CHAPTER 10
MEMORY COMPONENTS, FORGETTING, AND STRATEGIES
Memory Structure

• Definition of memory: Our capacity to remember
  – Memory is “the capacity that permits organisms to benefit from past experiences [Tulving, 1985]

• Memory structure comprised of two functional systems
  – Working memory
  – Long-term memory

• Memory functions
  – Storage of information
  – Retrieval of information
  – System specific functions
WORKING MEMORY

• Function
  – Referred to a perceptual or short-term
  – Associated with sensory, perceptual, attention, and short-term processes.
  – Plays a critical role in decision making, problem solving, movement production, and evaluation
  – Working memory serves as interactive workspace

continued
WORKING MEMORY

• Storage of information
  – Duration (length of time info will remain in working memory)
• Use info or lose the info!
  – Hold info for only 20-30 sec
  – Recall the following set of words in activity I

• Capacity (amount of info that resides with working memory)
  – Experience, organization, & meaningfulness increase capacity
  – Recall the following set of words in activity II
  – Seven +/- 2 items (Miller’s Law)
  – Recall the following numbers in activity III
WORKING MEMORY

• Process Activity
  – Manipulates the information in a way that it can be used to accomplish the:
    • Goal
    • Solve the problem
    • Retrieve from long term the movement information required to carry out the movement
Recall the following pairs of words

- Stone/Grip
- Read/Spam
- Real/Fetter
- Phony/Confer
- Phone/Coal
- Mess/Bud
- Miss/Suppose
Recall These Word

- Bench/Curl
- Sit/Reach
- Love/You
- Young/Old
- Fat/Skinny
- Touch/Toe
- Muscle/Nerve
Recall the following set of two numbers in order!!

- 36
- 10
- 97
- 85
- 08
- 10
- 04
- 24
# LONG-TERM MEMORY

<table>
<thead>
<tr>
<th><strong>Function</strong></th>
<th><strong>Capacity</strong></th>
<th><strong>Processes</strong></th>
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</thead>
<tbody>
<tr>
<td>Permanent storage of specific past events.</td>
<td>Duration is relative permanent.</td>
<td>Storage and retrieval of specific types of information necessary to perform and function in the world.</td>
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<tr>
<td>General knowledge about the world</td>
<td>Capacity is relatively unlimited.</td>
<td></td>
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Chapter 10
Three Types of Memory Systems in Long Term Memory

• Procedural: Stores information about “how to do” specific activities, (e.g., motor skills such as how to hit a baseball.)

• Semantic: Stores our general knowledge about the world based upon experiences, e.g. concepts; hitting and running the bases is how we score in baseball.

• Episodic: Stores our knowledge about personally experienced events
  – Allows us to “travel back in time.”
  – Last time I was up to bat, the pitcher threw a fast ball on the first pitchLast Tuesday at this intersection there was a car accident. I better look twice when crossing!
Distinguishing Between Knowing What to do and How to do

• A common approach to classifying the types of knowledge in the episodic and semantic memory systems in LTM describes the knowledge as
  – Declarative knowledge
    • Knowledge that can be verbally described (i.e., “What to do” to perform a skill)
  – Procedural knowledge
    • Knowledge that enables the person to actually perform a skill (i.e., know “how to do” a skill)
    • Typically this knowledge is not verbalized or difficult to verbalize.
Remembering & Forgetting

• Encoding
  – Transforming information to be remembered into a form that can be stored
    • Storage – process of placing information in long term memory
    • Rehearsal – enables humans to transfer information from working to long term memory

• Retrieval
  – Process of searching long term memory that must be processed and used in order to perform the task
ASSESSING REMEMBERING AND FORGETTING

• Explicit Memory Tests
  – Recall test is where one is required to produce a movement with little or no cues (i.e., show me how to tie the shoe.)
  – Recognition test is where one is given cues or information on which to base a response (i.e., two different people tie a shoe, you are then asked which person tied the shoe properly)

• Implicit Memory Tests
  – We assess implicit memory by asking a person to verbally describe how to perform a skill and then ask him or her to perform it.
  – Verbally describing it assesses one’s declarative knowledge where as performing it assess one’s procedural knowledge.
  – Many experts have high procedural knowledge but poorer declarative knowledge.
  – It is not uncommon for people to be able to describe the procedure or how to perform and not be able to perform it!
CAUSES OF FORGETTING

• *Trace Decay*
  – Time factor of working memory
  – Cause of forgetting in working memory but not long term memory

• *Proactive interference*
  – Activity that occurs prior to the presentation of the information that is to be remembered and negatively affects the remembering of that information.
  – Can occur in both STM and LTM

• *Retroactive interference*
  – Activity after we performed a movement we needed to remember (i.e., during retention interval) that results in poorer retention performance than if no activity had occurred.
  – Can occur in both STM and LTM
Fact!!!

Proactive and retroactive interference affecs are the greatest (i.e., we forget allot more) when there is similarity between what is remembered and the interfering activity.
When is forgetting the greatest?

• Attempt to remember the following terms in order they are presented:

  Spud       Rib
  Nut       © Kick
  Spur   © Spun
  Now       Kind
  Rob  © Spoon
  Kite
• Recall
Result

- spud, nut, spur, now, rob, kite, rib, kick, spun, kind, spoon

- Notice the every other term was similar and you may have remembered one but not both as you go along the line.

- Similarity between the words made it more difficult to remember the words.
Trace Decay

• Trace decay applies to short term memory not long term memory

  – It is likely that forgetting involves misplacing of information in long term memory rather than it decaying or deterioration due to passage of time or use.
Proactive Interference

• There is an activity just prior to the presentation of information to be remembered.
  – Major reason why the activity may cause problems in working memory is the activity caused *confusion*.
  – Greatest affects on working memory occurs when the activity and what is to be remembered are *similar*.
  – Effects of proactive interference on long term memory is *unknown* but is directly related to practice quality and quantity.
    • If we actively rehearse the task, the activity it has little effect
Proactive interference occurs when current information is lost because it is mixed up with previously learned, similar information. Earlier information projects itself forward (proactive) and interferes with what we try to learn next.
Proactive Interference & Judging

Research has indicated that judging previously seen elements biased the judges evaluations when the skill was performed differently from the previous observation (Memory article by Ste-Marie, Valiquette, and Taylor (2002)).

E.g., I have two ice skaters. The first skater performs the required skills in the routine in a traditional style. Then the second skater performs the traditional skills in a unique and different manner other than how it is to be performed traditionally. The first skater’s performance will bias the judge’s score of the second skater.
Retroactive Interference

• An activity occurs during the period of time we are needed to remember the movement.
  – Working memory is greatly affect by the degree of similarity between the interfering activity and the movement to be remembered.
    • People can remember the order the way they learned it but if they are ask to recall it differently than retention is impaired.
  – Retroactive interference greatly affects memory if activity and movement to be remembered exceeds our working memory capacity (Miller’s Law)
Retroactive Interference

<table>
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<tr>
<th>PAST</th>
<th>PRESENT</th>
<th>FUTURE</th>
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<tbody>
<tr>
<td>Interferes</td>
<td>New Learning</td>
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Retroactive interference occurs when present information works backwards to interfere with earlier information. It occurs when previously learned skills is lost because it is mixed up with new and somewhat similar information.
Card Sorting Task

The cards have been ordered by color (red or black) and suit. There are 6 red and black cards. For example, if your ace is a diamond or heart then your red cards are 1, 3, 5, 7, 9, 11 and black cards are 2, 4, 6, 8, 10, 12.

I want you to turn over all your red cards in order than black cards in order if you your ace is a diamond or heart.

I want you to turn over all your black cards 6 times in arrow than turn over your red card in order.

This activity will be timed!!

Once completed turn your cards face down. Wait for further instructions!!
Card Sorting Task

- I want you to recall the cards by suit from the highest number to last.
- Three card per suit.
- I want you to recall the cards in the following order
  - Hearts then Spade then Diamonds then Clubs!!
- Once completed sit and wait for more instructions!!!
Retroactive interference & LTM

• Type of tasks are remembered better over long periods than all others
  – Continuous motor skills are more resistant to LTM forgetting.
  – Discrete motor skill are less resistant to LTM forgetting, especially serial discrete motor skills.

• Why?
Movement Characteristics Related to Memory Performance

• **Location and Distance Characteristics.**
  – Instructions and demonstrations should concentrate on location points of the limb movement, especially end-point locations
    • Emphasize limb movement end-points or key spatial positions during movement in teaching a motor or sport skill (E.g. 3 O’clock; 6 O’clock; 12 O’clock)
    • Card sorting activity
      – Reshuffle the 12 remaining cards and place them face down making a circle that is associated with a face of the clock.
      – Now complete the task as before with only 12 cards staring with one and finishing with 12. Turn the cards over and wait for further instructions.
      – Most people can remember the beginning and end of the movement (Primacy-recency effect)
      – Movement end points are better recalled than distance movements.

• **Meaningfulness of the movement**
STRATEGIES THAT ENHANCE MEMORY PERFORMANCE

- Increase the movement’s meaningfulness
- Intention to remember
- Subjective organization (chunking)
- Practice-test context similarity
How do we make a task meaningful?

• Visual imagery
  – Provide the learner or client with a useful image of the movement (3 Fs of performing)

• Verbal label
  – Use verbal labels and cues that related to position during the movements
    • Up together, down together and through!
    • Pow-Pow-Pow
      • Useful in young children under the age of 7 as well as adults

• Relate the movement to what they will be doing in the game, sport, or real life skills
Intended and Incidental Memory

• Intended information
  – If you know in advance that you will be required to remember the movement there is great probability you will remember it!
  – E.g., study guides; highlighting a certain movement; “this part of movement is the most important”.
  – Advanced knowledge will increase the effort of practice and result in better remembering

• Incidental information
  – It information present, sometimes novel, and attention gathering but not intended.
  – Retained at the same level as intended.
Subjective Organization

• Grouping or organizing the information into units rather than pieces
  – Organize material based on its meaningfulness
    • Stoke and Parkinson’s patients have difficulty in subjectively organization strategies.
    • Bob Woodruff
    • At the novice stage, learner approaches movement as comprising a lot of parts.
    • At the experienced stage, learner organizes the parts into units (chunking).
Injured newsman Woodruff travels challenging road to memories

MENTAL HEALTH: The former anchor, who was injured in 2006 by a bomb in Iraq, is one of 1.5 million Americans who experience traumatic brain injuries every year.

BY JEFF SEIDEL

DETROIT — Bob Woodruff struggles to talk about his work in raising awareness of traumatic brain injuries.

“Some of it is ... is ...” Woodruff says and stops.

Woodruff suffered a traumatic brain injury on Jan. 26, 2006, when a roadside bomb exploded in Iraq, where he was doing reports for ABC News.

Traumatic brain injury, or TBI, has been called the signature wound of the wars in Iraq and Afghanistan. Thousands of troops have suffered mild or moderate TBI with symptoms that include headaches, dizziness, memory loss, vision problems and irritability.

Others have suffered severe brain injuries — their memory is shattered and they cannot walk, talk or feed themselves.

Woodruff, 46, considers himself a lucky one, even though he struggles to remember words and names.

Some of it is ... is ... Woodruff’s thoughts go racing down a mental highway, searching for a way to express himself because it’s out there, that perfect word, at the end of the road, stuck deep in his vocabulary. He knows the word. He can feel it. But he can’t reach it. He can’t quite bring himself to say it.

It is like the mental highway is cut in half — unseen roadwork, up ahead — creating a traffic jam. It can be maddening and frustrating, as this silent drama plays out in his head, if only for a microsecond, countless times every day, for a man who was once so eloquent and smooth.

Some of it is ... is ... “opening up awareness,” he says and stops. No, that’s the wrong word.

Back on that mental highway. Time for a trick. He takes an exit around the problem. Down a back road. Around the problem and ends up in another place, coming up with another word. A synonym; thank God for synonyms.

Some of it is ... is ... “ah, awareness of TBI generally, not only to general citizens of the country, but also to Congress and the Senate,” he says.

Awareness. Maybe it’s not the perfect word. But it works. For now — he can finish his sentence — and that’s an improvement.

There was a time when none of the words would come to him.

“I’ve learned to fake it,” Woodruff says.

But he can’t fake it well enough to return to ABC’s anchor chair, at least not yet.

Woodruff’s ability to speak is his job.

“You can’t cover the presidential race,” Woodruff says, “and forget the name of the candidate.”

There are 5.3 million Americans living with a disability as a result of TBI, according to the Brain Injury Association of America.

The leading causes of TBI are falls (25 percent), motor vehicle crashes (20 percent), struck by or against an object (19 percent) and assaults (11 percent), the association says. Only 2 percent of those Americans suffered TBI because of a war.

Every year, 1.5 million Americans sustain traumatic brain injuries, including 50,000 who die.

“The war is teaching the world about TBI,” Woodruff says. “Nobody generally, knew about TBI until the war.”
Subjective Organization

• Recall the following letters in their exact order:
  – L-W-I-C-X-N-Q-S-B-H-Y-O

• Recall the following letters in their exact order:
Practice-Test Context

- Relationship between the practice and test context....
  - More similar, more is remembered
  - In closed skill situations it is know as *encoding specificity principle*.... amount of similarity between the practice and the test context.