Memory without remembering and remembering without memory: Implicit and false memories:

By: Daniel Schacter and Tim Curran
What is memory?
How many kinds of memory?
How do we test memory?
How many kinds of memory?

- Sensory
- Short-term
- Long-term
How many kinds of memory?

- Sensory
- Short-term
- Long-term
- Procedural
- Declarative
  - Episodic
  - Semantic
- Explicit
- Implicit
How do we test memory?

Cognitive task:  
1. Presentation of the material  
2. Retention interval  
3. Test  

Memory processes:  
1. Encoding information  
2. Consolidation  
3. Retrieval
Implicit and Explicit memory.

- IM is revealed when previous experiences facilitate performance on a task that does not require conscious or intentional recollection of those experiences.

- EM is revealed when performance on a task requires conscious recollection of previous experiences.
False memory

• A conscious “recolletion” of an event that never happened.

Remembering is fundamentally a constructive process rather than a literal replay of past events!
Why worry about false memories?

- Debate regarding false and recovered memories of childhood trauma.
- Eyewitness testimony
- Also provide insights into the brain processes that underlie constructive memory phenomena.
4 different phenomena of implicit memory:

- Priming
- Artificial grammar learning
- Category learning
- Sequence learning.
1. Priming:

A) Perceptual.

FAKE
TAKE
STAKE
FLAKE
LAKE
1. Priming:

B) Conceptual.
Priming:

- **Amnesic patients** - with damage to medial temporal and diencephalic brain regions – severe deficits in explicit memory, but intact priming (not always 

- **Functional imaging** - perceptually-based visual priming – decreased activity in posterior extrastriate regions. Conceptually-based visual priming effects – reduced activity in the pre-frontal cortex.

- Right parahippocampal activation – contamination from explicit memory for previously studied words.

Finite State Grammar (FSG) task:

• subjects study letter strings formed from a FSG

• explicit or implicit instructions

• identify letter strings that could have been produced from the FSG
<table>
<thead>
<tr>
<th>&quot;Reber&quot;</th>
<th>&quot;Non-Reber&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTSSXXXTVVE</td>
<td>BTSSPXPXSE</td>
</tr>
<tr>
<td>BPVVE</td>
<td>BPTVVB</td>
</tr>
<tr>
<td>BTXXVPXVPXVXVE</td>
<td>BTXXVVVSE</td>
</tr>
<tr>
<td>BPVSPXVPXVXVE</td>
<td>BPVSPSE</td>
</tr>
<tr>
<td>BTSXXVPXVPXVXVE</td>
<td>BTSSSSE</td>
</tr>
</tbody>
</table>
Reber’s implicit learning.

- In which subjects learn complex information in the absence of awareness.
- Abstractionist - Subjects develop an abstract representation of the rules that comprise the grammar.
- Episodic – Subjects learn by storing individual exemplars.
- Implicit learning abstract representation and explicit exemplar storage?
Grammar learning  ⇐  neural mechanisms?

• Amnesic patients: medial temporal regions are not necessary!

• Patients with Huntington’s disease and Parkinson’s disease show normal artificial grammar learning. (striatum does not appear to make a contribution).

Squire and Knowlton (1995)

- A 73 yr old amnesic (retrograde and anterograde)
- Presented with distortions of a prototype dot pattern
- Recognition and classification tasks.
- The patient showed normal category learning.
- fMRI – (Reber et al 98)
  Categorical dot patterns \[ \bowtie \] reduced posterior activation
  (similar to perceptual priming)
4. Sequence learning.

- Studied using Serial Reaction Time (SRT) task.
- Normal Ss and amnesics – 🛍.
- Patients with HD and PD - 🛍
- Striatal contribution confirmed with PET and fMRI. Also observed learning-related changes in M1, SMA …
- Early decrease followed by a later increase in activity in perceptual-motor learning.
Functional anatomy of sequence learning.

- Depends on the nature of the information that is learned.
- 2 distinct systems?
  - Dorsal – within modality (visual alone)
  - Ventral – cross-dimensional sequences (A+V)
False memory

• Claiming memory for an event which never happened!!

• Usual paradigm – words – old/new; related/unrelated lures.

• False recognition was accompanied by high confidence and a sense of detailed recognition.

• Deese (1959) and then Roediger/Mcdermott (1995).
<table>
<thead>
<tr>
<th>Original list</th>
<th>Test list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
<td>Couch</td>
</tr>
<tr>
<td>Wood</td>
<td>Chair</td>
</tr>
<tr>
<td>Sit</td>
<td>Cushion</td>
</tr>
<tr>
<td>Sit</td>
<td>Chair</td>
</tr>
<tr>
<td>Legs</td>
<td>Seat</td>
</tr>
<tr>
<td>Legs</td>
<td>Sofa</td>
</tr>
<tr>
<td>Stool</td>
<td>Sofa</td>
</tr>
<tr>
<td>Couch</td>
<td>Sitting</td>
</tr>
<tr>
<td>Couch</td>
<td>Sofa</td>
</tr>
<tr>
<td>Desk</td>
<td>Rocking</td>
</tr>
<tr>
<td>Recliner</td>
<td>Bench</td>
</tr>
</tbody>
</table>
Why do certain lists elicit greater rates of false recognition than others?

- critical lures and the study items when horizontal associates of each other (e.g. dough, flour, toast, bread)
  Vs
- vertical associates (e.g. apple, orange, kiwi, pear, and banana and fruit).
False recognition and amnesia

Fewer hits to studied items and more false alarms to unrelated lures.

Yet smaller false recognition effect (less false alarms to semantically related lures).

Fewer false recognition of perceptually related words (lake, fake....)

Reduced false recognition of prototypes.

But amnesics made more false alarms to conjunction lures!
So what is happening here?

Wisdom is founded on memory; happiness on forgetfulness !!!
We find that amnesics make lesser false recognition.

Then,

The damaged area should be responsible for robust false recognition in normal subjects.

These areas are also known to be involved in coding or retrieval of semantic and perceptual gist information and global similarity information that supports false recognition. Amnesia impairs this mechanism!
False recognition in non-amnesics

- Increased false recognition in Frontal lobe deficits.
- False recognition reduced when the lure items did not share the general features of studied items.
- Functional imaging: More ant: frontal activity during false than true recognition.
- ER fMRI – Anterior PFC delayed onset of activity – involved in post-retrieval monitoring activities (criterion setting for false recognition).
<table>
<thead>
<tr>
<th>Task</th>
<th>Amnesia</th>
<th>PD/HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priming</td>
<td>🍁 (bad Explicit Memory)</td>
<td></td>
</tr>
<tr>
<td>Grammar learning</td>
<td>🍁</td>
<td>🍁 Probabilistic classification</td>
</tr>
<tr>
<td>Category learning</td>
<td>🍁</td>
<td></td>
</tr>
<tr>
<td>Sequence learning</td>
<td>🍁</td>
<td>🍁</td>
</tr>
<tr>
<td>False memory</td>
<td>🍁 to semantically &amp; perceptually related lures, prototypes and 🍁 to semantically unrelated and conjunction lures.</td>
<td></td>
</tr>
</tbody>
</table>
What can we conclude from the evidence presented?

Priming and false recognition can be based on two separate underlying mechanisms.