

9.65 October 15, 2001 MEMORY III: Explicit and implicit memory and the brain. HANDOUT.

Note: Chapter 6 begins with several topics that won't be discussed in today's lecture, but you should read about, including:

- state-dependent learning

- encoding specificity

- source memory versus familiarity as the basis for remembering

- how familiarity without source memory can generate some phenomena such as "how to become famous overnight" (p.178), false belief in the truth of statements, systematic mistakes in identification of a criminal.

- the hypothesis that a feeling of familiarity results not only from actual previous experience (which makes a repetition easy to process) but sometimes simply because something is unexpectedly easy to process (processing fluency) one judges that the word or stimulus must be familiar (other examples in text).

OUTLINE for lecture:

1. Implicit versus explicit memory

2. Amnesia and the neuropsychology of memory

- The brain and memory: H.M.

- Preserved implicit memory

### **1. Implicit and Explicit Memory:**

Explicit (declarative) memory:

The term "declarative memory" has been used for this kind of memory, because you can talk about what you remember: you can declare it.

- a. Episodic memory: memory of your personal history, of when and where you encountered someone, learned that there is no Santa Claus, etc.

- b. Semantic memory: your general knowledge, including word meanings, knowledge of science, history, facts about yourself and others that are not specific memories of a particular experience.

Implicit memory:

Implicit or "procedural" memory: no conscious retrieval, little or no ability to describe or become conscious of what you know. There are various forms of nondeclarative memory, not just a single "implicit memory system". For example:

-Skills

Riding a bicycle or ironing a shirt, or speaking a language: normally, such learned skills take lots of practice. In using these skills, you are not aware of having remembered anything: there is no conscious retrieval process. The implicit memory just seems to be triggered when the appropriate cues are present.

-Priming as implicit memory

In priming, a recent experience activates nodes or neural structures that make the same or a related process easier the next time. **Semantic priming**: seeing "doctor" primes "nurse."  
**Repetition priming**: seeing a particular stimulus like a word, and then seeing it again: the first encounter can be shown to speed up the second encounter, and make it more accurate.

Jacoby & Dallas (1981): compared implicit and explicit memories for words, in a two-part experiment:

Part 1: They had subjects look at a list of 60 words, answering questions such as,

Does it contain the letter A? Does it rhyme with "bad"? Is it an animal?

Part 2: Subjects were divided randomly into 2 groups. One group was given a list of 120 words (the 60 they had looked at in Part 1 and 60 new ones) and told to say whether they recognized them from Part 1: that is, they had to decide whether each word was old or new.

The other group was given a perceptual test, in which each word was presented for 35 ms, followed by a row of ampersands &&&&&& that served as a visual mask, making it hard to see the word. Subjects had to say what the word was. New words that hadn't been in Part 1 were mixed with words that had been in Part 1.

The big question was what the effect of the 3 tasks in Part 1 would be, on each of the two Part 2 tests.

Results:

	Part 1 task			
	Phys.	Rhyme	Semantic	New words

Recognition	.50	.63	.87	False yes, .15
Perception	.80	.81	.82	.65

The questions in Part 1 were graded in the depth of processing they invoked. When the task was to decide whether or not the word had been seen in Part 1, the best task was the semantic decision: is that an animal? (for example).

For explicit recognition, the "orienting task" made a large difference. But for implicit, perceptual "memory", although the benefit from having been presented in Part 1 was considerable (improvement of ~ 15%), it was not influenced by the type of TASK in Part 1.

Implicit memories are not just memories too weak to become explicit (conscious): they are qualitatively different from explicit, declarative memories.

Perceptual tests don't show any benefit unless the original item is shown again in the same format--a spoken word doesn't help perception of that word in written form. Note that Reisberg points out that having completed `_L_P_A_T` won't help you later complete `E_E_H_N_`.

However, a spoken word can be RECOGNIZED again in written form. Also, the perceptual effect seems to decay less rapidly than the ability to recognize an item as seen before in the experiment.

There is often little correlation between the words a given subject can perceive (on the perceptual test) and the ones that s/he can recognize, on a recognition test.

However, the repetition effect isn't restricted to perceptual tasks. Another experiment: Jacoby & Witherspoon (1982).

Part 1: (Spoken questions by the experimenter:) "Name a musical instrument that employs a reed." (Etc.)

Part 2: write spoken words to dictation: read/reed. Results: more likely to write r-e-e-d than a control group.

But did subjects simply remember that they'd heard that word-meaning before? No: because the experimenters found the same results for a group of amnesic patients--who could not explicitly remember the words from Part 1.

## 2. Amnesia and the neuropsychology of memory:

The amnesic syndrome is produced by lesions in the medial temporal and diencephalic parts of

the brain, including the hippocampus. General intellectual functions, including language, are normal--and so, more or less, is memory of events before the lesion. But there is impairment, sometimes almost total, in the ability to retain new information--that is, when the new information is explicit, declarative information, like "Who is the vice president?" **Anterograde amnesia**: inability to remember new information. Versus **retrograde amnesia**: forgetting of information you knew before the lesion or damage to the brain.

Damage from strokes or injuries...or alcohol, without proper vitamins, produces Korsakoffs: used to be a lot of the latter, before knew how to prevent.

But it turns out that such amnesics don't lose ALL capacity to learn new material, as used to be thought: such patients may have a relatively intact ability to acquire new skills and new information, if that memory is tapped by IMPLICIT memory tests.

-Jacoby and Witherspoon's REED finding. The amnesic subjects didn't remember Part 1 explicitly, but showed as much biasing effect as did the normal subjects.

Word-completion tasks like:

TAB\_\_ (tabby, table). Or:

\_SS\_SS\_\_ (assassin, assessed).

Prior exposure to a possible completion (or, the only possible one) facilitated later completion, or biased toward a certain completion when many were available. Similarly for tasks like producing exemplars of a category, or as many words as possible beginning with C...

HM: (hippocampus removed bilaterally)

Has good working memory, has old LT memories but can't fix or consolidate new information. BUT can pick up some new tasks! Mirror tracing, rotary pursuit, recognizing mirror-reversed words (mirror-reading): all are pretty normal. This much was known about HM in late 60's, and thought to be limited to sensory-motor learning.

But then it was discovered that he had preserved repetition priming, word-stem completions, etc. And perhaps he was able to learn a complex cognitive task, the Tower of Hanoi.

Alzheimer's Disease patients (who have problems both in the hippocampus and in their temporal-parietal lobes) learn new skills as amnesics do, but (unlike amnesics) they have impaired priming; whereas Huntington's disease patients and Parkinson's disease patients, with damage to basal ganglia, are impaired on skill learning but normal on priming.

So: fact-learning, skill-learning, and "priming" (reactivation of existing structures) all seem to be distinct forms of memory.

## A Memory Taxonomy

### MEMORY

#### DECLARATIVE (Explicit)

Semantic	Episodic
facts	events

*Medial temporal lobe,  
Diencephalon*

#### NONDECLARATIVE (Implicit)

Skills	Priming	Dispositions	Nonassociative
motor perceptual cognitive	perceptual semantic	classical conditioning*	habituation** sensitization**
adaptation level	shifts in judgment and preference	operant conditioning	
<i>striatum</i>	<i>neocortex</i>		<i>**reflex pathways</i>

*\*emotional responses: amygdala  
\*skeletal responses: cerebellum*

(Adapted from Zola-Morgan & Squire, 1990.)