

Psychology Module

Spring Term 2012

Session 7a: Memory

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Learning Objectives

- Define memory and the processes of registration, encoding, storage and retrieval
- Describe the components of working memory
- Describe the different types of long-term memory
- Define schema and explain how schemas enhance encoding
- Explain how schema influence memory consolidation

Learning Objectives

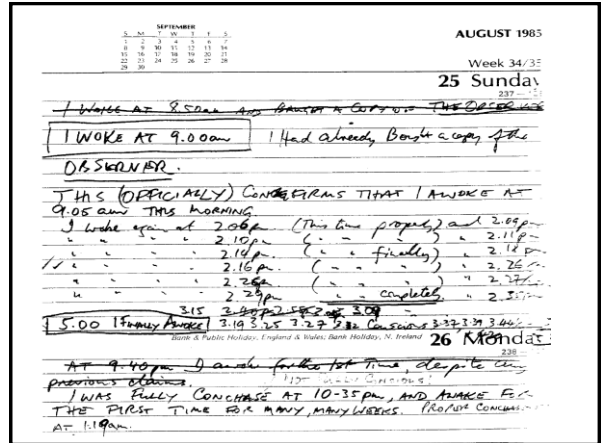
- Define an associative network
- Define the misinformation effect
- Outline the neural correlates of memory
- Describe the concepts of 'Executive Functioning' and the role of the pre-frontal cortex in higher mental functions
- Describe the dysexecutive syndrome
- Differentiate age-related changes in cognitive functioning from those caused by disease.

Imagine if

- In a blink of an eye the view before you was utterly forgotten
- So each blink, each glance away and back, brought an entirely new view.
- Everything and everyplace was perpetually unfamiliar and every person a stranger.

Clive Wearing

- He knew his name, siblings and childhood family
- Childhood autobiographical facts
- Education up to university- hazy after that.
- Recognised faces of people he had known for years.
- Otherwise everything was new



LO: Describe the neural correlates of memory

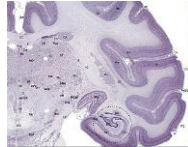
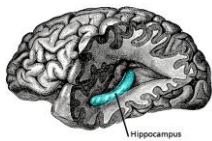
The role of the medial temporal lobes



- HM & CW
- Significant anterograde amnesia following bilateral MTL ablation
- Implicit memory intact- piano playing

Neural correlates of memory

- The hippocampus has an important role in the formation of new episodic or autobiographical memories (eg: Squire, Eichenbaum, O'Keefe). Some researchers prefer to consider the hippocampus as part of a larger **medial temporal lobe** memory system responsible for general declarative memory.



Role of the hippocampus

- Older memories remain stable- this sparing of older memories leads to the idea that consolidation over time involves the transfer of memories out of the hippocampus to other parts of the brain.
- This is difficult to test. In some cases of retrograde amnesia, the sparing appears to affect memories formed decades before the damage to the hippocampus occurred, so its role in maintaining these older memories remains uncertain.
- Animal studies- radiolabeled NT migrated over time to sensory specific region of brain.

Neural correlates of memory



- In Alzheimer's disease the hippocampus is one of the first regions of the brain to suffer damage; memory problems and disorientation appear among the first symptoms.
- Damage to the hippocampus can also result from anoxia, encephalitis or medial temporal lobe epilepsy.

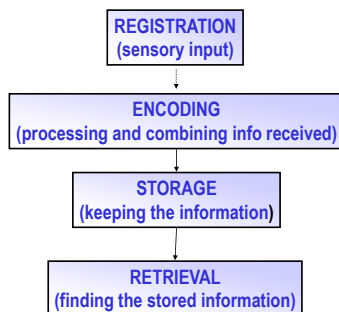
LO: Define memory and the processes of registration, encoding, storage, and retrieval

Try a commonly used learning
and memory test

Memory: defined

Memory refers to the processes that are used to acquire, store, retain and later retrieve information. There are three major processes involved in memory: encoding, storage and retrieval

Different Stages of Memory



Registration

- Registration is necessary for storage to take place but not everything that a person registers is stored
- Something has to be stored to be retrieved but the fact that it is stored does not guarantee it will be retrieved on a particular occasion

Encoding

- More effective encoding into long-term memory increases the likelihood of retrieval
- *Effortful Processing*:
 - initiated intentionally
 - requires conscious attention
- *Automatic Processing*
 - occurs without intention
 - requires minimal attention

Storage

- There is more than one type of memory store
- Each has its own performance characteristics and function
- Each is the function of a different neuroanatomical system

Retrieval

- Failed retrieval does not always mean that information is lost from memory
- Internal or external *retrieval cues* can activate information stored in long-term memory
- Multiple cues enhance retrieval
- Conscious (effortful) or unconscious (automatic)

The Multi-Store Model of Memory

Atkinson & Shiffrin (1968)

- 3 classifications of memory based on duration of memory retention:
 - Sensory Memory
 - Working Memory
 - Long-term Memory

Sensory Memory

- Sensory memory is the earliest stage of memory.
- Sensory information from the environment is stored for a very brief period of time (<1/2 sec for visual info; 3 or 4 sec for auditory info)
 - Contains more information than can be reported before the memory decays
- We don't attend to everything.
- Overwritten by subsequent perceptual information
- What we do attend to then passes into our working memory.

LO: Describe the components of working memory

First try some tests of working memory...

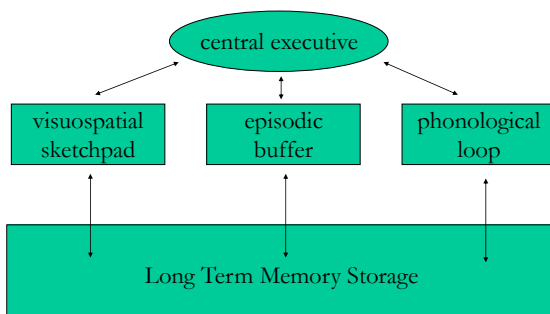
How did you do?

Working Memory

- A short-term memory store- but not a unitary store as previously suggested.
- limited capacity in terms of information content NOT time
 - George Miller's 7 items \pm 2
 - 7 for digits, 6 for letters, 5 for words
- Can remember more short words than long words
- Chunking allows more to be remembered
 - 9070990620
 -
 - 007 999 2006

- New information pushes out old
 - Distraction
 - Long lists
- Rehearsal can maintain information in memory
- Information in store can be actively manipulated, hence 'Working Memory'

Multicomponent Model of Working Memory (Baddeley 1974-2003)



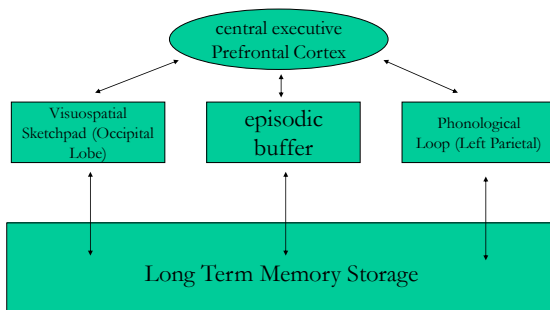
Central Executive

- Manipulation of information and direction of attention
- Suppression of irrelevant information and undesired actions
- Supervision of information integration
- Coordination of multiple tasks to be executed in parallel
- Co-ordination of the sub-systems of WM

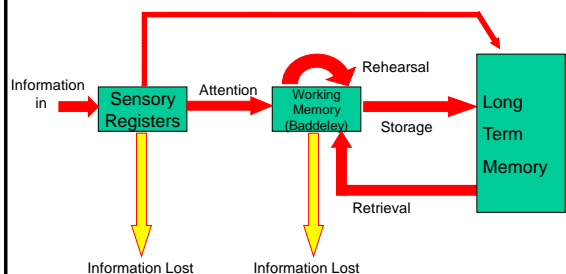
- Visuospatial Sketchpad
 - storage of visual and spatial information
 - e.g. for constructing and manipulating visual images, for the representation of mental maps
- Phonological loop
 - storage of auditory/verbal information
 - preventing decay by silently articulating contents, refreshing the information in a rehearsal loop
 - e.g. phone number

- Episodic Buffer
 - Temporarily integrates phonological, visual, and spatial information in a unitary, *episodic* representation.
 - Provides interface with episodic long-term memory

Multicomponent Model of Working Memory (Baddeley 1974-2003)



Putting it all together

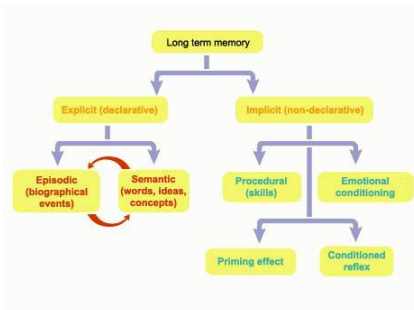


LO: Describe the different types of long term memory

Long-term Memory

- Store of all things in memory that are not currently being used but are available for use in the future
- Allows use of past information to deal with present
- Can hold unlimited amount of information
- Retrieval from long term memory may be:
 - Explicit/Declarative (conscious)
 - Implicit/Non-declarative (unconscious)

Types of Long-term Memory



Non Declarative Memory

- Familiar with something, know how to interact with object or in situation but don't have to think about it
- For actions or behaviours is called ***procedural memory***
- Can carry out complex activities without having to think about them e.g. walking, eating

Declarative Memory

- Store of our knowledge
- There are two separate types

Episodic

- Memory related to personal experience
- What we generally think of as 'memories'
- Knowing what you did last night or where you went on holiday

Semantic

- Memory for facts
- What we think of as general knowledge
- Knowing the capital of France or the colour of a bus

Summary

Type of Memory

Type of Information

Episodic memory	Personal memories/ Events
Semantic memory:	Facts
Implicit memory:	Skills and procedures
Prospective memory	Remembering to do things in the future

How do we remember?

(LO: Define an associative network)

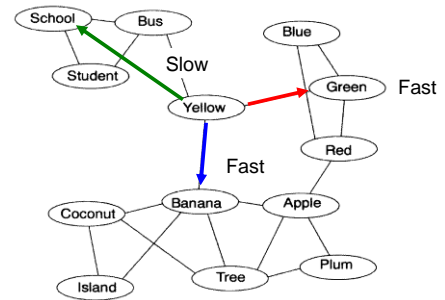
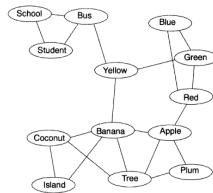
Associative Network

Stored ideas are connected by links of meaning, strengthened through rehearsal and elaboration.

Multiple links to a given concept in memory make it easier to retrieve because of many alternative routes to locate it.

Associative Network

- Each concept represented by a *node*
- Activation of one network leads to *spreading activation* of related concepts
- Activation of node results in increased ease of activating related (neighbouring) node
- Works to a lesser extent for indirectly related nodes



How do we remember?

(LO: Define schema and explain how schemas enhance encoding)

- a mental structure that represents some aspect of the world
- used to organise current knowledge and provide a framework for future understanding
- Automatic not effortful thought
- Acquired through experience

- For example we will have a schema for weddings, so that when we attend our first wedding we are able to behave in accordance with social norms without having to read up on them first.
- Our schema for wedding will exist even if we have never been to a wedding before, because we will have read about them, heard about them and seen them portrayed in TV shows etc.

LO: Explain how schemas influence memory construction

The War of the Ghosts

One night two young men from Egulac went down to the river to hunt seals and while they were there it became foggy and calm. Then they heard war-cries, and they thought: "Maybe this is a war-party". They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said:

"What do you think? We wish to take you along. We are going up the river to make war on the people."

One of the young men said, "I have no arrows." "Arrows are in the canoe," they said.

"I will not go along. I might be killed. My relatives do not know where I have gone. But you," he said, turning to the other, "may go with them."

So one of the young men went, but the other returned home. And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water and they began to fight, and many were killed. But presently the young man heard one of the warriors say, "Quick, let us go home: that Indian has been hit." Now he thought: "Oh, they are ghosts." He did not feel sick, but they said he had been shot.

So the canoes went back to Egulac and the young man went ashore to his house and made a fire. And he told everybody and said: "Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick."

He told it all, and then he became quiet. When the sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried. He was dead.

- Being a native North American story the narrative contains words, concepts and ideas different to ones that as Westerners we are used to. As a result when we are asked to retell the story we make alterations. These are based on our own schemas, stereotypes and expectations.

War of the Ghosts: sample recall

Two men from Edulac went fishing. While thus occupied by the river they heard a noise in the distance.

"It sounds like a cry", said one, and presently there appeared some men in canoes who invited them to join the party on their adventure. One of the young men refused to go, on the ground of family ties, but he other offered to go.

"But there are no arrows", he said.

"The arrows are in the boat", was the reply.

He thereupon took his place, while his friend returned home. The party paddled up the river to

Kaloma, and began to land on the banks of the river. The enemy came rushing upon them, and

some sharp fighting ensued. Presently some one was injured, and the cry was

raised that the

enemy were ghosts.

The party returned down the stream, and the young man arrived home feeling none the worse

for is experience. The next morning at dawn he endeavoured to recount his adventures. While

he was talking something black issued from his mouth. Suddenly he uttered a cry and fell down.

His friends gathered round him. But he was dead.

(from Bartlett, Remembering, 1932)

Research into schemas: Bartlett's War of the Ghosts (1932)

Bartlett's theory provides a valuable insight into the reconstructive nature of human memory.

His theory was based on Western recall of a native North American folk story. He suggested that we make the following alterations in such cases:

- Rationalisations: people tended to add material to justify parts of the story.
- Omissions: parts of the story, particularly those difficult to understand, were left out.
- Changes of order: the storyline was rearranged in an attempt to make sense out of it.
- Distortions of emotion: people added their own feelings and attitudes to the story.

Cohen (1993) suggested a number of ways in which schemas affect our memory.

1. Selection: Information that does not fit current schemas is ignored.
2. Abstraction: we are inclined to recall the overall gist and forget the detail.
3. Interpretation: schemas provide existing knowledge to help us understand novel situations.
4. Normalisation: memories are distorted to fit with our existing expectations.
5. Retrieval: schemas (or schemata) help us fill gaps in our memory by making a best guess.

Evidence suggests that minor details are not remembered accurately but are added later in line with what we would expect to have happened- the misinformation effect

Define the misinformation effect

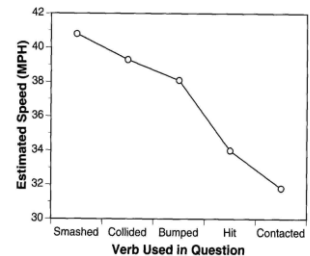
- Distortion of a memory by misleading post-event information (role of schema?)

Study: Eyewitness testimony

- Subjects see a film depicting car accident or other naturalistic eyewitness event
- Asked a series of questions
- Manipulate the way one question is asked to determine effects on recall

Loftus & Palmer (1974)

- Estimate speed that cars smashed/collided/. each other
- "smashed" 3x more likely than "contacted" to prompt subsequent (false) recall of broken glass



- **Loftus & Palmer (1974)** had shown how language and wording could influence a person's recall of an incident.
- **Loftus & Zanni (1975)** The effects of wording can also be more subtle. In a similar study participants were asked questions using either the definite article ('the') or indefinite article ('a' or 'an'). So for example: 'Did you see *the* broken headlight?' or 'Did you see *a* broken headlight?'
- Participants asked 'the' were twice as likely to recall seeing *the* broken headlight as those asked 'a'.

Misinformation Effect

- Christianson & Hubinette (1993) found that fear has an effect on recall.
- They asked people involved in real bank robberies, either as victims or as onlookers, about the incident. The recall of the victims was more accurate than that of the onlookers, suggesting the stress of the situation had aided recall.
- The better recall was still present 15 months later.

LO: Explain how retrieval cues assist recall

The list

– how many words do you remember?

- What if I give you some cues/prompts?
- Furniture?
- Vegetables?
- Ways of travelling?
- Animals?

- | | |
|--------------|------------|
| • Truck | • Zebra |
| • Spinach | • Coach |
| • Giraffe | • Lamp |
| • Bookcase | • Celery |
| • Onion | • Cow |
| • Motorcycle | • Desk |
| • Cabinet | • Boat |
| • Doctor | • Squirrel |
| | • Cabbage |

Free vs Cued Recall

- The probability of recalling a word is related to
 - Order in the list - serial position effect
 - Personal salience of words
 - Delay/ Time
 - Distraction
 - Did you make any errors?

The Serial Position Effect



Differentiate age-related changes in cognitive functioning from those caused by disease.

- While topical this LO is a lecture series in itself.
- Requires knowledge of normative data and statistics.
- Role of neuropsychologist.
- However as a guide...

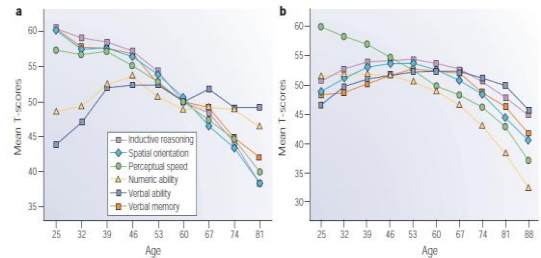


Figure 1 | Cross-sectional and longitudinal estimates of age-related change in cognition. a | Cross-sectional data from the Seattle Longitudinal Study. Declines are evident in all domains, with the exception of preserved verbal and numeric ability. b | Seven-year longitudinal data from the same study. Declines are evident in all domains after age 55, with only processing speed displaying declines before 55. Reproduced, with permission, from REE:5 © (1996) Cambridge University Press.

T score of 30 or less indicates Impairment

What this means- Graph 1

- Verbal and numerical ability preserved across all ages
- All other cognitive functions decline with time
- Normal sample

Graph 2

- Followed participants for 7 years and re-tested.
- All cognitive domains declined after age 55.
- Processing speed declined before age 55.

Case Example

- Referral
- 70 year old female, increasing awareness of being forgetful. For example misplaces keys, difficulty remembering birthdates, still driving but losing confidence. Reports never confused or lost when driving. Is travelling alone to house in France for extended stay please see prior to this.

Case Example 2

- 70 year old female, family increasingly aware of patient being forgetful and repetitious. For example loses keys, forgetting family birthdays, appears confused when driving and has gotten lost when driving. Wants to travelling alone to house in France but was disorientated when went last year. If possible please see prior to this.

Differentiate age-related changes in cognitive functioning from those caused by disease.

<u>Classification</u>	<u>Memory</u>	<u>Other Cog</u>	<u>Cog Decline</u>	<u>Sub Mem Loss</u>
<i>Normal aging</i>	No	No	No	N/S
<i>Questionable Dementia</i>	Yes Obj	Yes Obj	Yes Obj	N/S
<i>Mild cognitive impairment</i>	Yes Obj	No	N/S	Yes

- Seems to be a problem when the memory difficulties impact on more demanding ADL