



Brain Structures That are Involved with Memory

Psychology 372

Physiological Psychology

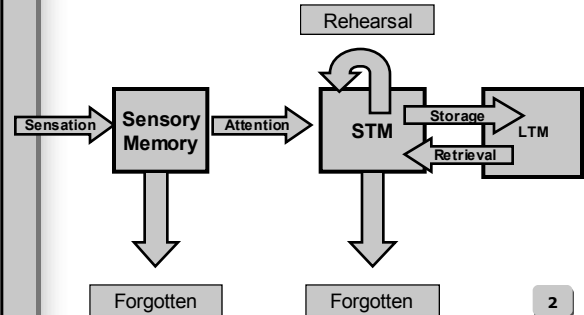
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Early Theories of Memory



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Sensory Memory

In sensory memory, sensory impressions are stored in a form similar to the original sensation.

Several subgroups.

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Iconic Memory

- Related to the visual system
 - Are visual images in the retina and the brain.
 - Lasts approximately .25 seconds.
 - Can last longer.
 - Why? Processing in Bipolar, Ganglion, Amacrine, and Horizontal cells.

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Echoic Memory

- Related to the auditory system
 - Auditory sounds that last in the Cochlea and Temporal Lobe.
 - Lasts 2 seconds or less.
 - Can last longer.
- Why? Waves occurring in the cochlea

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Short Term Memory

- Two components
 - Events that just occurred are still in consciousness
 - Are different from events that need to be brought back by recall from Long Term Memory.

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Information in STM can do
One of Three Things.

- It can be rehearsed and remain in STM
- It is not rehearsed and is forgotten
- It can go into the next stage (LTM)

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7 plus or minus two

- Miller you can generally only store 7 plus or minus two items in short term memory.
- Lasts a short period of time (10 – 20 seconds).

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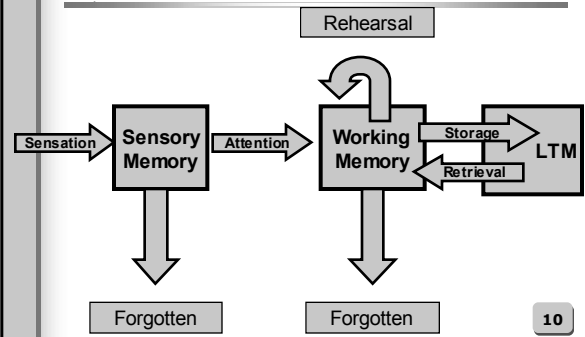
Long Term Memory

- Is where information goes into the system and is retained
- Duration - apparently forever
- Penfield Studies

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Later Theories of Memory



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Uses a Computer Model

- Sensory Input from keyboard
- Working Memory RAM
- LTM Storage System/Hard Drive

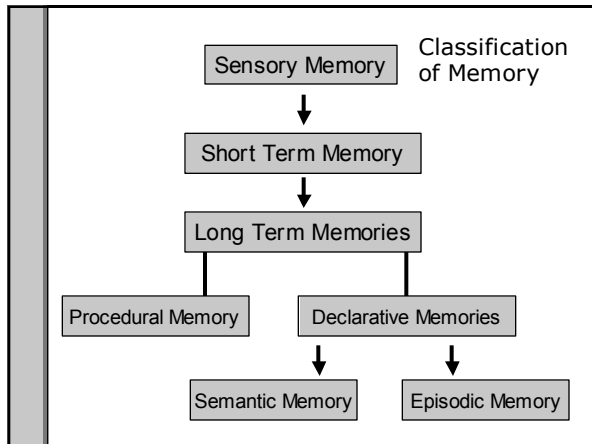
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Classification of Memory

- Many Schemes

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Types of Long Term Memory

- Many types
 - Episodic Memories
 - Declarative Memory
 - Visual Memory
 - Procedural Memory

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Episodic Memories

- Is a memory for a specific event.
- What happened, where did it happen, etc.

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Declarative Memory

- Is memory for items of knowledge.
- Is independent of the particular occasion in which one acquired them.
- Is the sum of all acquired knowledge.
 - All words, symbols, facts of words, appearance of objects, principles, schemas, scripts. etc. we have.

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Visual Memory

- Eidetic (I de Tic) Imagery (photographic memory)
- Individuals can recall detailed images of visual scenes for long periods of time
- Is very rare
- 5% of kids
- Less for adults
- Kids rely more on imagery than adults

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Procedural Memory

- Memory for physical things
- Riding a bike

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More Accurate Representation

- Implicit (Non-Declarative) Memory
- Explicit (Declarative) Memory

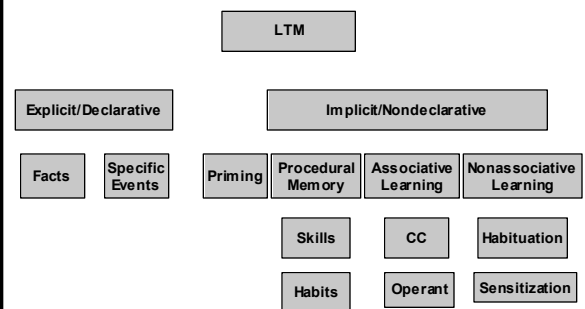
Implicit (Non-Declarative) Memory

- Involves training reflexive behavior or procedural skills
- Is recalled unconsciously
- Is more rigid
- Is more connected to the stimulus conditions where the knowledge was learned

Explicit (Declarative) Memory

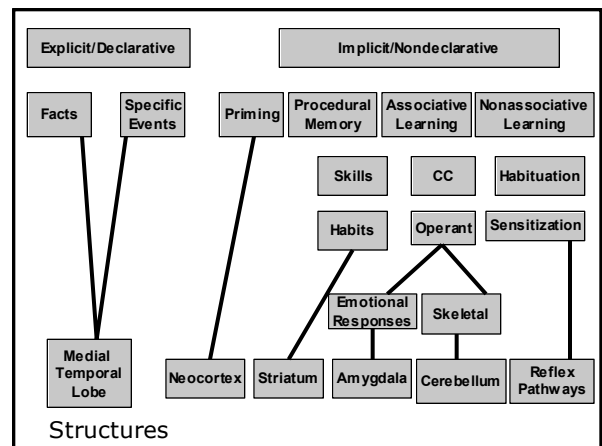
- Is knowledge of people, places, things and what they mean
- Is recalled by deliberate, conscious effort
- Is highly flexible
- Involves the association of multiple pieces of information
- Two components
 - Episodic memory (First Kiss)
 - Semantic memory (Knowledge from texts)

Explicit (Declarative) Memory



Some Structures Involved With Memory

- Cortex
- Amygdala
- Cerebellum
- Reflex Pathways
- Thalamus
- Hippocampal Formation
- Entorhinal Cortex
- Others



Explicit Memory Pathways

- Begins in polymodal association cortices (prefrontal, limbic, parieto-occipital-temporal)
 - Processes visual, spatial, and somatic memory
- Information is conveyed to parahippocampus and perirhinal cortical structures
- Conveyed to entorhinal cortex
- Conveyed to dentate gyrus
- Conveyed to hippocampus
- Conveyed to subiculum
- Conveyed back to entorhinal cortex
- Sent back to perirhinal and parahippocampus
- Back to polymodal association cortices of neocortex

Hippocampal Formation

Entorhinal Cortex

- For location see Figure 13.5
- Gets input from
 - Association Cortex
 - Fornix
 - Amygdala
- Sends information to the dentate gyrus via the Perforant Pathway.
 - Is the critical pathway to get information from the association cortices to the hippocampus.
- Is also the major output structure from the hippocampus
- Thus, information comes from both association cortices and hippocampus and converges.
- Usually the earliest structure for damage that occurs in Alzheimer's Disease

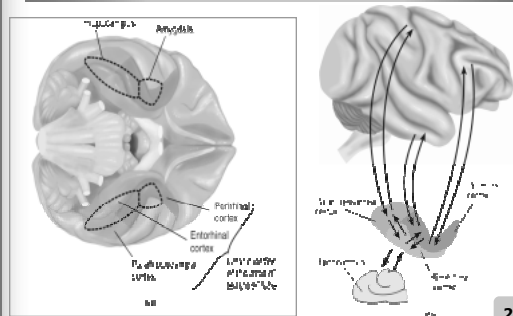
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Hippocampal Formation

- Includes
 - dentate gyrus
 - the CA fields of the hippocampus
 - subiculum
- Sends inputs to the hippocampal formation
- Receives outputs of hippocampal formation
- Is crucial for the formation of new memories

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Hippocampal Anatomy



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Hippocampus Overall

- Plays a major role in encoding and storing information.
- With damage, you have difficulty storing and recalling information.
 - Generally, the information is not appropriately coded due to insufficient elaboration.
- With damage, new information is not stored, but old information remains intact.
- Called Anterograde Amnesia

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ACh.

- Is involved in theta rhythms of hippocampus
- Block ACh. get disruption of spatial working memory
- ACh agonism can reverse effects associated with diminished cholinergic function

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Other Structures - Thalamus

- Is also involved with memory formation.
- Is thought to give the message to print the memory initially.
- With damage, memory traces never get created to begin with.
- So, it isn't stored in either Short Term Memory or Long Term Memory.

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Summary

- So with damage to the Hippocampus, memory is formed but due to elaboration problems, it is not properly encoded.
- With the Thalamus, the memory never gets formed at all.

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Cerebellum

- Thompson
- Conditioned a eye blink response and a leg movement response.
- Lesioned the area that disrupted the eyeblink response. Result, the leg response was unaffected.
- Then moved 1 millimeter closer to the middle of the brain and lesioned.
- Result, found the conditioned leg response was affected but the eyeblink was not.

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Conclusion

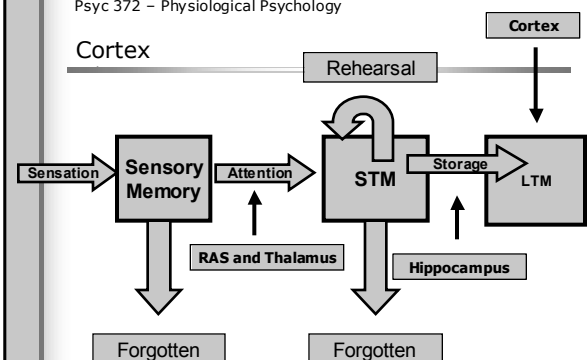
- Isolated procedural memories have unique pathways in the Cerebellum.
- Also get the same response when you remove Hippocampus.

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Cortex

- Lots of locations related to memory.
- Tends to be related to the type of memory involved.
- Mostly in the frontal lobe in a variety of structures.

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