances recall
  - Please Excuse My Dear Aunt Sally
  - Every Good Boy Does Fine

- While applicable to almost anything, they depend on existing knowledge store

**Types of Mnemonics**

- **Pegword method** (uses rhyming)
- **Method of loci** (place imagery)
- **Keyword method** (language learning, reminder words)
Storage

• How we store our experiences in memory depends on our interpretations and expectations of them

• Schemas are organized knowledge structure or mental model that we've stored in memory
  – What happens when you go to a restaurant?

Storage

• Schemas give us frames of reference and allow us to interpret new situations

• Useful, but tend to oversimplify information

• Strong example of why the paradox of memory exists

Retrieval

• Many types of forgetting are failures of retrieval

• Using retrieval cues can help to access information in long-term memory

• Measuring memory makes use of the “3 Rs”
Measuring Memory

- **Recall** - generating previously remembered information
- **Recognition** - selecting previously remembered information from an array of options
- **Relearning** - “savings”; how much more quickly we reacquire something learned before

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<tr>
<th>MEMORY CONCEPT</th>
<th>POINTER</th>
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<tbody>
<tr>
<td>1) Distributed vs massed study</td>
<td>Spread your study time out</td>
</tr>
<tr>
<td>2) Testing effect</td>
<td>Frequently test yourself on the material you read</td>
</tr>
<tr>
<td>3) Elaborative rehearsal</td>
<td>Connect new knowledge with existing knowledge instead of memorizing</td>
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<td>4) Levels of processing</td>
<td>Work to process ideas deeply and meaningfully</td>
</tr>
<tr>
<td>5) Mnemonic devices</td>
<td>The more cues you can connect from your knowledge to new material, the better</td>
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Tip-of-the-Tongue

- Retrieval failure where we are sure we know the answer, but can’t come up with it
- When people believe that something is on the tip of their tongues, they’re frequently right
Encoding Specificity

- We are more likely to remember something when the conditions present at the time we encoded it are also present at retrieval

- Two kinds: context-dependent learning and state-dependent learning

Context-Dependent Learning

- Superior retrieval when the external context of the original memories matches the retrieval context

State-Dependent Learning

- Superior retrieval of memories when the organism is in the same physiological or psychological state as it was during encoding

- Can extend to mood-dependent learning and the retrospective bias
Amnesia

• Most common types are retrograde (loss of past memories) and anterograde (loss of ability to make new memories)

• Myths abound, but generalized amnesia is very rare, as is sudden recovery of memory

H.M.

• Had radical surgery to treat severe epilepsy

• Chunks of temporal lobes, including both hippocampi, were removed

• Experienced mild retrograde and severe anterograde amnesia, but implicit memory improvements

Clive Wearing

• Hippocampi were destroyed by a virus, resulting in complete anterograde amnesia

• Still shows priming effects, thought

• Bottom line: destroying hippocampus leaves implicit memory intact
Emotional Memory

- The amygdala and hippocampus interact to give us emotional memories
- Amygdala helps recall emotions associated with fearful events
- Hippocampus helps us recall the events themselves

Infantile Amnesia

- Inability of adults to retrieve accurate memories before 2-3 years old
- Hippocampus is only partially developed in infants; lack of sense of self
- No evidence for use of hypnotic age regression or other techniques to “beat” this

False Memories

- Our memories can be more fallible than any of us could have imagined
- **Flashbulb memories** are very vivid, able to be recalled in detail much later
- But they change over time, and are often inaccurate when compared to initial memories
False Memories

- **Source monitoring confusion** is a lack of clarity about the origins of a memory
- Can cause numerous memory illusions, including cryptoamnesia
  - George Harrison and the Chiffons

Implanting False Memories

- Elizabeth Loftus’ work on *suggestive memory techniques*
- Smashed vs. hit crashed cars, misleading questions and the *misinformation effect*
- “Lost in the mall” study and recalling events that never happened

Implanting False Memories

- Event plausibility and recency can both impact strength of false memories
- Existence proofs show that it is possible to create memories that are impossible
  - Hot air balloon ride
  - Bugs Bunny at Disney World
From the Lab to the Real World

- Weak correlation between eyewitness confidence in their testimony and accuracy
- Less accurate when
  - Observing others of different race
  - Witness has talked to other witnesses
  - The observed situation is stressful (e.g., threatening, weapon involved)

False Memory Controversy

- Repressing and then later recovering memories of abuse with memory recovery therapists
- Researchers find no evidence to support these claims and say it is due to suggestive techniques