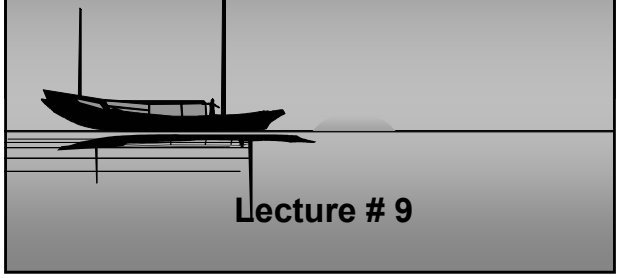
Cognitive Psychology

PSYC230



Lecture # 9

Memory Processes

Attention: Samples the incoming information

Encoding: Transforming and working with the information

Storage: Consolidating encoded information with previous memories

Retrieval: Accessing the information

Reminder – Quiz #2 this week
Test Next Week

Review – Encoding processes

Why do we encode the way we do?

1. Type of stimulus
2. Type of task
3. Our prior experiences

Schemata

mental frameworks for organising and representing knowledge

Allows us to prioritise our attentional resources and perform some tasks automatically

Memory for schemata is very good, but recall of individual instances may be "reconstructed" and subject to intrusions

Review – Storage & consolidation

Integrating new information with stored memories

Amnesiac syndrome & the temporal gradient

ECT effects

REM sleep deprivation effects

The Hippocampus appears to be the brain structure responsible for these "active" memory traces
an episodic map of new information that is progressively integrated into general knowledge (schemata)

Review – Storage & consolidation

Hippocampus & nearby areas	Cortical areas
- quick acquisition of information	- slow acquisition of information
- can't store information forever	- much longer term storage

Why two memory systems?

Hippocampus acquires information rapidly but produces little overlap in representations (helps reduce interference)
Cortical brain areas are slower but result in highly overlapping representations to allow generalization

Semantic similarity (overlap) is bad if you want very specific information

Semantic similarity is good if you want to retain useful, general knowledge (like schemata)

Today – Retrieval processes

getting information out of LTM

Why do we forget?

"Forgetting" is a failure to retrieve

2 "Classic" theories of forgetting:

1. Decay: Information disappears with disuse
2. Interference: Proactive and retroactive interference

Retrieval processes

Decay Theory of forgetting

Memories spontaneously decay (grow weaker) as time passes

Thorndike's (1911) "*Law of Disuse*"

Why aren't older memories always weaker than recent memories?

Thorndike's "*Law of effect*" & "*Law of Exercise*"

Some memories (associations) start off stronger than others (followed by satisfiers)

Every time you use a memory it gets stronger

Retrieval processes

Problems with Decay Theory

Decay is a tautology – doesn't explain how

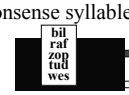
The passage of time doesn't ***do*** anything

Must be something happening ***during*** that time

Very difficult to test decay in an experiment and rule out other factors like interference

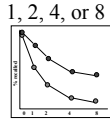
Jenkins & Dallenbach (1924)

Learn list of nonsense syllables



Followed by either sleep or daily activities

Recall test after 0, 1, 2, 4, or 8 hrs



Retrieval processes

Problems with Decay Theory

Minami & Dallenbach (1946) replicated the Jenkins & Dallenbach study, but used cockroaches instead of university students

Cockroaches learned to avoid one corner of a cage where shock occurred

Group 1 put in a matchbox for 24 hrs, Group 2 went about their "daily activities" (free range roaches)

Test showed good avoidance by Group 1, Group 2 required substantial relearning

Interpreted as evidence for Interference Theory and against Decay Theory of forgetting

Retrieval processes

Problems with Decay Theory

Recall vs. Recognition Tests

Even if you can't recall something, you can probably recognise it as correct – the information is still stored in LTM – no decay

Recognition tests are more sensitive
only one process, not two -- fewer opportunities for error

Recall involves search of items in LTM and then deciding which one is correct

Recognition involves only the decision about which item is correct

Retrieval processes

Problems with Decay Theory

Savings scores (relearning tests) are even more sensitive than recognition tests

Savings for Non-recognised Items

Nelson (1978)

Previously unrecognised pairs had higher savings scores (were easier to learn)

When a more sensitive test is used, no evidence for decay in LTM

Retrieval processes

Interference Theory

Three processes:

Forgetting is due to proactive interference (old memories blocking new information)

Forgetting is due to retroactive interference (new information blocking old memories)

Forgetting is due to competition between responses

Retrieval processes

Interference Theory

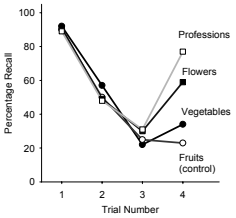
Ample evidence for Proactive interference in STM (previous items interfere with current memory set)

Interference theory predicts that you can reduce interference by making new items more distinct

Release from PI

Wickens (1972)

Presented list of fruits for first 3 trials, then changed word categories for 75%, or continued with fruit. Amount of increase in recall inversely related to categorical similarity



Retrieval processes

Interference Theory

Problems with Interference Theory

Interference seems to affect STM not LTM

The Generation Effect

Slamecka (1966)

No interference with the responses that were selected by participants (*already in LTM*)

Retrieval processes

Decay & interference appear to affect sensory memories and short-term (working) memories, but not LTM

So why do we forget?

Encoding Specificity

Endel Tulving (1970)

Memories are available, just not accessible

Memory contains a rich set of inter-related information present during encoding – recall depends on the amount of overlap between encoding and retrieval conditions

Retrieval processes

Encoding Specificity

Memories are available, just not accessible

Context at encoding serves as a cue for retrieval

Recognition is better than recall because there is more of the encoding context during test

Recognition failure of recallable words

Tulving & Thomson (1973)

The Encoding Specificity Effect is so powerful it can over-ride the usual superiority of recognition over recall

Retrieval processes

Encoding Specificity

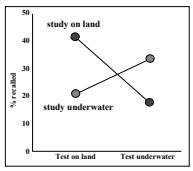
Context-dependent memory of deep-sea divers

Godden & Baddeley (1975)

Members of deep-sea diving club learned word lists either on land or underwater
Recall test either on land or underwater

40% better recall when recall context matched encoding context

No main effect of environment



Retrieval processes

Encoding Specificity

Recalling the Context

Smith (1979)

Participants studied word lists in basement
Recalled either in basement, or fifth-floor room

Recall was better in basement than upper room

Recall in upper room was equal to basement performance when participants told to mentally picture the original learning environment

Retrieval processes
Encoding Specificity
State-dependent memory effects

Goodwin et al. (1969)

Alcohol study: Learning list either drunk or sober followed by recall test either drunk or sober

Eich (1975)

Cannabis study: Learning list after smoking either cannabis or tobacco, recall test following either cannabis or tobacco

Best recall when internal states matched (state dependent memory)

Study	Recall test: cannabis	Recall test: tobacco	Avg.
cannabis	23%	12%	18%
tobacco	20%	25%	23%

Retrieval processes
Encoding Specificity
Mood congruent memory

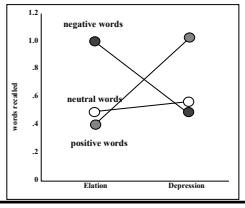
Leight & Ellis (1981)

Experimentally-induced mood states

Best recall when encoding and recall moods matched (also a main effect of mood)

Teasdale & Russell (1983)

Memory is best for words with the same valence as mood during test



Retrieval processes
Encoding Specificity

A change in context from the time of encoding to the time of retrieval can interfere with recall

One or more strong cues from the encoding context are needed to reactivate the memory

Is an overlap in context ever bad?

If you want one specific piece of information overlap between multiple memories that have no intrinsic relationship can produce interference

Retrieval processes
Specificity & Redundancy

Encoding specificity: contextual information present at both encoding and test can improve memory retrieval

Redundancy: multiple cues lead to same information

The Fan Effect

Anderson (1974)

The more associations with a concept, the longer it takes to locate specific information

The doctor is in the bank (1 person, 1 location) - 1.11 sec.
The fireman is in the park (1 person, 2 location) - 1.17 sec.
The lawyer is in the church (2 person, 1 location) - 1.17 sec.
The lawyer is in the park (2 person, 2 location) - 1.22 sec.

Retrieval processes
Specificity & Redundancy

Bradshaw and Anderson (1982)

3 Conditions

Single Facts: "*Newton became emotionally unstable and insecure as a child*"

Irrelevant Facts: "*Locke was unhappy as a student at Westminster*"
"Locke felt fruits were unwholesome for children"
"Locke had a long history of back trouble"

Relevant Facts: *"Mozart made a long journey from Munich to Paris"*
"Mozart wanted to leave Munich to avoid a romantic entanglement"
"Mozart was intrigued by musical developments coming out of Paris"

Retrieval processes
Specificity & Redundancy

Bradshaw and Anderson (1982)

	Immediate Recall	One week later
Single Fact	92%	62%
Irrelevant facts	80%	45%
Relevant facts	94%	73%

Overlap between unrelated episodes => interference

Overlap between related episodes (redundancy) can help memory

Retrieval processes

Other causes of forgetting

1. Medicines

Nonsteroidal anti-inflammatory drugs (NSAIDs)
Aspirin, Ibuprofin, Panadine, Tylenol, Vioxx

Antihistamines
Claratyne Flixonase, Sinutab

Cough suppressants
Robitussin, Strepsils, Vicks Formula 44

All of the above over-the-counter medicines can produce memory impairment via changes in blood flow and cholinergic activity (in addition to state-dependent effects)

Retrieval processes

Other causes of forgetting

2. Exercise

Lack of exercise impairs speed of cognitive processing, ability to sequence information, & ability to follow instructions

3. Stress

Stress releases neuroactive peptides which impair hippocampus functioning

4. Blood sugar

Sugar intake causes insulin surge which lowers blood sugar => lowers attention => lowers STM

Retrieval processes

Other causes of forgetting

5. Stimulants (caffeine)

In moderate doses can improve memory, <u>but</u> caffeine withdrawal results in extreme fatigue, impaired attention, impaired motor performance (begins 12 hrs, peaks 24 hrs)

6. Sleep

lack of sleep impairs attention, STM, consolidation of LTM and produces increased stress and fatigue

Retrieval processes

Other causes of forgetting

7. Organic amnesia: brain damage due to injury, stroke, surgery, disease

anterograde amnesia: unable to form new long-term memories
retrograde amnesia: unable to remember events from the pre-illness/pre-trauma period (temporal gradient)

Main causes: stroke, closed head injury, Korsakoff's Syndrome (thiamine deficiency), herpes simplex encephalitis (viral infection)

Retrieval processes

Other causes of forgetting

Organic amnesia

HM – had surgery to control severe epilepsy; bilateral resection of the temporal lobes, removing the hippocampus, amygdala, and medial temporal cortex.

No loss of intellectual or perceptual ability

No loss of working memory capacity (7 items or 2 sec phonological store)

Good learning of new motor tasks but unable to recall learning them

50 other patients with similar symptoms have been studied

Retrieval processes

Other causes of forgetting

Organic amnesia -- prefrontal cortex lesions

usually result from head injury, neurosurgery, aneurysm

PFC lesions do not result in full amnesic syndrome (until recently, memory was thought to be essentially intact in these patients)

Impairment in recognition memory
Recall more impaired than recognition
Source amnesia – patients can often remember the item that was learned, but cannot remember where or how the information was acquired

Retrieval processes

Other causes of forgetting

Transient Global Amnesia (TGA)

Abrupt and complete anterograde amnesia

No confusion about identity

Risk factors include history of epilepsy or migrane but 30% of cases linked to precipitating stressors (exertion, pain, immersion in water, emotional events)

Extreme stress may affect hippocampus through overstimulation (fear and emotion) leading to lowered blood flow & subsequent memory loss

Effects disappear after 4-6 hours

Retrieval processes

Other causes of forgetting

Psychogenic Amnesia (dissociative amnesia)

Temporary memory impairment characterised by loss of identity and autobiographical memories

Causes vary but many linked to stressors accidents, violence, natural disasters, etc.

(Up to 5% of soldiers returning from WWII had no memory for combat events they had just experienced)

No structural brain damage, but may be altered brain function (process autobiographical memories in a "neutral" semantic way, no emotional associations)

Retrieval processes

Other causes of forgetting

What does retrieval tell us about memory?

Different patterns of forgetting suggest different types of memories

But little agreement on whether these memory "types" involve different memory systems, different encoding processes (or codes) within a unitary memory system, or simply different retrieval processes (or even what a memory "system" means)

Models of memory

(a preview)

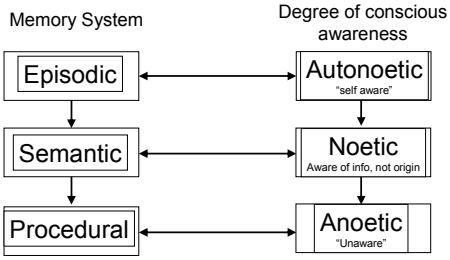
Consider the following questions:
When did you last ride a bicycle?
What is a bicycle?
How do you ride a bicycle?

Different kinds of information required to answer each question

1. conscious recollection of unique temporally distinct past experience (may be context-bound & fragile)
2. conscious recollection of knowledge, but no unique "experience" (context free & robust)
3. typically unanswerable - unconscious learning (but robust)

Models of memory

Tulving's (1985) model



Tulvings model implies that:
All memories start out episodic.
When conceptually linked, they become semantic.
If used very frequently they can become procedures.

Next Time

Constructive Processes in Retrieval

Repressed & Recovered Memories

Memory for People & Faces

Memory for Dreams

Remembering the Future