Chapter 1

Cognitive psychology

Column 1: tick when you have produced brief notes.

Column 2: tick when you have a good grasp of this topic.

Column 3: tick during the final revision when you feel you have complete mastery of the topic.

Key terms • **3 marks worth of material**	**1**	**2**	**3**
Short-term memory (STM)			
Long-term memory (LTM)			
Encoding			
Duration			
Capacity			
Eyewitness testimony (EWT)			
Misleading information			
Research studies related to … • **6 marks worth of description** • **6 marks worth of evaluation (including the issues of reliability, validity and ethics)**			
STM			
LTM			
Capacity			
Duration			
Encoding			
Multi-store model			
Working memory model			
Accuracy of EWT			
Effect of age of witness on EWT			
Effect of anxiety on EWT			
Effect of misleading questions in EWT			
Cognitive interview			
Strategies for memory improvement			
Factors that affect … • **6 marks worth of material**			
Capacity of STM			
Duration of STM			
Encoding in STM and LTM			
Accuracy of eyewitness testimony			
Explanations/theories • **6 marks worth of description** • **6 marks worth of evaluation (both strengths and weaknesses)**			
Multi-store model			
Working memory model			
Applications of memory research • **6 marks worth of material**			
Strategies for memory improvement			

KEY TERMS

Capacity
- A measure of how much can be held in memory.
- Measured in terms of bits of information, such as number of digits.

Duration
- A measure of how long a memory lasts before it is no longer available.

Encoding
- The way information is changed so it can be stored in memory.
- Information enters the brain via the senses (e.g. eyes and ears) and is then stored in various forms, such as visual codes (like a picture), acoustic forms (sounds), or a semantic form (the meaning of the experience).

Long-term memory (LTM)
- Memory for events that have happened in the past.
- Lasts anywhere from 2 minutes to 100 years.
- Potentially unlimited duration and capacity.

Short term memory (STM)
- Memory for immediate events.
- Lasts for a very short time and disappears unless they are rehearsed.
- Limited duration and limited capacity.
- Sometimes referred to as *working memory*.

	STM	LTM
Duration	Measured in seconds and minutes	Measured in hours, days and years
Capacity	Less than 7 chunks	Potentially unlimited
Encoding	Acoustic (i.e. information represented as sounds or visual)	Semantic (i.e. information represented by its meaning)

Duration of STM

keySTUDY Peterson and Peterson (1959)

How? Method – **lab experiment**. Participants: 24 students. Participants were given a **nonsense trigram** to be remembered and also given a three-digit number. They were asked to count backwards from the number until told to stop and recall the nonsense trigram. This was repeated eight times with different retention intervals: 3, 6, 9, 12, 15, or 18 seconds.

Showed? Participants could remember about 90% when there was only a 3 second interval, which dropped to about 20% after 9 seconds and about 2% when there was an 18 second interval. This suggests that STM has a duration of less than 18 seconds if verbal rehearsal is prevented. In fact, much information has disappeared within a few seconds.

Evaluation (1) **Ecological validity**: the stimulus material is artificial and therefore findings may not apply to all aspects of everyday life, though it does apply to memorising verbal material. (2) **Internal validity**: were they testing duration? Trigrams may have been displaced by numbers when counting backwards and therefore forgetting was not due to spontaneous decay but, instead, due to displacement.

ResearchUPDATE Nairne *et al.* (1999)

How? Participants were asked to recall the *same* items across trials, whereas in the earlier study different items were used on each trial, which would have led to interference between items, decreasing recall.

Showed? Items could be recalled after as long as 96 seconds. Therefore it seems that information remains for quite a while in STM *unless* other material replaces or overwrites it.

Duration of LTM

ResearchEVIDENCE

Shepard conducted a **lab experiment** to test the duration of LTM. He showed participants 612 memorable pictures, one at a time. An hour later they were shown some of these pictures within a set of others and displayed almost perfect recognition. Four months later they were still able to recognise 50% of the photographs.

Bahrick *et al.* conducted a **natural experiment**. They asked people of various ages to put names to faces from their high school year book and 48 years on, people were about 70% accurate. In this case, the material to be remembered was more meaningful to the participants and therefore the duration of the long-term memories was better.

Capacity and encoding covered on facing page.

KEY TERMS

Chunking

- Miller proposed that the capacity of STM can be enhanced by grouping sets of digits or letters into meaningful units or 'chunks'.
- For example it is easier to remember 100 1000 10 10000 than 10010001010000.
- Miller suggested we can remember 7 ± 2 chunks at a time.
- The size of a chunk may affect how many other chunks can be processed.

Digit span technique

- A technique to assess the span of immediate (short-term) memory.
- Participants are given progressively more digits in a list to see how many can be recalled.

Capacity of STM

ResearchEVIDENCE

Miller reviewed previous research and concluded that the span of **STM** is 7 ± 2, e.g. people can cope reasonably well with counting seven dots flashed onto a screen but not many more than this.

Jacobs used the **digit span technique** to assess the capacity of STM. He found the average span for digits was 9.3 items, whereas it was 7.3 for letters. It may be easier to recall digits because there are only 10 possible digits (0–9) wheras there are 25 letters.

Jacobs also found that digit span increased with age; 8-year-olds could remember an average of 6.6 digits, whereas the mean for 19-year-olds was 8.6 digits. This might be due to a gradual increase in brain capacity, and/or that people develop strategies to improve their digit span, such as **chunking**.

Chunking

Miller also found that people can recall 5 *words* as well as they can recall 5 *letters* – we **chunk** things together and then can remember more.

Simon conducted a **lab experiment**. He found that the size of the chunk matters – people had a shorter span for larger chunks, such as 8-word phrases, than smaller chunks, such as one-syllable words.

Cowan reviewed a variety of studies on the capacity of STM and concluded that STM is likely to be limited to about 4 chunks.

RealWORLD application – **Baddeley** discovered that if the initial letters of a postcode made up something meaningful (e.g. BS for Bristol) it made the postcode easier to remember. Numbers were best remembered if they were placed between the city name and random letters.

Encoding in STM and LTM

keySTUDY Baddeley (1966)

How? Method – **lab experiment**. Participants were given lists of acoustically similar or dissimilar and semantically similar or dissimilar words.

Showed? Participants had more difficulty remembering acoustically similar words in STM but not in LTM, whereas semantically similar words posed little problem for short-term recall but led to muddled long-term memories.

otherRESEARCH

Brandimote *et al.* conducted a **lab experiment**. They found that participants used visual encoding in STM if they were given a *visual* task (pictures) and were prevented from doing any *verbal* rehearsal in the retention interval (they had to say 'la la la') before performing a *visual* recall task. Normally we 'translate' visual images into verbal codes in STM, but since verbal rehearsal was prevented, they used visual codes.

Wickens *et al.* found that STM sometimes uses a semantic code rather than being restricted to acoustic coding.

In LTM **Frost** showed that recall was related to visual as well as semantic categories. **Nelson and Rothbart** found evidence of acoustic coding in LTM.

PUTTING IT ALL TOGETHER

Research supports a distinction between STM and LTM in terms of duration (less than 18 seconds or forever), capacity (less than 7 chunks or infinite) and encoding (*generally* acoustic or semantic).

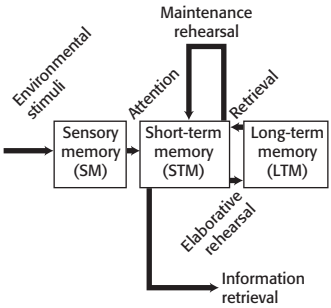
KEY TERMS

Multi-store model (MSM)

- An explanation of memory based on three separate memory stores.
- How information is transferred between these stores.

Sensory memory (SM)

- Information at the senses – information collected by your eyes, ears, nose, fingers and so on.
- Information is retained for a very brief period by the sensory registers (less than half a second).
- Capacity of sensory memory is very large.
- Method of encoding depends on the sense organ involved, i.e. visual for the eyes, acoustic for the ears.



▲ *The multi-store model*

PUTTING IT ALL TOGETHER

Research does support the view that there are a number of different memory stores which are quantitatively and qualitatively different, as described by the multi-store model. However the multi-store model is oversimplified.

Multi-store model (Atkinson and Shiffrin, 1968)

- An explanation of how memory processes work based on the idea that there are three separate stores (**SM**, **STM**, **LTM**).
- Each store has unique characteristics: duration, capacity and encoding.
- Information first arrives at SM. Attention causes transference to STM.
- Information in STM is in a fragile state, and disappears if not rehearsed (*decay*) or if new information enters (*displacement*).
- Increasing rehearsal leads to transfer from STM to LTM; the more rehearsal the better it is remembered.
- Rehearsal is maintenance rehearsal (verbal) but also elaborative rehearsal.

Research EVIDENCE supporting the MSM

Sensory memory – **Sperling** conducted a **lab experiment**. He asked participants to report 12 letters/digits from a three line display after a 50 millisecond delay. Recall was poorer for all items (5 items recalled, about 42%) than when asked to give one row only (3 items recalled, 75%). This shows that information decays rapidly in the sensory store.

Serial position effect – **Glanzer and Cunitz** conducted a **lab experiment**. They gave participants a list of words and found that words recalled were from the start of the list (*primacy effect*) and end of list (*recency effect*). This *serial position effect* occurs because the first words are best rehearsed and transferred to LTM, and the last words are in STM when you start recalling the list.

Brain scans – **Beardsley** used **brain scanning** to investigate brain activity and found that the *prefrontal cortex* is active during STM tasks. **Squire *et al.*** also used **brain scanning** and found the **hippocampus** is active when LTM is engaged. This shows there are distinct stores.

Case study of HM – **Scoville and Milner** conducted a **case study**. They found that the ability to form new LTM was impaired when the hippocampus was removed; LTMs formed prior to the operation remained intact.

Evaluation

Strengths

1 **Research support** e.g. studies above and on previous pages related to duration, capacity, encoding.
2 **Produces testable predictions**, which is important for the scientific process to enable theory testing and verification.

Limitations

1 **STM and LTM are not unitary stores**. STM has verbal and visual stores (see WMM on facing page) and LTM is divided into semantic, episodic and procedural memory as well as perceptual-representation system (PRS). Supported by **Spiers *et al.*** who studied amnesiac patients, whose procedural and PRS systems were intact but not the other types of LTM.
2 **Rehearsal involves processing (elaboration) as well as maintenance**. Supported by **Craik and Tulving** who found that words processed more deeply (semantically) were better remembered.
3 **STM not entirely separate from LTM**. **Ruchkin *et al.*** found participants' brain activity was different when they processed real or pseudo-words.

KEY TERMS

Central executive
- Monitors and coordinates all other mental functions in WM.

Episodic buffer
- Receives input from many sources.
- Temporarily stores this information.
- Integrates it in order to construct a mental episode of what is being experienced right now.

Phonological loop
- Encodes speech sounds.
- Involves maintenance rehearsal (repeating the words over and over again i.e. a *loop*).
- Divided into **phonological store** (inner ear) and **articulatory process** (inner voice).

Visuo-spatial sketchpad
- Encodes visual information.
- Divided into the **visual cache** (stores information) and **inner scribe** (spatial relations).

Word-length effect
- People remember lists of short words better than long words.
- Governed by the capacity of the phonological loop.

Working memory model (WMM)
- An explanation of STM, called 'working memory'.
- Based on four components, some with storage capacity.

PUTTING IT ALL TOGETHER

The working memory model offers a refinement of the multi-store model, describing working memory in terms of specialised auditory and visual units.

Working memory model (Baddeley and Hitch, 1974)

- An explanation of STM (i.e. the memory used when working on something, such as solving problems, comprehending language, etc.).
- **Central executive** is an attentional process to monitor incoming data and allocate 'slave systems' to tasks. Has very limited capacity.
- **Phonological loop** deals with auditory information and preserves its order. Subdivided into **phonological store**, which stores the words you hear, and **articulatory process**, which allows maintenance rehearsal – repeating the words.
- **Visuo-spatial sketchpad** stores visual and/or spatial information. Subdivided into **visual cache**, which stores visual data, and **inner scribe**, which encodes the arrangement of objects in the visual field.
- **Episodic buffer** provides a temporary store and links with LTM.

Research EVIDENCE supporting the WMM

Dual task performance – **Hitch and Baddeley** conducted a **lab experiment**. They demonstrated that performance was slower when participants were given a task involving the central executive and a second task involving both the central executive and the articulatory loop, than articulatory loop alone or no extra task.

Phonological loop – **Baddeley *et al.*** conducted a **lab experiment**. They demonstrated that the phonological loop holds the amount of information you can say in 2 seconds, but the **word length effect** disappears if a person is given an *articulatory suppression task* (a repetitive task that ties up the articulatory process). This is evidence of the phonological loop (because there is a finite space for rehearsal related to what can be said) and the articulatory suppression task is evidence of the articulatory process.

Visuo-spatial sketchpad – **Baddeley *et al.*** conducted a **lab experiment**. They showed that participants had more difficulty doing two visual tasks (track a light and describe letter F) than a visual and verbal task.

Case studies – **Shallice and Warrington** conducted a **case study** of KF whose LTM was intact, as was STM for visual stimuli, but he had poor STM ability with verbal material (letters and digits but not sounds).

Evaluation

Strengths

1 **Emphasises process** more than the MSM and presents a more detailed understanding of STM.
2 **Plenty of research support** for different stores and dual-task performance, as described above.
3 **Produces testable** predictions, which is important for scientific process.

Limitations

1 **Central executive is vaguely defined** and doesn't really explain anything. May consist of separate components.
2 **Evidence from brain-damaged patients may not be reliable** because it concerns unique cases often involving traumatic experiences.
3 **The WMM is restricted to STM** and has nothing to say about LTM.

The effect of misleading information on EWT

keySTUDY Loftus and Palmer (1974)

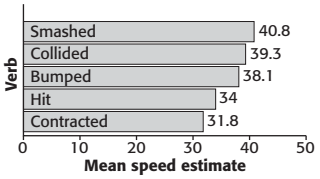
1st experiment, how? Method – **lab experiment**. Forty-five students were shown films of traffic accidents. *Leading questions* afterwards included a critical one about speed of car containing the word 'hit', 'smashed', 'collided', 'bumped' or 'contacted'.

Showed? The group with 'smashed' estimated a higher speed, the group given the word 'contacted' estimated the lowest speed. Suggests that leading questions (*post-event information*) can have a significant effect on memory (could be on how memory is stored or how it is retrieved).

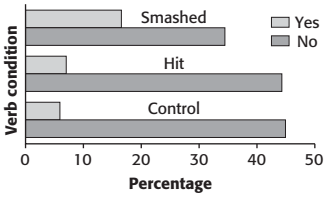
2nd experiment to investigate whether post-event information alters storage or retrieval. A different set of participants were shown a film of an accident. A week later they asked whether there was any broken glass.

Showed? Those given the question with 'smashed' were more likely to recollect broken glass (there was none). Shows that post-event information affects initial storage.

Evaluation (1) **Validity** – not true to life because participants may not take the task seriously and thus behaviour does not represent real EWT; **Foster *et al.*** showed that recall is more accurate in real life. (2) **Demand characteristic** – very hard to estimate speed so participants use any available clue, in this case the verb in the question.



▲ *Findings from 1st experiment by Loftus and Palmer*



▲ *Findings from 2nd experiment by Loftus and Palmer*

otherRESEARCH

Loftus *et al.* conducted a **lab experiment**. Participants were shown photos of a car at a junction with a STOP or YIELD sign, then asked questions either consistent with a photo (e.g. participant saw photo of a STOP sign and asked about a car at a STOP sign), or inconsistent (e.g. participants saw photo of a YIELD sign but asked about a car at a STOP sign). Finally, they were shown pairs of photos and asked to identify which was one of the original photos. Those given inconsistent questions (i.e. misleading) were 41% correct in their identification, compared with 75% when consistent questions were used.

Bekerian and Bowers disputed the above result. When participants were given a question that matched the sign they were shown (STOP or YIELD) their recall was more accurate when questions were consistent than inconsistent. *But* when the slides were presented in the right sequence, misleading information (inconsistent question) had no effect. This suggests that misleading questions (post-event information) affect retrieval rather than storage.

Evaluation

RealWORLD applications – Wells and Olsen reported that mistaken eyewitness identification was the largest single factor in convicting innocent people. Psychological research has been crucial in providing a scientific understanding of how misleading information may affect EWT.

IndividualDIFFERENCES (1) **Gender** – men and women take interest in different aspects of a scene but both are equally accurate (**Wells and Olsen**). (2) **Age** – elderly people are less able to remember the source of information than younger people (**Schacter *et al.***).

KEY TERMS

Eyewitness testimony (EWT)

- The evidence provided in court by a person who witnessed a crime, with a view to identifying the perpetrator of the crime.
- The accuracy of eyewitness recall may be affected during initial encoding, subsequent storage and eventual retrieval.

Leading (misleading) question

- A question that, either by its form or content, suggests to the witness what answer is desired, or leads him to the desired answer.

More on EWT on facing page.

KEY TERMS

Anxiety

- A nervous emotional state where we fear that something unpleasant is about to happen.
- People often become anxious when they are in stressful situations.
- Anxiety tends to be accompanied by physiological arousal (e.g. a pounding heart and rapid shallow breathing). Therefore research in this area is often focused on the effects of arousal.

The effect of anxiety on EWT

ResearchEVIDENCE

Deffenbacher *et al.* conducted a **meta-analysis**. They analysed 18 studies of anxiety and EWT. Many showed that stress has a negative impact on accuracy of EWT but some studies showed that anxiety may actually enhance the accuracy of recall.

Christianson and Hubinette conducted a **questionnaire**. They spoke to 58 real witnesses to bank robberies. The greater the threat, the more accurate the recall and more detail was remembered, compared to onlookers who were less emotionally aroused.

Johnson and Scott conducted a **lab experiment** to demonstrate the **weapon focus effect** – arousal (anxiety) may focus attention on central features of a crime (e.g. the weapon) and thus reduce recall for details (e.g. of perpetrator's face). In this experiment, a man runs through a room carrying a pen covered in grease or knife covered in blood. Witnesses were 49% accurate in identifying the man with the pen, compared to 33% accuracy with the knife.

Evaluation

Contradictory findings can be explained in terms of the **Yerkes-Dodson law** – medium levels of arousal (anxiety) enhance accurate recall, whereas high levels decrease it.

RealWORLD applications – **Rinolo *et al.*** used evidence from the sinking of the Titanic, where 75% of the survivors had reported that the ship broke apart when sinking. Their testimony was regarded as inaccurate until the wreck was discovered and their account was proved right. This supports the view that anxiety does not necessarily result in inaccurate recall.

The effect of age on EWT

ResearchEVIDENCE

The following studies are all **natural or quasi-experiments** because the IV (age) varies naturally.

Brassard found that young children (four years old) were more affected by cues from the interviewer than were slightly older children (eight years old).

Parker and Carranza found that primary school children were more likely to choose someone from a mock line-up than adults, but also more likely to make errors.

Yarney found that older adults (45–65) were less confident, but not less accurate, when recalling a confederate than younger adults.

Memon *et al.* found that accuracy in older people (60–82) dropped when the identification task was delayed for a week.

Anastasi and Rhodes found that young (18–25) and middle-aged (35–45) participants were significantly more accurate in recall of target faces than older (55–78) participants.

Evaluation

Own-age bias – Apparent superior performance of younger people may be because the faces to be recognised are younger faces. **Anastasi and Rhodes** found that all age groups are most accurate when the target photographs are from their own age group.

Explaining own-age bias – The less contact we have with certain groups of people, the poorer our ability to discriminate between individuals in this group (= *differential experience hypothesis*, **Brigham and Malpas**).

ResearchMETHODS – Participants may not behave as they would in everyday life in contrived studies. They may not take the task as seriously as in real life or, on the other hand, they may be looking for cues in an experiment which they wouldn't do in everyday life.

PUTTING IT ALL TOGETHER

Eyewitness testimony may lack accuracy in some situations, e.g. because of misleading questions, high arousal or identifying people of a different age group. However it may also be impressively accurate.

The cognitive interview (Fisher and Gieselman, 1992)

1. **Report everything** – Include every single detail of the event, even though it may seem irrelevant. Aims to increase consistency between actual event and recall of event, thus increasing accuracy of recall.
2. **Mental reinstatement of original context** – Mentally recreate the environment from the original incident. Aim is same as for no.1.
3. **Changing the order** – e.g. reversing the order in which events occurred. Aims to vary route through memory in order to increase recall.
4. **Changing the perspective** – Recall the incident from multiple perspectives, e.g. imagining how it would have appeared to other witnesses present at the time. Aim is same as for no.3.

Enhanced CI includes additional techniques for probing witness's mental image of an event.

KEY TERMS

Cognitive interview (CI)

- A police technique for interviewing witnesses to a crime.
- Based on what psychologists have found out about memory.
- Because our memory is made up of a network of associations rather than of discrete events, memories are best accessed using multiple retrieval strategies.
- Unlike a standard interview, the CI encourages witnesses to recreate the original context so as to increase the accessibility of stored information.

Standard interview

- An interview that lacks the four CI components.

ResearchEVIDENCE

Köhnken *et al.* conducted a **meta-analysis** of 53 studies and found a 34% increase in correct recall using CI compared with **standard interview**.

Milne and Bull conducted a **lab experiment** using college students and children, where using steps 1 and 2 (report everything and mental reinstatement) gave better recall than when using just one component. They also found that using just one component was no better than an instruction to 'try again'.

Stein and Memon tested female cleaning staff in Brazil and found increased recall, especially for details that would be useful e.g. description of man holding the gun.

Evaluation

ResearchMETHODS – Many of the studies tested volunteer witnesses (often college students) in a lab, which may not generalise to everyday life.

Hard to evaluate because there are many versions of CI used by different police forces, some just use one or two components and are not comparable to the full version.

More time-consuming than standard interview, police officers prefer to use strategies that limit amount of information collected (**Kebbell and Wagstaff**).

PUTTING IT ALL TOGETHER

The cognitive interview is based on psychological insights into memory processes and has proved effective, though the limitations (e.g. too time-consuming) may outweigh the advantages.

Memory improvement

Verbal techniques

1. **Acronyms** – e.g. ROYGBIV to remember the colours of the rainbow: **R**ed, **O**range, **Y**ellow, **G**reen, **B**lue, **I**ndigo, **V**iolet.
2. **Acrostics** – e.g. **M**y **V**ery **E**asy **M**ethod **J**ust **S**peeds **U**p **N**aming **P**lanets is used to remember the order of the planets: **M**ercury, **V**enus, **E**arth, **M**ars, **J**upiter, **S**aturn, **U**ranus, **N**eptune, **P**luto.
3. **Rhymes** – e.g. using the tune of *Twinkle Twinkle Little Star* to remember the letters of the alphabet.
4. **Chunking** – e.g. telephone numbers and post codes.

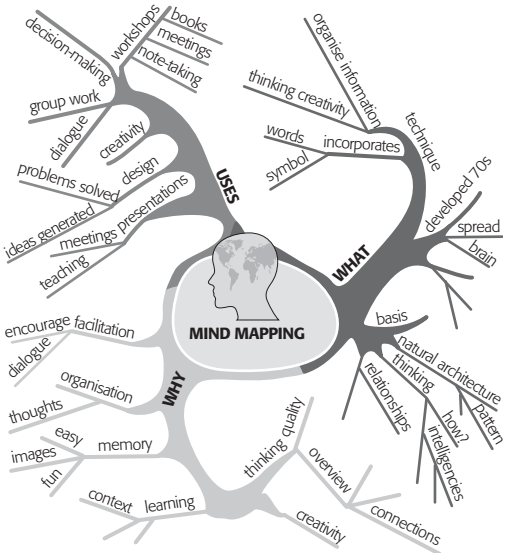
ResearchEVIDENCE

Role of organisation – **Bower *et al.*** conducted a **lab experiment**. They gave participants 112 words to learn. Recall was 2–3 times better if the words were presented in an organised hierarchy rather than in a random order. Our memories naturally organise themselves, making links – using mnemonic techniques merely speeds up this process.

Role of elaborative rehearsal – **Craik and Tulving** conducted a **lab experiment**. They gave participants words to learn and for each word asked participants one of three questions: (1) Is the word in capital letters? (shallow processing), (2) Does the word rhyme with _____? (phonemic processing), (3) A question that analysed meaning e.g. 'Is the word a piece of fruit?' (semantic processing). Words in group 3 were recalled best.

PUTTING IT ALL TOGETHER

Research shows that people who learn about mnemonic techniques are better at learning material, so these techniques work. However it is important to select the appropriate technique for the task.



▲ *A mind map about mind mapping*

Visual techniques

1. **Method of loci** – Learner associates material to be learned with different locations in a house, along a road, etc. Then the learner mentally retraces their steps to recall the items.
2. **Keyword method** – Used when associating pieces of information, e.g. learning a new language. The new word is broken into components with images created for each component that link to English meaning.
3. **Mind maps** – Main topic is placed in the centre and then branching links are made producing a unique visual appearance.

ResearchEVIDENCE

Dual coding hypothesis – **Pavio** suggested that words and images are processed separately (because some brain damaged individuals can process one but not the other). Therefore, concrete words will be remembered better because they are double-encoded – once as a word, and once as a visual image.

Bower conducted a **lab experiment**. He found that participants who were asked to mentally produce an image linking a pair of words (e.g. cat and brick) could recall 80% of the words when given cued recall (given first word of pair and asked for second word, whereas 'non-imagers' recalled only 45%. Shows the value of double-encoding.