



Lecture Six:

Cognitive Psychology - Memory

Today's lecture

- What is memory?
 - Registration, storage, retrieval
 - Availability V accessibility
- Types of memory
- Atkinson & Shiffrin's Multi Store Model (MSM)
- Studying memory
 - Techniques and experiential studies
- Limitations of/Alternatives to the MSM
- Theories of forgetting

What is memory?

Memory: a hypothetical construct; an abstract concept

Definition: the retention of learning or experience

Learning and memory

e.g.

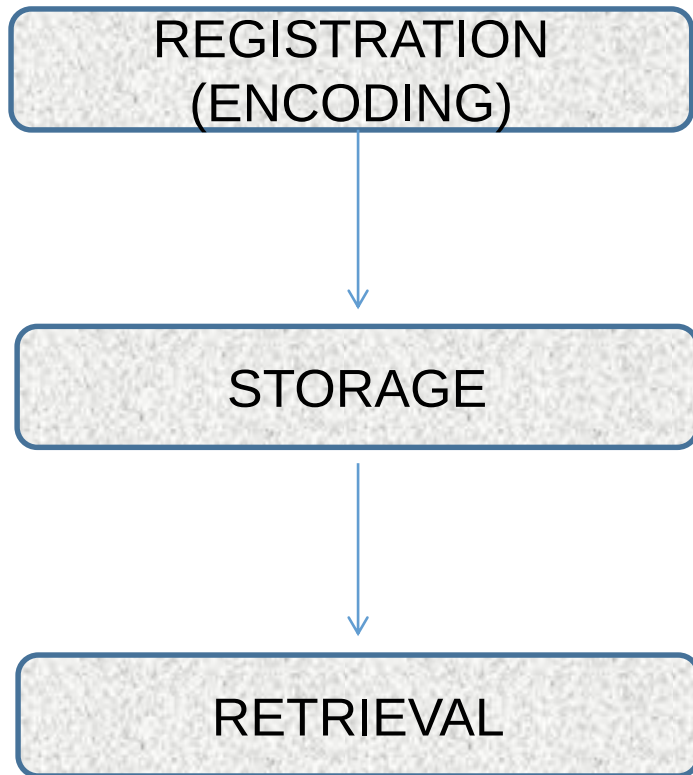
“...learning is the acquisition of knowledge and memory is the storage of an internal representation of that knowledge...”

(Blakemore, 1988)

Without memory humans would merely react to their environment on a moment-by-moment basis

What is memory?

- Involves 3 distinct but interrelated processes:



- How is sensory information processed in order to be stored?
- How are things remembered?
- Where are memories kept?
- Is there more than one kind of memory?
- Are there different kinds of remembering?
- What do we remember?
- Why do we forget?

- Sensory memory
- Short term memory / Working memory
- Long term memory
- The multi-store model of memory
- Forgetting

Types of memory (Tulving, 1972; 1985)

- Three major types of memory:

EPISODIC memory: Memories of past experiences, etc.

SEMANTIC memory: Knowledge of the world, facts, concepts rules, symbols and their meanings and referents – don't need to know where information originally acquired

PROCEDURAL memory: Memories of how to do something

Availability and Accessibility

- **Availability:**

- Whether or not the information has been stored in the first place
 - We do not register everything our senses take in

- **Accessibility:**

- Whether or not it can be retrieved from memory
 - We will not necessarily be able to retrieve or remember something we have stored at any given moment

“I can’t remember” may mean different things

Measuring memory (linked to retrieval)

- Pure memory
 - Ebbinghaus (1885)
 - Learned lists of nonsense syllables (e.g. TAQ, BUW)
 - Tested himself on reciting the lists of syllables
 - Then learned new lists
 - After specific time periods (20mins; 60mins; 24hrs; 31days), tried to recite a specific list.
 - Concluded that memory declines quickly at first but then tends to level off

Sensory Memory

(e.g. visual = iconic store; audio = echoic store)

- Occurs within the sensory system
- Necessary for storage

Lloyd et al (1984) - less than one-hundredth of sensory information received reaches consciousness - of this, only 5% stored permanently

e.g. a visual image

- Remains for approx. 0.5 second - relatively unanalysed form
- Long enough to determine worth re. further processing
- After this time, information not attended to and processed further is forgotten

Sperling (1960):

K	Z	R
Q	B	T
S	G	N

Three rows of four letters each presented for 50 milliseconds

Participants could recall four or five letters, but claimed to have seen many more

The information had faded before it could be reported

But:

When directed to remember a _____, participants able to do so

Measuring memory

- **Recognition**

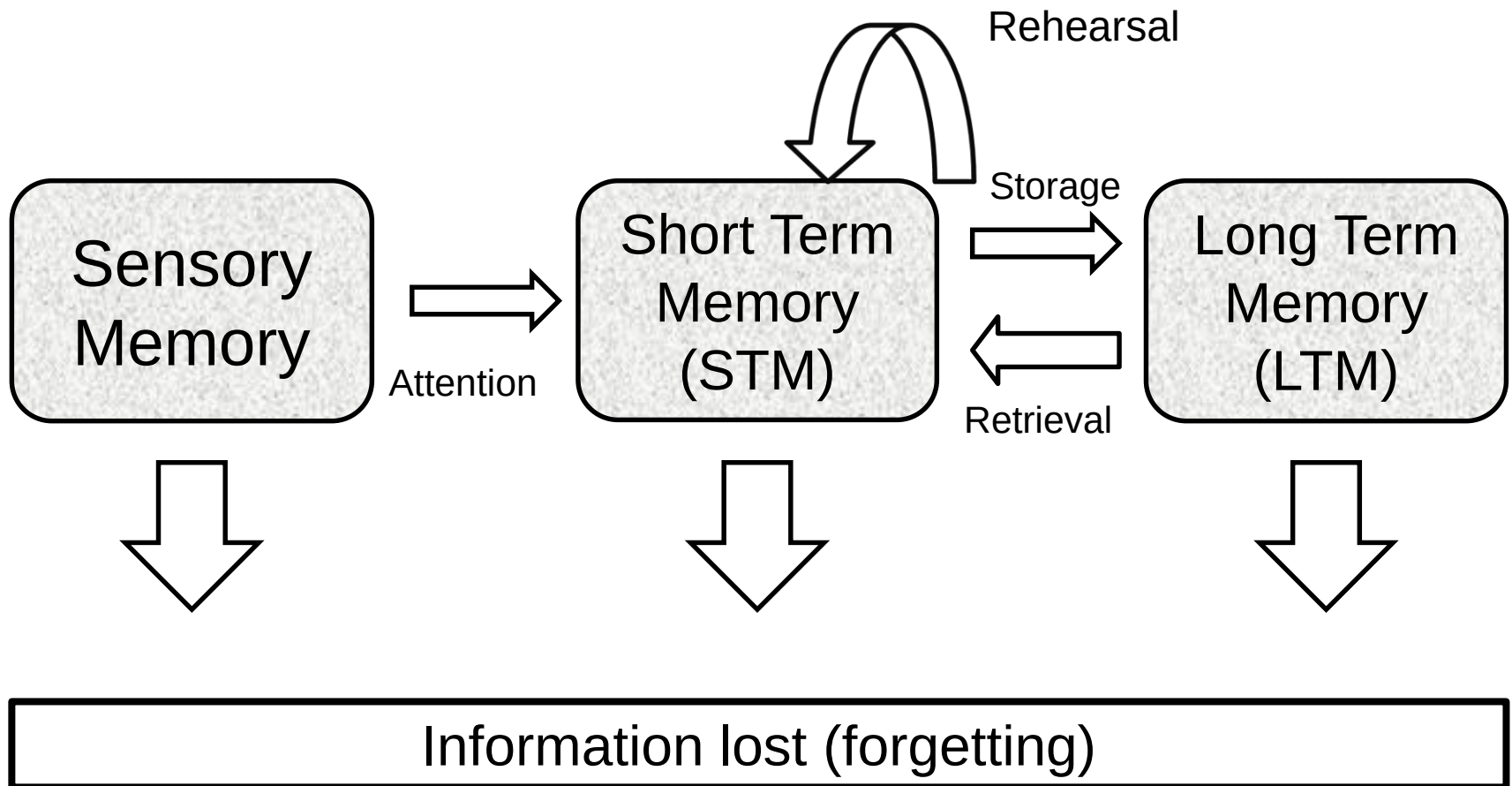
- Simply being able to decide whether or not a specific piece of information has been encountered before
- Standing (1973)
 - Participants were given lists of words of pictures
 - 2 days later – shown the same words/pictures that were mixed with new ones – the participants had to indicate *familiarity*
 - Ability to recognise a huge number of familiar stimuli

Measuring memory

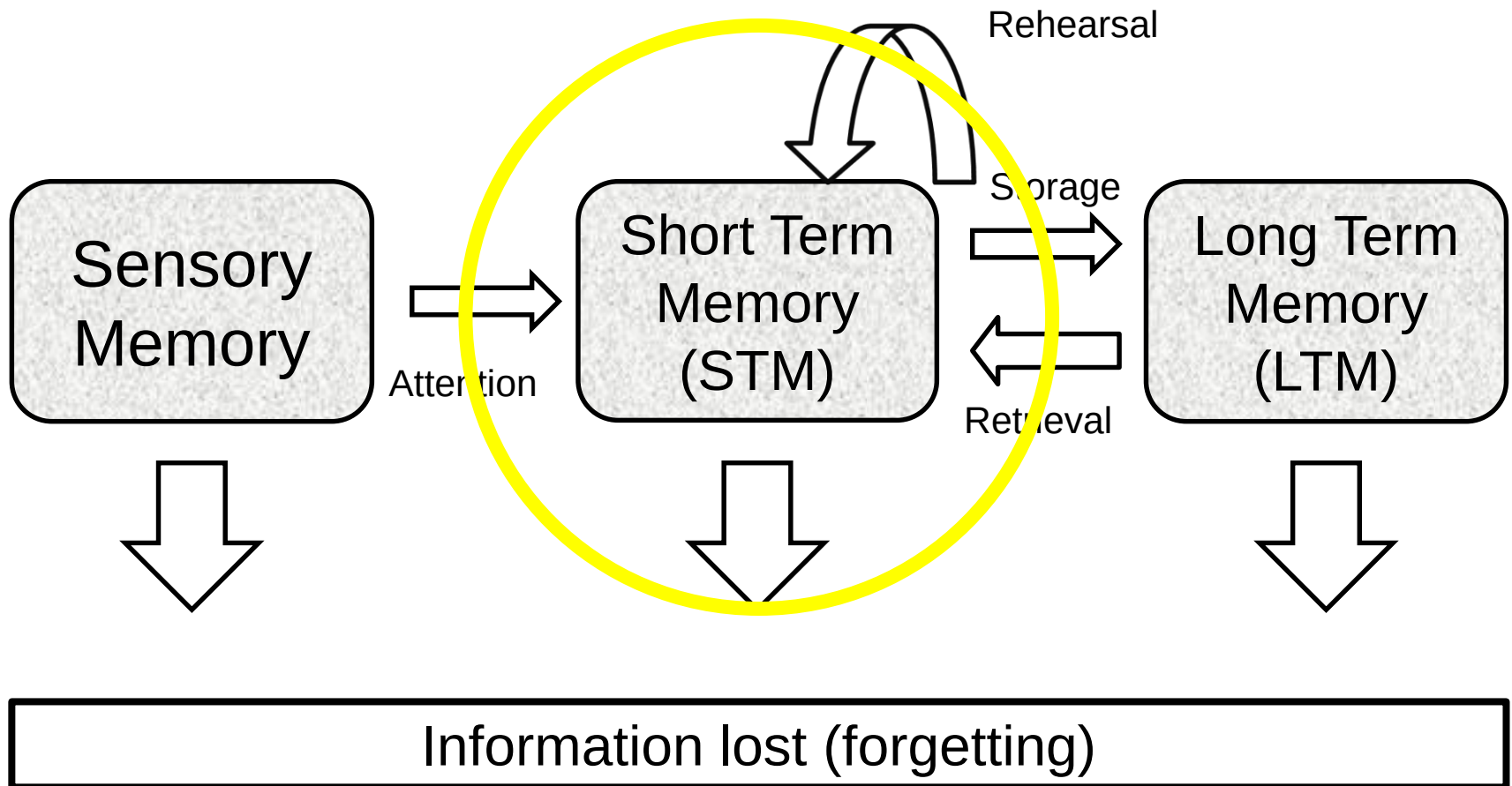
- **Recall**

- Active searching of memory store to retrieve a specific piece of information
- **Free recall:** material recalled in any order
- **Serial recall or memory-span procedure:** material recalled in the exact order it was presented
- **Paired associates recall:** learn a pair of words and have to recall one of the pair

The multi-store model of memory (Atkinson & Shiffrin, 1968)



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8374

59386

390284

2718945

39274819

683947215

1830982754

8374

59386

390284

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Short Term Memory (STM)

Capacity

- Miller (1956): “magical number seven, plus or minus two”
 - **Chunking – expand the limited capacity of STM** by reducing large amounts of information to a smaller meaningful amount
 - The length of the chunks may be large but the actual number of separate chunks will still be 7 +/- 2
 - Chunking e.g.

1 0 6 6

Four pieces of information = four chunks

‘1066’ the battle of Hastings

One piece of meaningful information = one chunk

Short Term Memory (STM)

Try and remember this:

yrghusawdnayahehtllaetaesroheht

Read it backwards:

Thehorseateallthehayandwashungry

The horse ate all the hay and was hungry

Short Term Memory (STM)

What about this one....:

149162536496491100

21 digits = 21 chunks to remember

How can we break this down?

Short Term Memory (STM)

We can also use **rules** to organise information in STM

149162536496491100

1 4 9 16 25 36 49 64 91 100

The rule here is that each number is a number squared. So $1^2 = 1$, $2^2 = 4$.. and so on

Using this rule we can break down 21 digits to ten meaningful chunks of information to remember

Or – a rule that certain numbers are broken down into particular size units e.g. 01792 234 567

Short Term Memory (STM)

Duration in STM - very short if no efforts or opportunity to rehearse

Rehearsal – repeating something that needs to be remembered. This can retain information in STM indefinitely

The Brown-Peterson Technique (Peterson & Peterson, 1959)

- Presented participants with a trigram (BVM, CTG)
- Asked to recall in the correct order (serial recall)
- Recall was required after a delay of 3, 6, 9, 12, 15, or 18 seconds
- Participants counted backwards during this time in threes from a random three-digit number

Short Term Memory (STM)

- The Brown-Peterson Technique (Peterson & Peterson, 1959)
- Findings:
 - 3 second delay: 80% of trigrams correctly recalled
 - 6 second delay: 50% of trigrams correctly recalled
 - 18 second delay: less than 10% of trigrams correctly recalled
- Percentage of correctly recalled trigrams reduced with longer delays
- Information held in STM is lost rapidly when there is little or no opportunity to rehearse

Short Term Memory (STM)

- **Duration**: Rehearsal is the key
- **Maintenance rehearsal:**
 - Rehearsing information in the way/order it was presented
- **Elaborative rehearsal:**
 - Gives the information some meaning, or links it with some pre-existing knowledge (in Long Term Memory - LTM)

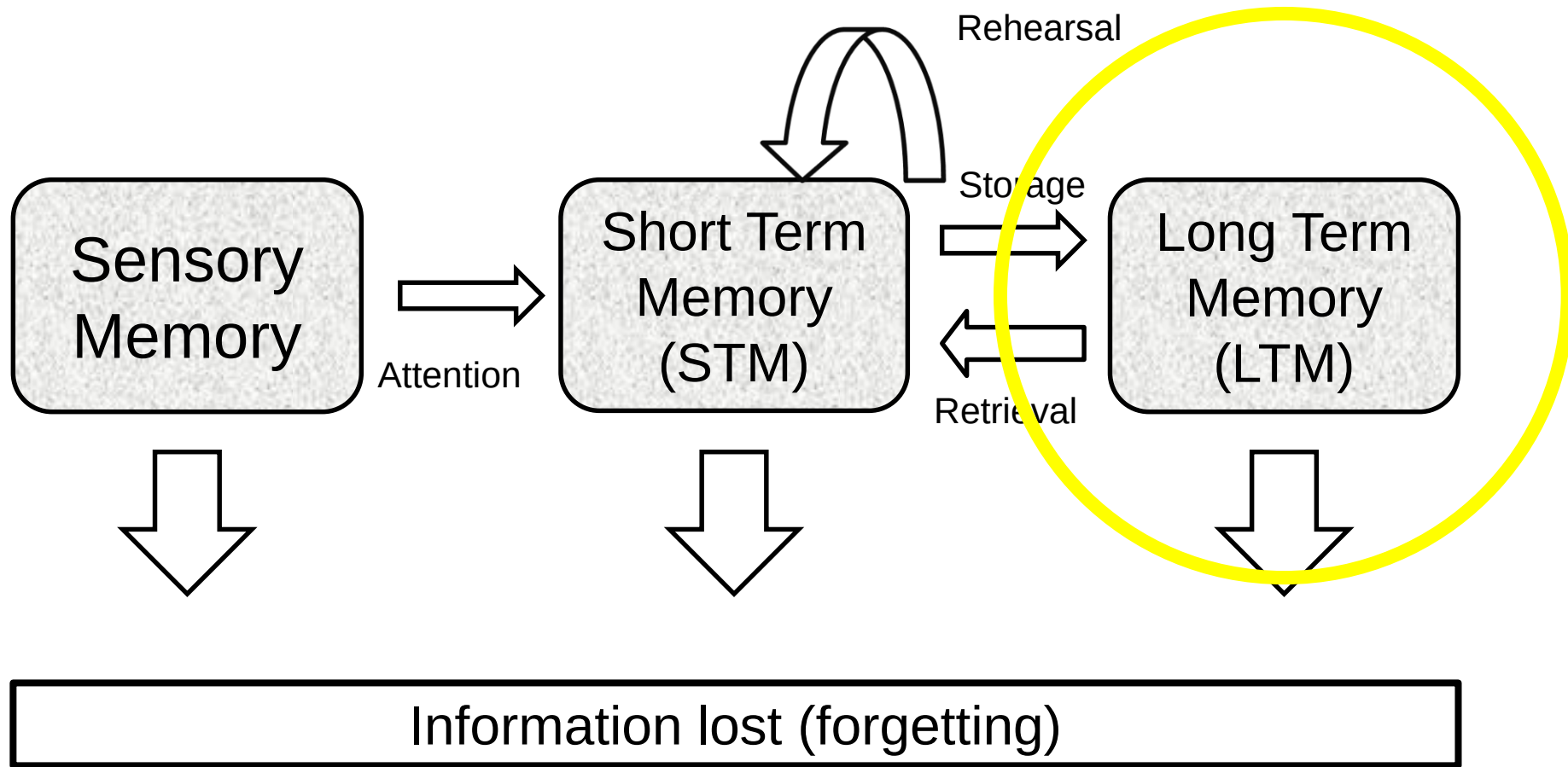
Think of examples of when you have engaged in either maintenance or elaborative rehearsal

Short Term Memory (STM)

Coding

- Mainly acoustic: some semantic and visual coding
- **Acoustic** coding:
 - Conrad (1964): when presented with lists of consonants which they then had to recall, participants tended to make mistakes on similar sounding letters e.g., recalling “b” instead of “p”
- **Semantic** coding:
 - Schulman (1970): errors made recalling words when presented with words with a similar meaning e.g., recognising “talk” rather than “speak”
- **Visual** coding:
 - Pictures can also be stored temporarily

The multi-store model of memory (Atkinson & Shiffrin, 1968)



BREAK



10 MINUTES!

Long Term Memory (LTM)

- Bower (1975) – LTM includes:
 - Spatial model of our environment/world
 - Knowledge of the physical world
 - Beliefs, norms and goals
 - Motor skills, etc.
 - Perceptual and language skills
- Much of this reflects **semantic memory** (Tulving, 1972)



Capacity: Unlimited

Duration: up to a lifetime

Long Term Memory (LTM)

Coding

- Mainly semantic (Baddeley 1966) – opposite effects found for LTM than with STM
 - Acoustically similar words had no effect on recall for LTM
 - **Few semantically similar words recalled**
- But also uses visual coding and acoustic coding
 - How else can we picture our favourite place or remember the words of our favourite song?

What evidence is there to support the Multi-Store Model?

STM and LTM

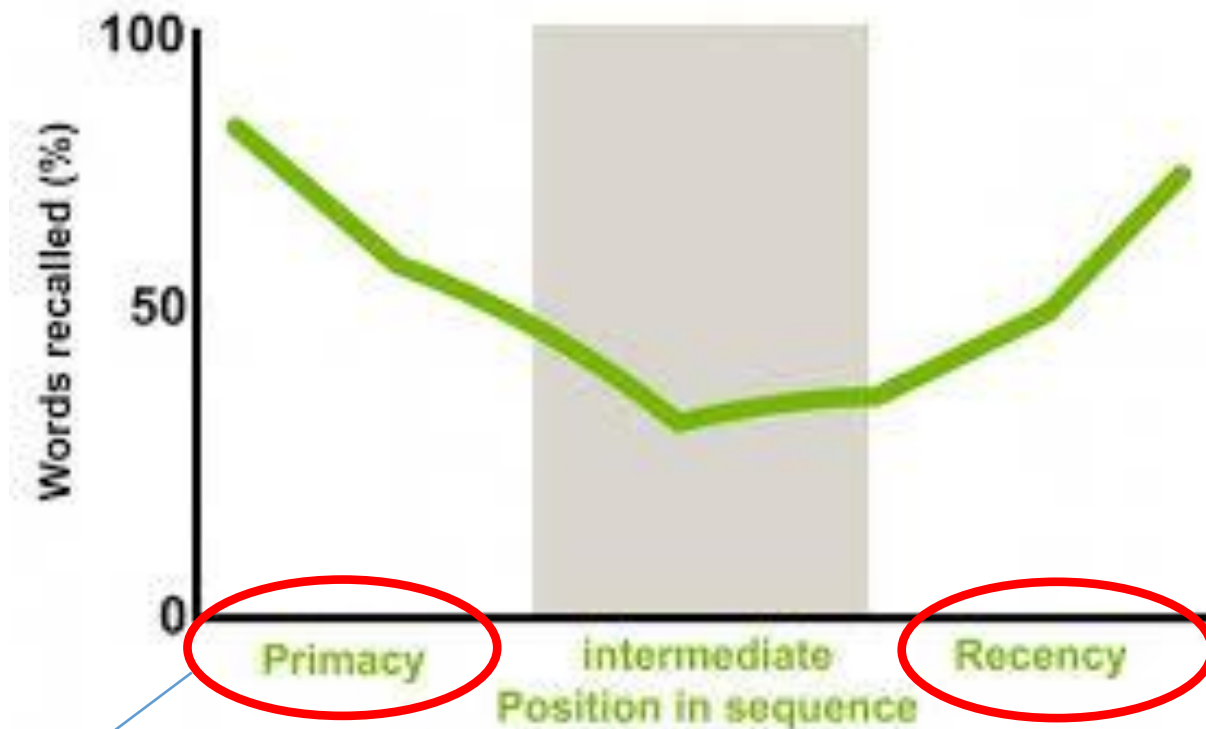
Coding

- Baddeley (1966) presented words that were either:
 - Acoustically similar: caught; short; taut
 - Semantically similar: huge; great; wide
 - Acoustically dissimilar: foul; old; deep
 - Semantically dissimilar: pen; day; ring
- In LTM, semantically similar words were recalled less well than semantically dissimilar words; little effect for acoustic words
- In STM the opposite was found – acoustically similar words were recalled less well

The serial position effect (Murdock, 1962)

The correct recall of words depends upon their position in a list

Primacy and Recency effects



Items at the beginning have been rehearsed and entered LTM, from where they are recalled

Items currently in STM – recalled directly from STM (have to be recalled first)

STM and LTM

- The Brown-Peterson Technique
- **Chunking**
 - Recall from STM is more accurate if better semantic/grammatical structure
 - Suggests some processing/flow to and from LTM

Studies of brain-damaged patients



Do certain types of brain damage effect only STM or LTM?

- H M: anterograde amnesia (Milner et al., 1968)
 - Removal of $\frac{2}{3}$ of hippocampus and amygdala
 - Normal STM, no LTM
 - Cannot remember any new facts, has to get to know people from scratch every time. So impaired memory of the recent past
 - *But he can learn and remember perceptual and motor skills*
- Clive Wearing: Rare brain infection
 - Constantly believes he has just awoken from years of unconsciousness
 - Retained his musical and motor skills
 - Patchy recall of previous life/knowledge

Studies of brain-damaged patients



- **Anterograde amnesia**

- STM function tends to be preserved, but limited LTM function
- This could be due to problems with TRANSFER between STM and LTM, or problems of RETRIEVAL from LTM

- **Retrograde amnesia**

- Patient fails to remember any events that happened *before* the onset of the amnesia

The Working Memory Model (Baddeley & Hitch, 1974)

- Criticises the concept of a unitary STM
- STM is not just a 'stopping off station'

Why?

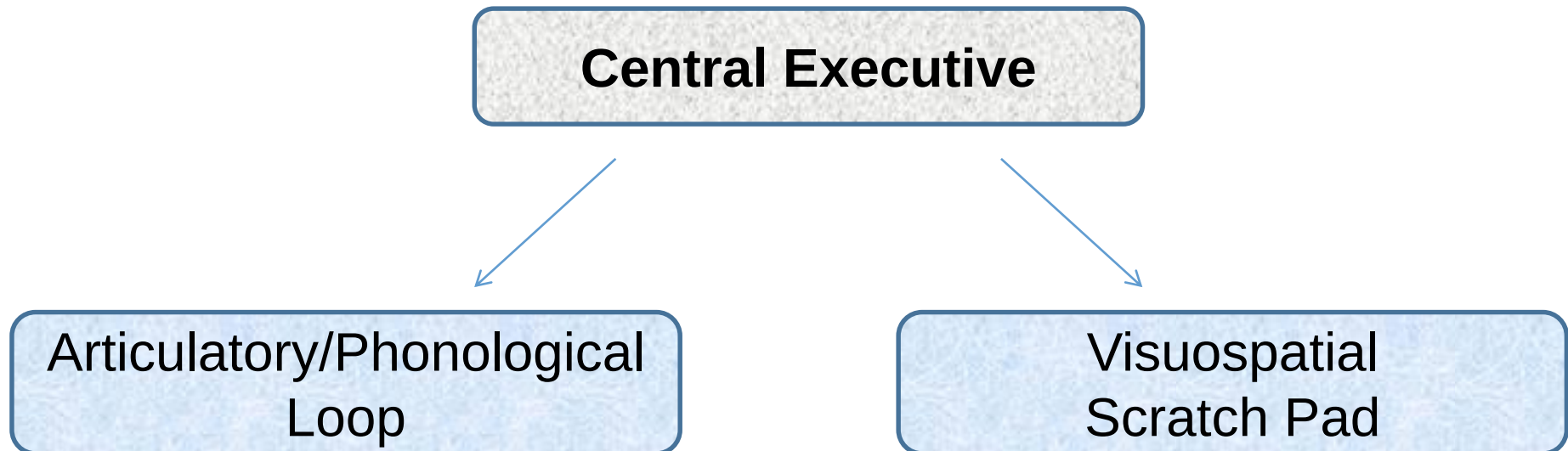
- Chunking – meaning must come from LTM
- Greater two-way flow of information from STM to LTM
- Expertise can increase the capacity of STM – chess players; football fans; burglars!

The Working Memory Model

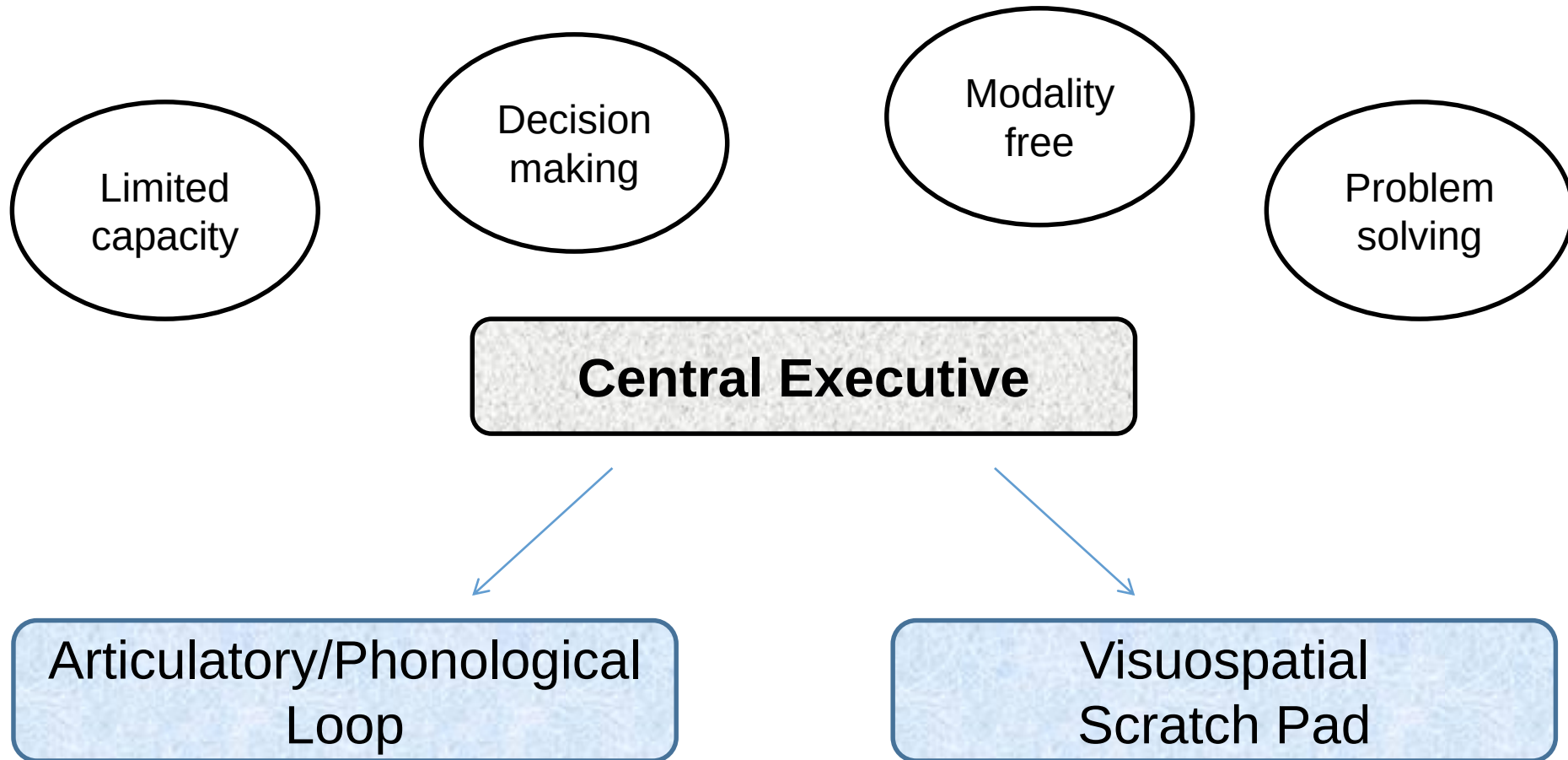
- STM conceptualised as a '**working memory**': like a computer screen doing different things with different pieces of information
 - An '**active desktop**'
- LTM – conceptualised as a computer memory – holds large amounts of information in a passive state for possible future retrieval

The Working Memory Model

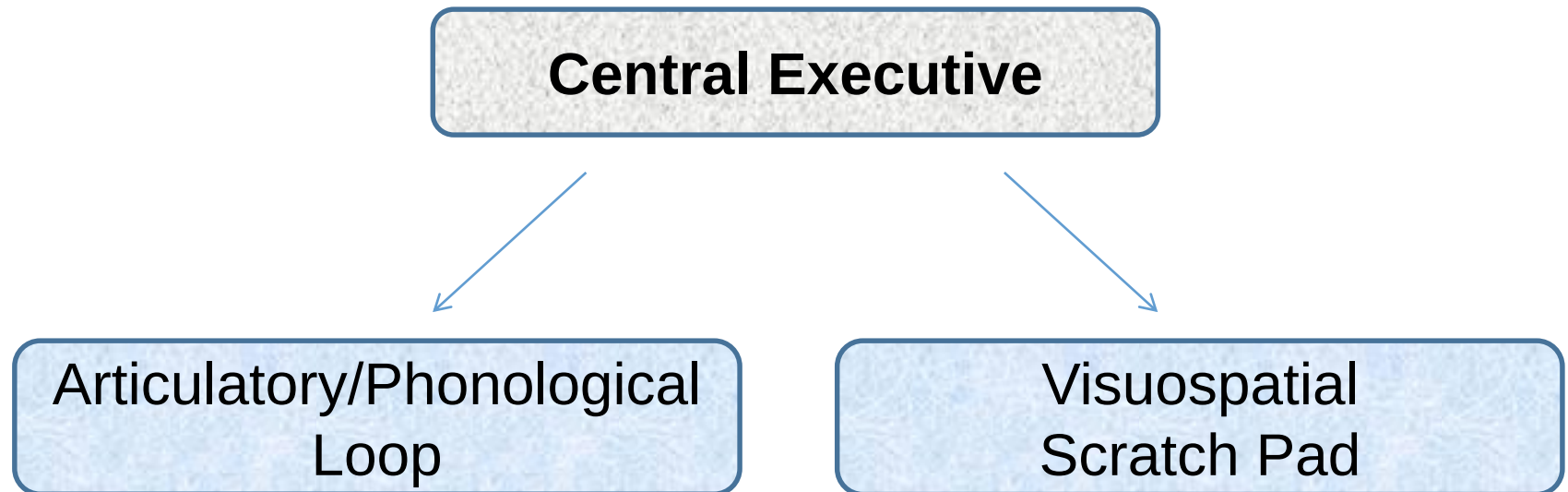
- STM as 'working memory'



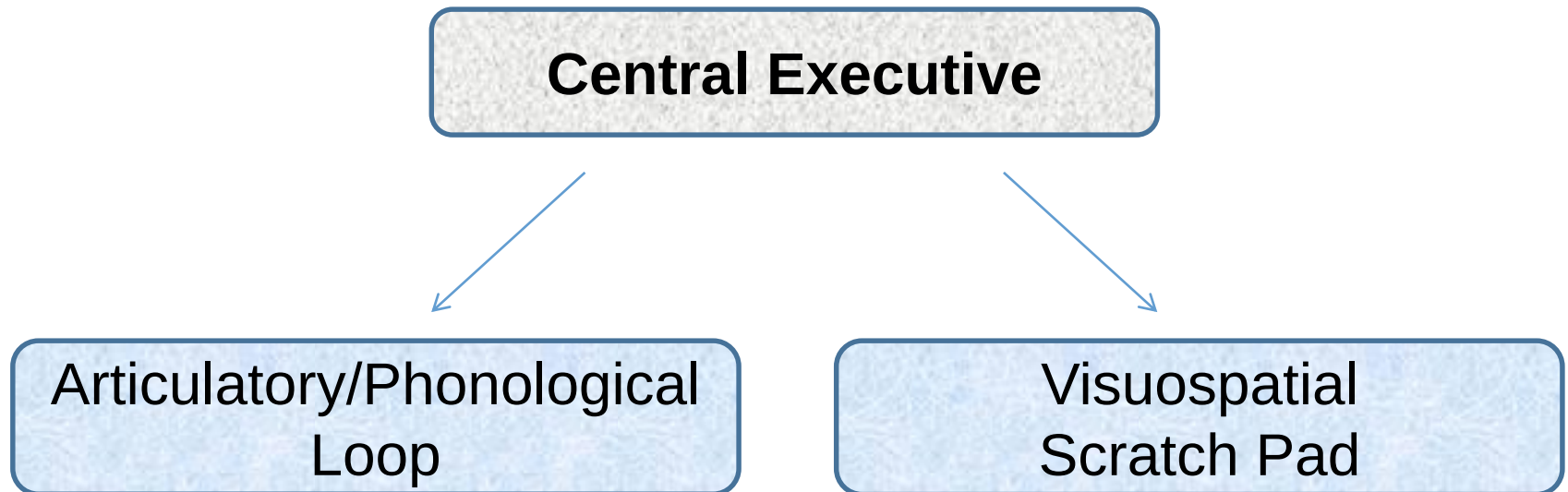
The Working Memory Model



The Working Memory Model



The Working Memory Model



The Working Memory Model

Evidence for the Working Memory model

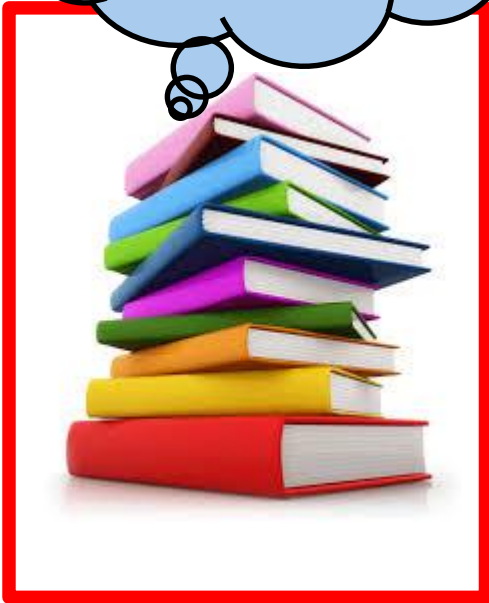
- Dual task method (Baddeley et al., 1975)
 - Two tasks involving the same slave system = poorer performance
 - Two tasks involving different slave systems = no performance impairment.
- But... major weakness is that little is known about what the central executive actually is or does!

The Levels of Processing Model (Craik and Lockhart, 1972)

- Concentrates on the processes involved in memory, not just on the stores involved.
 - Memory is really just what happens as a result of processing information
- No STM or LTM – only one type of memory store and its capacity is enormous
- Memory, attention, and perception are all inter-related processes.

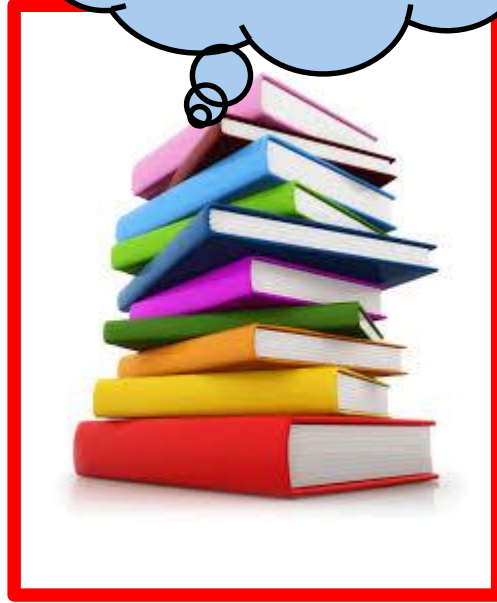
The Levels of Processing Model

**Coloured
paper
objects**



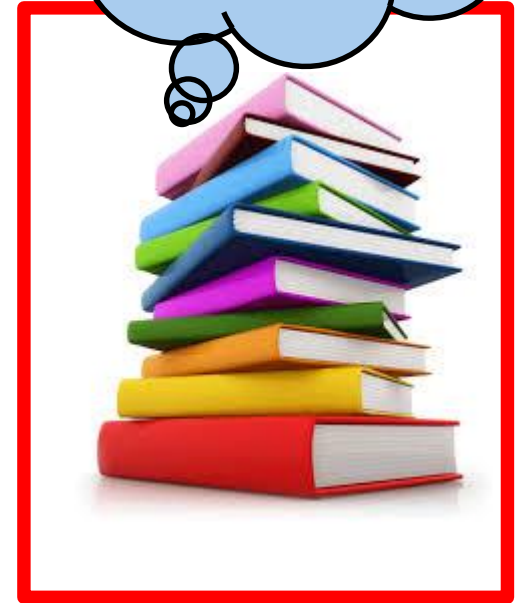
Superficial/ Shallow
processing

**Library
books**



Intermediate/
Phonemic/ Phonetic
processing

**These books
will help me
do better in
my course**



Deep/ Semantic
processing

Evidence for the Levels of Processing model

- Craik and Tulving (1975)

Shallow processing	Is the word in capital letters? e.g., HOUSE / house
Phonetic processing	Does the word rhyme with school? e.g., tool / apple
Semantic processing	Is the word a type of animal? e.g., horse / table (need to consider MEANING)
Deeper semantic processing	Would the word (e.g., ball/rain) fit in the sentence “He kicked the _____ into the tree”

Evidence for the Levels of Processing model

- Craik and Tulving (1975)
 - Better recognition of words processed at a semantic level
 - Better recall of words involved in more elaborate sentences
 - Better recall of words involved in more distinctive sentences
 - Elaboration, distinctiveness and levels of processing are difficult to separate out from each other

Limitations of the Levels of Processing model

- Mainly descriptive
 - Doesn't tell us WHY deeper processing leads to better recall
 - Sometimes we attach emotion as well as meaning, but not always
- Could be due to methods of testing recall/recognition
 - Some recall/recognition tests are better suited to semantic processing
 - Studies have shown that the nature of a test can influence recall of words at different levels
- Suggests that only **elaborative rehearsal** improves long term memory
 - Giving information some meaning by which to remember it

Techniques for improving memory: what have these theories and studies taught us?

- Chunking
- Use mental pictures or images
- Method of loci – use of familiar locations as cues
- ‘Pegword’ technique – use of familiar words or names as cues
- Acronyms (e.g. ‘AIDS’) and acrostics (e.g. poem)– create special codes to help remember less meaningful items

Which do you use?

Useful Reading

Gross, R. D. (2010). *Psychology: The Science of Mind and Behaviour* (6th edition). London: Hodder Education. (e-book also available)

Chapter 17: Memory and Forgetting