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**Treating Memory and Learning in the
Individual with TBI**

Presented By:
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Moderated By:
Amy Natho, M.S., CCC-SLP, CEU Administrator, SpeechPathology.com

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EARNING CEUS

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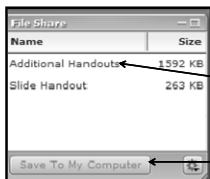


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Memory and Learning

Victoria Harding, MBA, MS CCC/SLP

Individuals with TBI have identified as problems:

- Forgetting to write things down
- Writing things down but not in enough detail so it gets thrown away.
- Missing appointments
- Misplacing things
- Forgetting conversations
- Repeating statements and questions over & over
- Forgetting what they did last week
- "Everyday things" which translates to forgetting:
 - items cooking on the stove
 - to let their dog back in
 - if they already put on deodorant
 - where their kids are going today after school
- Short-term and sensory memory are typically functional

Individuals with TBI also identify that:

- they become distracted very easily

- and their attention drifts to other conversations.

Short Term Memory

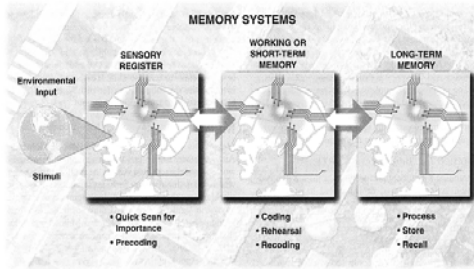


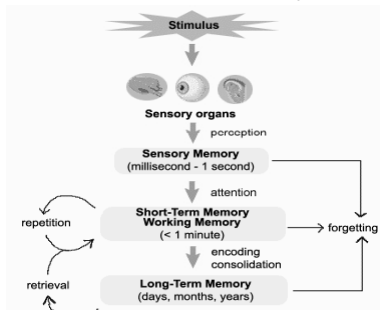
Figure 1-8. Information processing within the sensory register, working or short-term memory, and long-term memory includes complex coding, sorting, storing, and recall functions.

The Memory TRRAP, Rick Parente

- T Translate into your own words
- R Rehearse Immediately
- R Relate the old to the new
- A A picture is worth 1,000 words
- P Practice output

Why does this work??

Memory



"The Brain from top to Bottom" at McGill.ca (McGill University, Montreal, Quebec, Canada) <http://thebrain.mcgill.ca/flash>

Proposed Types of Memory

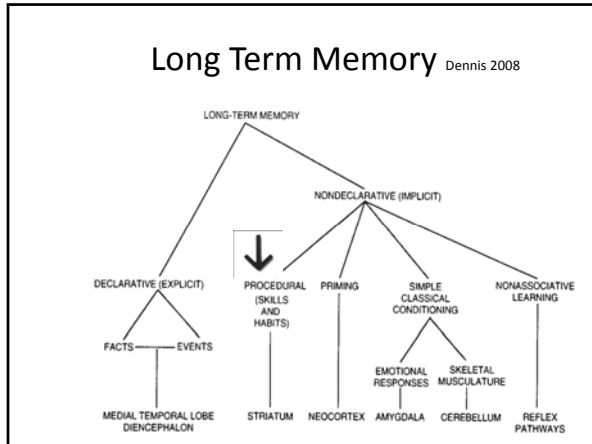
Fact memory	Skill memory
Declarative	Non-declarative (Procedural)
Memory	Habit
Explicit	Implicit
Knowing that	Knowing How
Cognitive mediation	Semantic
Conscious recollection	Skills
Elaboration	Integration
Autobiographical	Perceptual
Representational	Dispositional
Vertical association	Horizontal association
Episodic	Semantic

Long Term Memory Dennis 2008



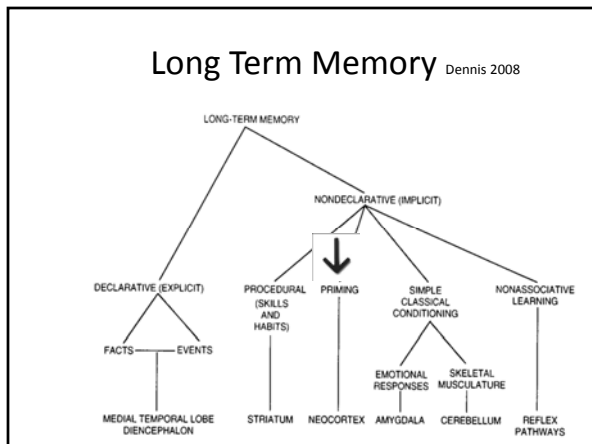
Defining Some Terms

- Declarative/Explicit – memories which can be consciously recalled such as facts and events
 - Episodic memory: stores specific personal experiences; Episodes of a person’s life with respect of time and locus (space)
 - Semantic memory: stores factual information; Facts without a personal reference, i.e., knowing how to do arithmetic, conjugate a verb
- Nondeclarative/Implicit – unconscious memories such as skills



Procedural Memory

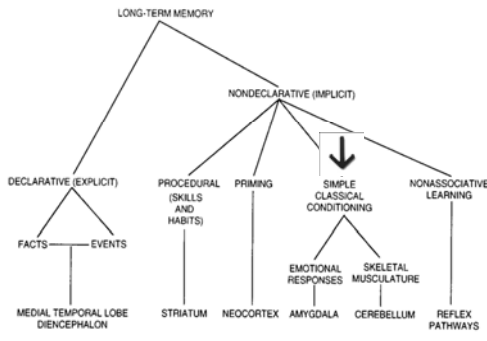
- Our memory for “how to do things.”
- When needed, procedural memories are automatically retrieved and utilized for the execution of the step-by-step procedures involved in both cognitive and motor skills.
- This process occurs without the need for conscious control or attention.
- Includes the knowledge of certain activities or procedures, which eventually become automatic with repetition and practice.
- This type of memory is often used without conscious thought or planning, and is therefore very difficult to verbalize.
- The type of knowledge gained as a procedural memory tends to last for a long time. Eg: tying shoes, flying an airplane, swimming, riding a bike, playing a musical instrument



Priming

- The implicit memory effect in which exposure to a stimulus influences causes a response to a later stimulus.
- Eg: if a person reads a list of words including the word *table*, and is later asked to complete a word starting with *tab*, the probability that they will answer *table* is greater than if not so primed.
- Eg: when people see an incomplete sketch that they are unable to identify: they are shown more of the sketch until they recognize the picture. Later they will identify the sketch at an earlier stage than was possible for them the first time.
- The effects of priming can be very salient and long lasting.
- Priming works best when the two stimuli are in the same modality (eg: visual priming works best with visual cues and verbal priming works best with verbal cues), but priming also occurs between modalities, or between semantically related words such as "doctor" and "nurse".

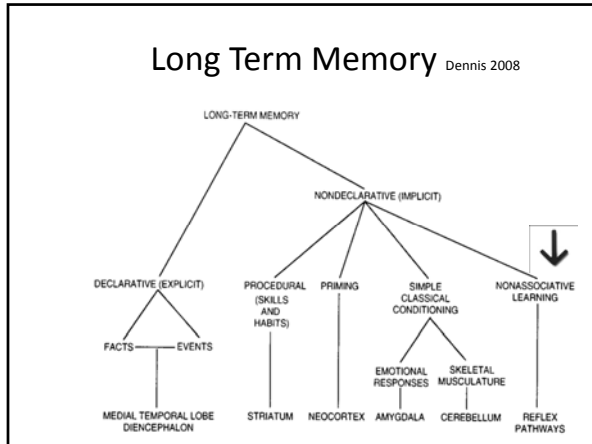
Long Term Memory Dennis 2008



Simple Classical Conditioning

- Popular forms of classical conditioning that are used to study neural structures and functions underlying learning and memory include fear conditioning and eyeblink conditioning.





Nonassociative Learning

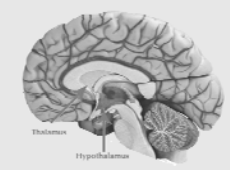
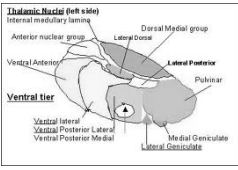
- **Habituation**
 - An example of non-associative learning in which there is a progressive diminishing of behavioral response probability with repetition of a stimulus.
 - Eg: An animal first responds to a stimulus, but if it is neither rewarding nor harmful the animal reduces subsequent responses.
- **Sensitization**
 - An example of non-associative learning in which the progressive amplification of a response follows repeated administrations of a stimulus
 - Eg: the repeated tonic stimulation of peripheral nerves that will occur if a person rubs his arm continuously. After a while, this stimulation will create a warm sensation that will eventually turn painful. The pain is the result of the progressively amplified synaptic response of the peripheral nerves warning the person that the stimulation is harmful. Sensitization is thought to underlie both adaptive as well as maladaptive learning processes.

Structures of the Limbic System and Functional Involvement in Memory – Patrick 2010

- Cingulate gyrus Attention, drive, pain reception
- Hippocampus Memory, spatiotemporal integration
- Amygdala Emotion evaluation, motivation, olfaction
- Basal Forebrain Emotional evaluation, memory

Patrick, Peter 2010

Structures of the Diencephalon System and Functional Involvement in Memory - Patrick 2010

- Mammillary bodies Memory, emotion
- Anterior Thalamus Memory, emotion, attention
- Mediodorsal thalamus Memory, consciousness, sleep, emotion
- Nonspecific thalamus Consciousness

Patrick, Peter 2010

Paralimbic cortex Patrick 2010

- Medial /orbitalfrontal Emotional evaluation, social behavior, initiative
- Insula Sensory-motivational integration
- Temporal pole Memory-related sensory integration, initiation of recall

Patrick, Peter 2010

Structures Associated with Four Types of Long-Term Memory - Bowen 2009

	Episodic	Semantic	Procedural	Priming
Encoding/ consolidation	Limbic/ Pre-frontal cortex	Limbic/ cortex	Basal ganglia/ Cerebellum	Uni/poly-association areas
Storage	Cortical Association Areas/Limbic area	Cortical Association Areas/ Limbic areas	Basal ganglia/ Cerebellum	Uni/poly-association areas of the cortex
Retrieval	Right Temporo- frontal Cortex	Left Temporo- frontal cortex	Basal ganglia/ Cerebellum	Uni/poly-association areas of the cortex

Amnesia

- Loss of memory ability - usually due to lesion or surgical removal of various parts of the brain
- Two broad categories:
 - *Retrograde*: loss of memories for events prior to damage
 - *Anterograde*: loss of ability to store new memories of events after damage

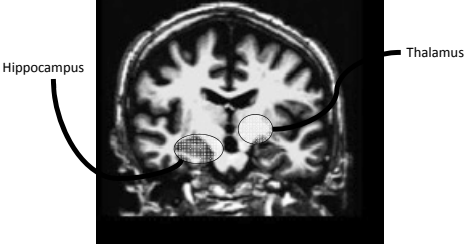
Retrograde and Anterograde Amnesia

- **Retrograde**
 - Recall of information from the point of "incident" into the past
 - Historical memory
- **Anterograde**
 - Recall of information from point of "incident" forward
 - Post-traumatic amnesia
 - Laying down new memories/learning

Amnesia - Associated Brain Regions

- Diencephalic amnesia - damage to the medial thalamus and mammillary nuclei...thalamic walls
- Medial temporal lobe amnesia - damage to the hippocampal formation, uncus, amygdala, and surrounding cortical areas
- Other implicated regions include Anterior Lateral Temporal Lobe and Frontal Lobes

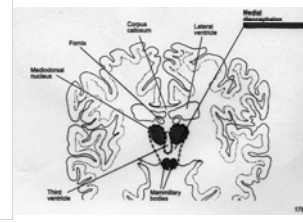
Amnesia



A coronal MRI scan of the brain. Two circular callouts highlight the hippocampus on the left and the thalamus on the right. Labels with arrows point to these structures: 'Hippocampus' on the left and 'Thalamus' on the right.

Diencephalic Amnesia

- Damage to the medial thalamus and/or mammillary bodies
 - stroke
- Korsakoff's syndrome
 - Caused by thiamine deficiency as a result of chronic alcoholism



A sagittal diagram of the brain showing internal structures. Labels include: Fornix, Corpus callosum, Lateral ventricle, Medial mammillary nucleus, Medial thalamus, Third ventricle, and Mammillary bodies. A small number '178' is visible at the bottom right of the diagram.

Korsakoff's Syndrome

- Lesions to Medial Thalamus
 - Results from chronic alcoholism and consequent thiamine deficiency
 - Tumor
 - Infarct
 - Hemorrhagic stroke
- Lesions to Mammillary Bodies
 - Severe anterograde amnesia
 - Severe retrograde amnesia extending years before damage
 - Confabulation - make up stories to explain absence of memory
 - Often unaware of their deficit

NeuroPsychology Memory Testing

- Test of Memory and Learning (TOMAL)



- Wide Range Assessment of Memory and Learning 2 (WRAML-2)



Rehabilitation of Memory

- Approaches to memory rehabilitation
 - The repair or optimal use of damaged systems
 - The alleviation of functional disability (this is assumed under first one)

Restoration of Damaged Function

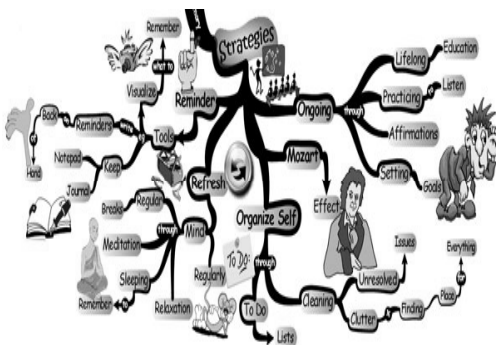
- Assumption that memory can be restored through stimulation or activation of pre-morbid memory abilities
 - Memory practice or retraining model
 - Implies neural and cognitive restoration through learning/training intervention.

Optimization of Residual Function

- Assumption that memory is not lost entirely but reduced in efficiency.
- Approach is to improve or enhance performance of existing skills
 - Compensatory strategies
 - Mnemonic strategies
 - External Aids
 - Vanishing cues
 - Errorless learning
 - When to use serial learning
 - **How can the capacity of STM be increased?**
 - chunking

Medical Interventions

- Cognitive enhancing medications




• From <http://www.blog.lamatrix.com/wp-content/uploads/2008/04/memory-strategies.jpg>

Forgetting

- **Does not “get into” LTM**
- **Breakdown of “getting into” LTM:**
 - **Displacement:** is most likely to occur when the capacity limit of STM has been reached (about 7 units of information)
- **Does “get into” LTM, but...**
 - **Decay:** Loss of memory over time
 - **Interference:** Occurs when the learning of something new causes forgetting of older material on the basis of competition between the two. Main assumption of Interference Theory is that the stored memory is intact but unable to be retrieved due to competition created by newly acquired information.

The Concurrent Four Pronged Treatment Approach – Malia et al

1. Education about TBI
2. Impairment Level Process Training Treatment
3. Compensatory Strategy Treatment
4. Carryover to real world functional executive routines in a multidisciplinary treatment environment



Education about TBI and Memory Impairment

- *The Brain Injury Workbook*, Powell and Malia
- *The Human Brain Coloring Book*, Diamond, Scheibel & Elson
- *Brainwave* – R Malia, Beckwick, Raymond & Bennett

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External Strategies

Strategies originating outside the person.





Internal Strategies

Strategies originating from inside the mind.

Some Internal Compensatory Strategies

- Acronyms
- Association/Categorization
- Chunking
- Musical lyrics/rhymes
- Repetition
- Routines
- Say it out loud
- Visual Imagery
- Increase use of the senses
- Method of Loci
- PQRS

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