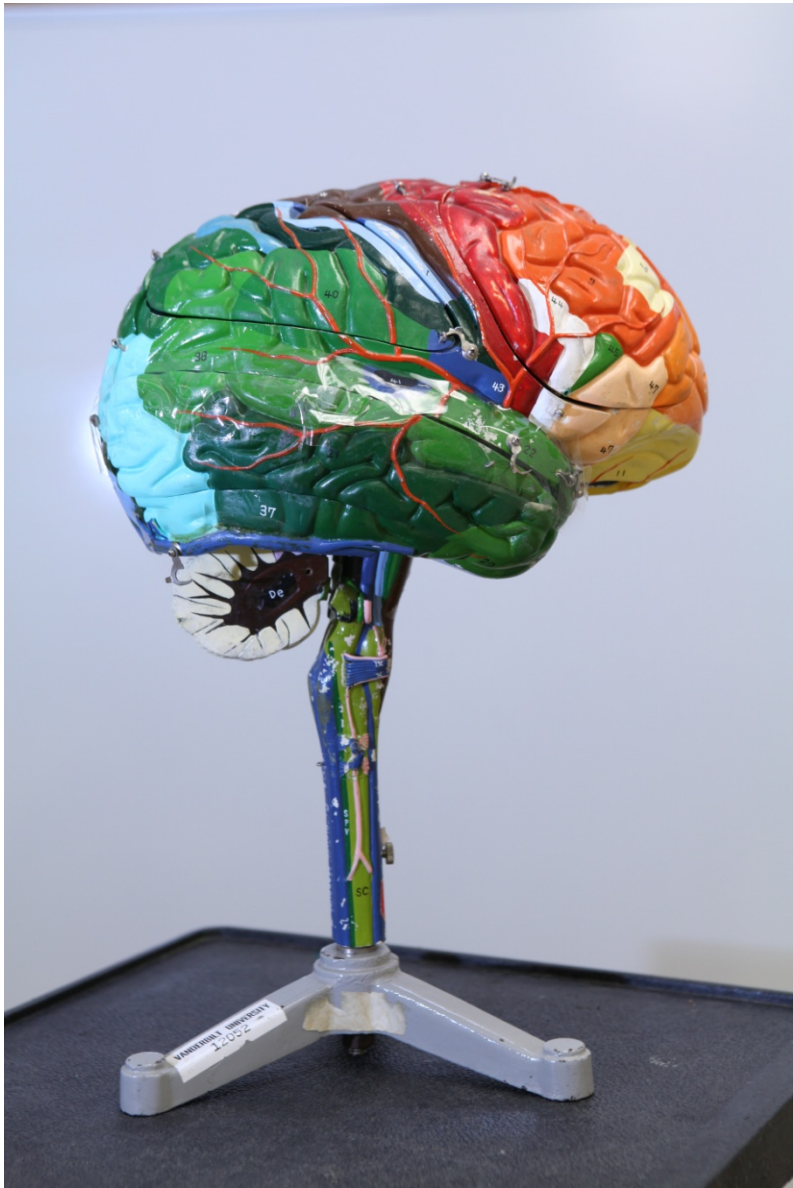


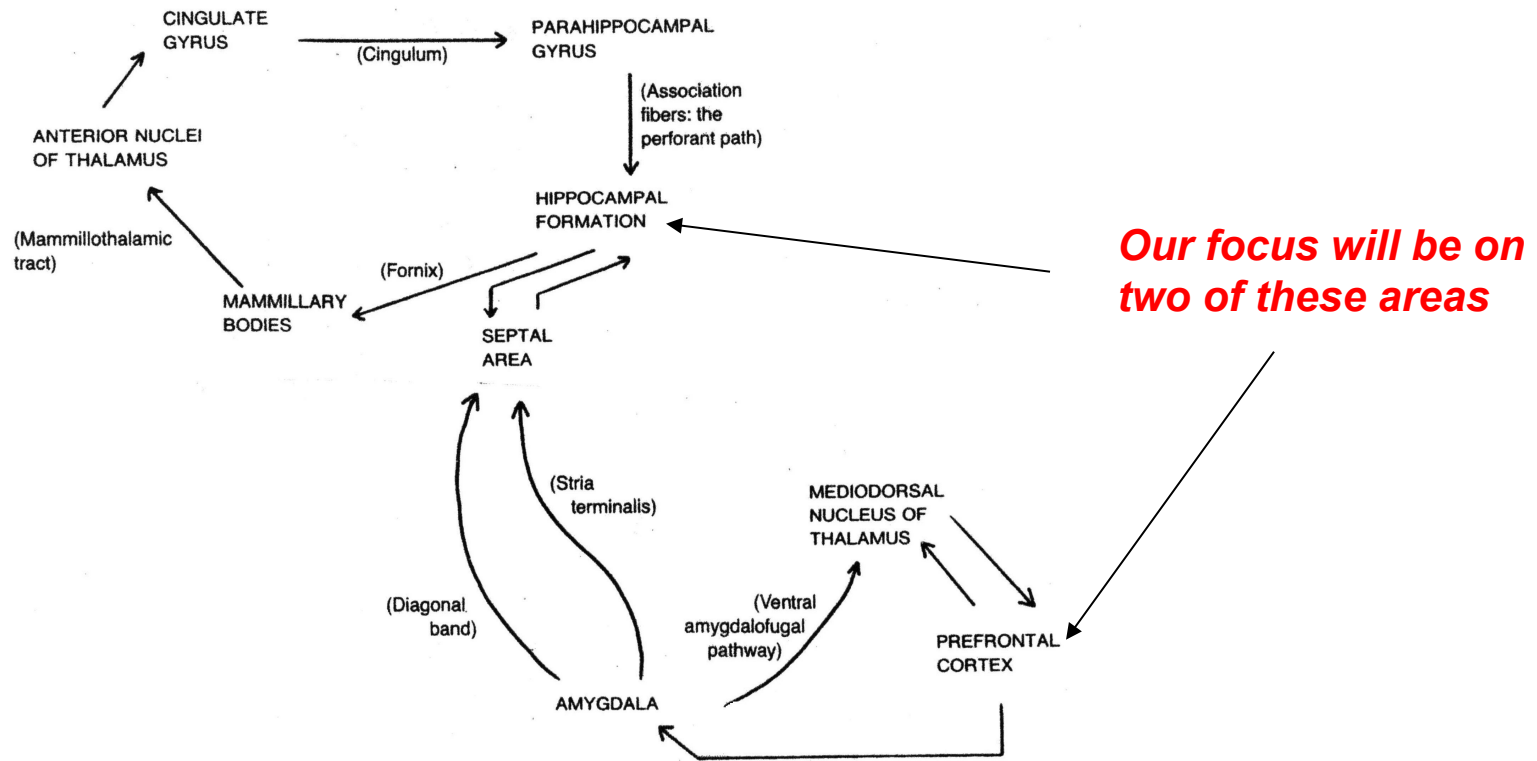
Memory and All That Jazz

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Memory is a complex brain function involving widely distributed, but interconnected, areas of the brain



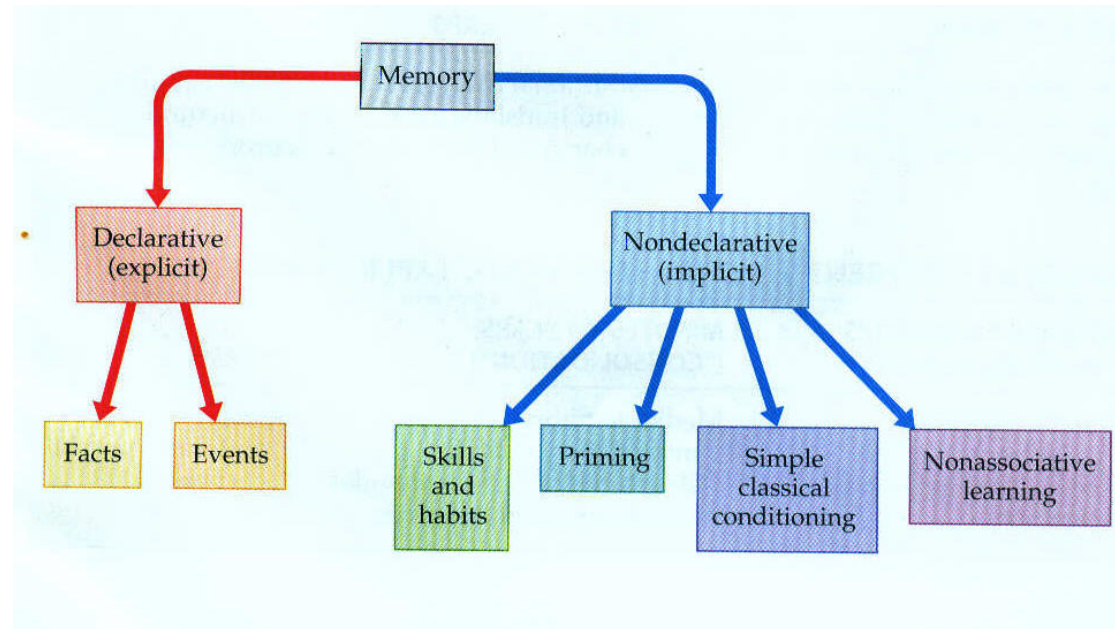
- ***The brain does just what scientist do – it CREATES a model of reality – It isn't necessarily very accurate – but it doesn't need to be!***
- ***The brain will make “predictions” based on previous experience; memory need be only “good enough” to be useful!***

- ***A “recollection” of an event is only as good as the perception of the event itself (in fact, probably not even that good).***
- ***It would not be efficient for the brain to take in ALL information each time and create a totally new paradigm; it needs to create a paradigm or model that works – most of the time!***

What the brain needs to know: Is the present experience **similar enough** to some past experience (Should be reinforced?) or is the present experience **novel** (Should it be encoded)?



Two Major Types of Learning & Memory:



Adapted from Blumenfeld, 2010

– ***Non-Declarative (implicit) memory***

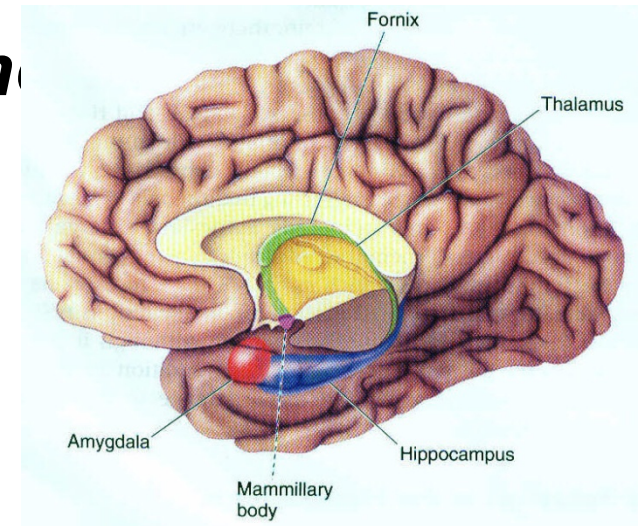
- Memory for skills, habits and behaviors
- Operates without conscious awareness once learned
- Requires repetition and practice
- Less likely to be forgotten once learned
- Involves basal ganglia, cerebellum
- Allows many types of behavior to be on “auto-pilot”

- **Emotional implicit memory involves amygdala**

– ***Declarative (explicit) memory***

- **Memory of “facts”**

- Can be consciously recalled
- Easy to acquire, easy to forget
- Hippocampus plays a major role; L hippo words/facts, R hippo spatial memory



Adapted from Bear et al, 2007

- **Memory of “events” (episodic memory)**

- **L Hippocampus – strings together these events (precious few at that) and “creates” an autobiography!**

- **Time lines of memory**

- *Less than a second: “attention to something”*

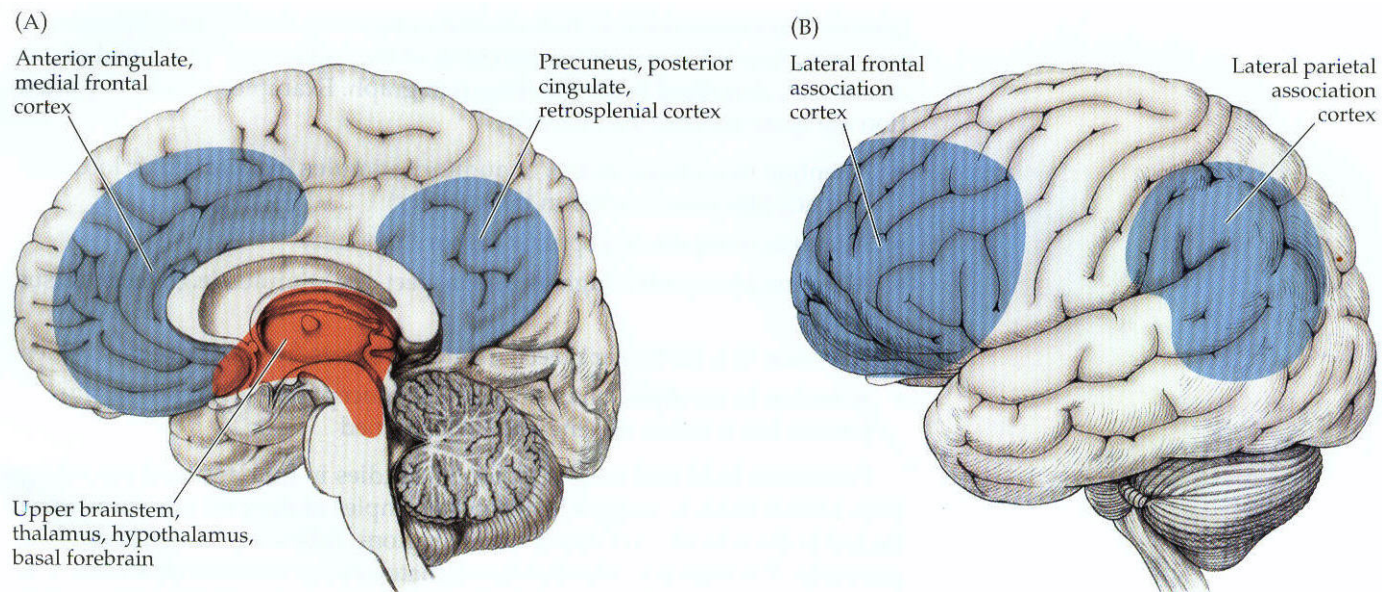
- *Seconds to minutes: “working” memory*

- *Minutes to years:*

- *Short-term and Long-term memory*

- **Immediate Memory**

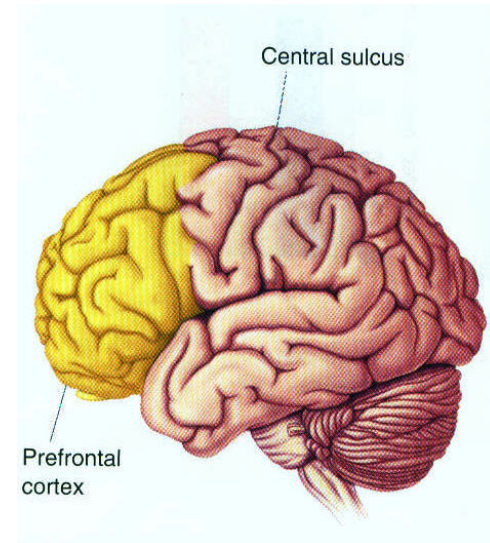
- Many different areas of the brain contribute to “attention”; these include cortical areas and also areas of the **reticular formation** – ***all areas which contribute to “alertness, attention and awareness”***



Adapted from Blumenfeld, 2010

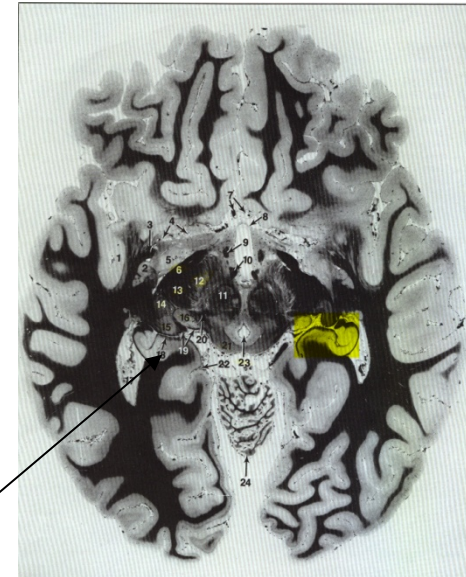
- ***Working Memory***

- Temporary and vulnerable to disruption
- Very limited in capacity
- Ability to hold some piece of information in “mind” for a short period
- WM must constantly be “dumped”
- Selected for in terms of evolution because it confers great advantage for planning behavior, etc. WM was NOT selected for to allow us to remember phone numbers!
- Involves multiple areas primarily of the ***Prefrontal Cortex***



- ***Short-term Memory***

- What we used as “students”!
(good and bad)
- Can potentially be consolidated into long-term memory
- Involves **medial temporal lobe structures**, like the hippocampus and **medial diencephalic structures**, as well as a few cortical areas

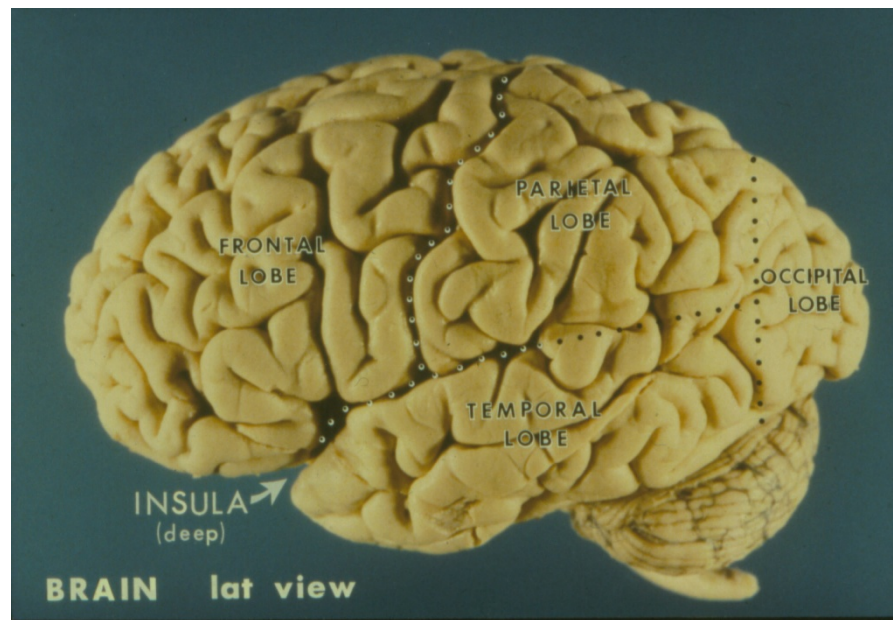


Adapted from Fix, 2008



- ***Long-term Memory***

- The recollections of our lives
- Involves **widespread areas of the cortex**
- Can “fade”, but widespread loss is rare



- D. Schachter: *The Seven Sins of Memory*

- ***Sins of Omission***

- **Transience**

- A weakening of memory over time; the past “recedes” as we have new experiences
 - Over time, the brain may retain the “gist” of the experience, without much detail
 - Bias affects this – we remember what “fits” with our paradigms and our “autobiography”
 - Increases with age, decreases with educational level



– Absent-mindedness

- Represents a breakdown between attention & memory
- Then again, how much DO we really notice???
- Note that many things we do – are automatic (*non-conscious*)
- Also note that we are effectively blind (*literally and figuratively*) to unattended objects – so no memory of the event occurs!
- *But* – the brain (particularly the reticular system) IS paying attention (😊)

– Blocking

- **A fact, etc. that has been stored as a memory, but cannot be recalled when we *WANT* to recall it!**
- **Most often occurs with familiar facts – like names of people**
- **Thought to be due to a “loosening of associations”**
- **Note that a person’s name does NOT allow synonyms to be used, and that the name means nothing in itself**

- ***Sins of Commission***

- **Misattribution**

- **Memory of events that never occurred!**
 - **Believed to represent a misattribution of current perceptions and experiences onto past events**
 - **Note that memory “glues together” aspects of our experience – if not glued together properly – misattribution occurs**
 - **Our “imagination” also plays havoc with accurate memory and plays a role in misattribution**

– Suggestibility

- **Strong individual differences in vulnerability to suggestibility**
- **Particularly important in certain settings: police interrogation, interaction with children, psychotherapy**
- **An individual may “confess” to a crime they did not commit**
- **An individual can be made to believe something happened to them, i.e., alter their “autobiography”, which never happened**

– Bias

- **Re-scripting of past memories to fit with current view**
- **We remember ourselves in a more positive light (generally)**
- **We remember events consistent with our “autobiography” (or “self-schema”)**
- **Stereotypes strongly influence *if* we remember and *what* we remember**

– Persistence

- **Intrusive memories of events you *WANT* to forget**
- **Can be mild to debilitating (think a song in your head vs. Post-Traumatic Stress Disorder [PTSD])**
- **Strong individual differences; linked to depression**
- **May be related to “self-schema” and to resilience**
- **In disorders like PTSD, strongly linked to abnormal amygdala activation**

- ***What do these “sins” tell us about what memory IS or ISN’T?***
 - ***Memory results from some change in electrical activity of neurons– and as such is vulnerable to what has happened before – and what happens after***
 - ***It is, at best, fragmentary, and contains “just enough” information about what “actually” happened, to be useful most of the time***

– *The brain cares mostly about the “gist” of things!*

- Normal individuals remember the “gist” of what happened, details may or may not be correct**

**RECALL OF DETAILED MEMORIES IN NORMAL, TEMPORAL LOBE-DAMAGED, AND
AUTISTIC INDIVIDUALS**

	<u>GIST</u>	<u>TRUE DETAILS</u>	<u>FALSE DETAILS</u>
Normals	↑	↑	↑
Patients with TL damage	↓	↓	↓
Autistic individuals w/ exceptional memory		↓	↑ ↓

– *Our past experiences, our biases, our temperaments influence IF and WHAT we “remember”*

- **Suggested additional readings:**

- Allman, J. *Evolving Brains*. W.H. Freeman, 2000.

- Kandel, E. *In Search of Memory*.
W. W. Norton, 2006.



THIS HANDSOME LITTLE DUDE IS A "SEA SLUG"

- Margalit, A. *The Ethics of Memory*. Harvard U. Press, 2004.

- Price, J. *The Woman who can't Forget*. Free Press, 2008.

- Schachter, D. *The Seven Sins of Memory*. Houghton Mifflin Co., NY, 2001. (Other books by the same author as well.)

- Squire, L. *Memory and the Brain*. Oxford, 1987. (Other books by this author.)