CHAPTER 10

MEMORY COMPONENTS, FORGETTING, AND STRATEGIES
Discussion Assignment

- Read the following stories in Motor Control text:
  - The Keypad (pages 205-7)
  - Like Riding a bike (pages 219-221)
  - H.M. (pages 223-224)

- Be able to lead a small or large class discussion over these stories. This will be student led discussion.
INTRODUCTION

• Structure of memory

• What are the causes of forgetting?

• What can one do to decrease the amount of forgetting?

• What can one do to increase how much one remembers?
MEMORY

- Retention or remembering
- Capacity that permits humans to benefit from past experiences (Tulving, 1985)
- Related to every situation and skill we perform.
TERMINOLOGY & MEMORY STUDY

- Motor memory + Verbal Memory = Memory

- Retention and Forgetting
  - Retention refers to *what we remember*
  - Forgetting is a retrieval problem
Memory Structure

- Part of memory is oriented to events just occurred (short term memory)
- Part of memory is related to events in the past (long term memory)
- Memory then is usually presented as representing these two components.
  - Short term
  - Long term
Two-components of Memory

- Two Components of Memory
  - Working or short term memory
  - Permanent or long term memory
WORKING MEMORY

- 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
  - 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 & meaningfulness increase capacity
      - Recall the following set of words in activity II
    - Seven +/- 2 items (Miller)
      - Increase size of items recalled depends on chunking

continued
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
- 10
- 04
- 24
WORKING MEMORY

Processing Activities

• Manipulates information to solve specific movement problem
• Manipulates information to perform the goal of movement
• Manipulates information for storage in permanent memory
LONG-TERM MEMORY

- It is what we think of when we hear the term memory

  - Duration of information storage is permanent
    • Forgetting is a retrieval problem.
  - Capacity of information storage is unlimited
    • Studying how one organizes information in long term memory is of great importance.

Continued
Types of Information Stored in Long Term Memory

- **Procedural memory** enables us to know “how to do” the skill.
  - Perform the skill (e.g., know how to do the skill!)
  - How to drive a vehicle or car! How to put a model airplane together!

- **Declarative (What to do!)-**
  - Should be able to describe it
  - I need to turn left at the stop light!

- **Episodic**
  - Remembering some experience in terms of time & context
  - Last Tuesday at this intersection there was a car accident. I better look twice when crossing!

- **Semantic**
  - General knowledge about the situation and skill
  - The diver attempted a left hand turn and was hit by an oncoming car.
Knowing what to do and Doing it!

- Declarative Knowledge
  - What to do!
  - Can verbalize it
  - Able to describe it when asked but may not be able to do it!
  - Implicit

- Procedural Knowledge
  - How to do!
  - Able to do it but might not be able to describe it!
  - Explicit
Experienced Versus Inexperienced Performers

- Studies demonstrate that experienced performer’s declarative and procedural knowledge is greater than inexperienced performers.
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 (Let me show you how and/what I can do it!)
  - Recall test (produce a movement with little or no cues – “Perform the skill I just showed you!”)
  - Recognition test (gives us an understanding of what information was actually stored even though cues or aids are needed)

- Implicit Memory Tests (Let me tell you how and what to do it?)
  - Verbally describe what to do in the situation.
  - 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

- **Proactive interference**
  - Activity that occurs prior to the presentation of the information that is to be remembered

- **Retroactive interference**
  - Activity that occurs during retention
Fact!!!

Forgetting is the greatest when there is similarity between what is remembered and the interfering activity.

e.g. tennis serve and overhand throw
When is forgetting the greatest?

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

- Spud
- Nut
- Spur
- Now
- Rob
- Kite
- Rib
- Kick
- Spun
- Kind
- Spoon
Recall
Professional Implications that Apply to Memory

- After you give a demonstration of the skill of what to do or how to do the skill, you should do what!
  - Physically practice immediately
- Do not describe or demonstrate what not to do before you give a demonstration of what to do!
- If people ask questions after your demonstration, what should you do?
  - Repeat the demonstration
- If the players can describe to you the play, they most certainly did remember it. Yes or NO?
- 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.
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.
Memory Card Game

- Separate your cards into two stacks.
  - One stack is black other red.
- Shuffle the black stack and place the cards face down. Wait for further instructions.
- Recall the black cards from highest to lowest. Once you can recall the cards. Turn the cards over face down and wait for further instructions.
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*.
    - 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.
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!!
Retroactive Interference

- An activity occurs during the period of time we are needed to remember the movement.
  - Working memory is greatly affected 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 asked 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 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.
Reducing the Retrieval Problem Associated with Motor Skills

- **One should use a location-type strategy in recalling.**
  - Instructions and demonstrations should concentrate on critical location points of the limb movement.
    - E.g. 3 O’clock; 6 O’clock; 12 O’clock
    - Card sorting task
      - 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)**

- **Moment end points are better recalled than distance movements.**
  - Different positions of the limb movement should be emphasized.
  - Body part cues should be emphasized.

- **Meaningfulness of the movement**
FORGETTING AND LONG-TERM MEMORY SUMMARY

- Trace decay, retroactive, and proactive interference affects working memory more than long-term memory.
- Continuous motor skills are more resistant to forgetting (verbal coding is small) due to repetition.
- Procedural skills (primacy-recency effect) are easily forgotten then discrete skills.
- Forgetting in long term is a retrieval problem.
STRATEGIES THAT ENHANCE MEMORY PERFORMANCE

- Increase the 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 versus unintended
Movement to Remember

- Intended
  - 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”.

- Intended versus unintended!
  - Advanced knowledge will increase the effort of practice and result in better remembering

- Unintended
  - Unexpected recall test over the movement (pop quiz)
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. 29, 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 (26 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 known as the encoding specificity principle. Amount of similarity between the practice and the test context.
SUMMARY

- Memory has two components
  - Working memory
  - Long-term memory
- Forgetting relates to factors of trace decay, interfering activities and type of skill (procedural versus continuous)
- Remembering is related to movement location strategies, end points, and meaningfulness
- How well one remember is related to verbal cueing, intention, subjective organization, and practice-context similarity