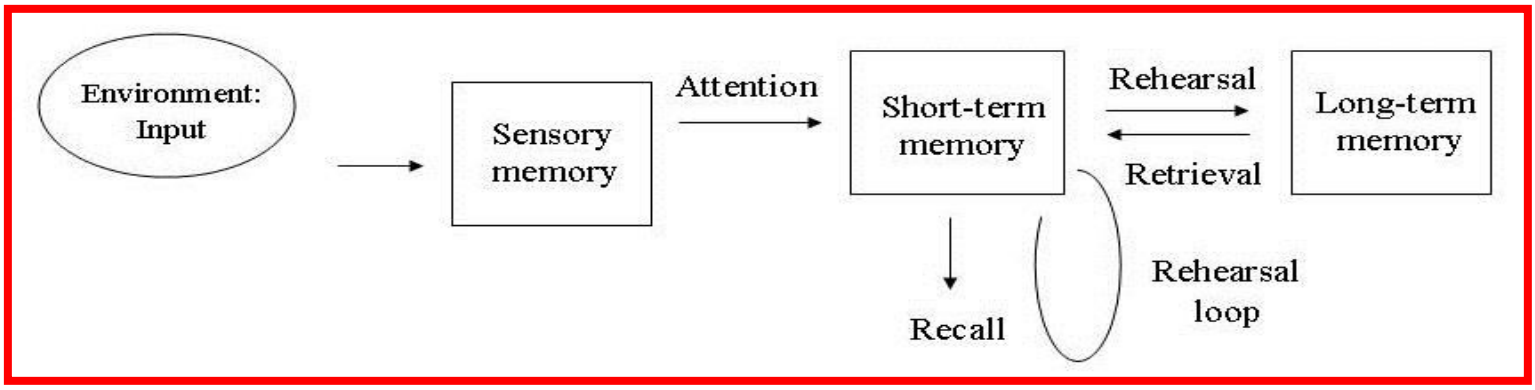
MEMORY

WHAT THE SPEC SAYS:-

- A) the multi-store model of memory and features,
- B) types of long-term memory,
- C) the working memory model and features,
- D) explanations for forgetting,
- E) factors affecting the accuracy of eyewitness testimony,
- F) improving the accuracy of eyewitness testimony,

A)

- Richard Atkinson and Richard Shiffrin presented the concept of the multi-store model which describes how information flows through the memory system. The model suggests the memory is made up of three stores linked by processing.



- A stimulus from the environment will pass into the sensory register where it will be sorted into one of five stores. The two main stores are called iconic memory where visual information is coded and echoic memory where auditory information is coded. The duration is less that half a second whereas as it has a very high capacity. Very little of what goes into the sensory register passes further into the memory system.
- STM is known as a limited capacity store, because it can only contain between 5 to 9 items of information before forgetting takes place. Information in STM is coded acoustically and lasts about 30 seconds unless it is rehearsed.
- LTM is a potentially permanent store for information that has been rehearsed for a prolonged time and so its capacity is unlimited. LTMs tend to be coded semantically which means in terms of meaning. When we want to recall material that has been stored in LTM, it has to be transferred back into STM by a process called retrieval. According to the multi-store model, none of our memories can be recalled directly from LTM.

- **EVALUATION:**
  - Strength of the multi-store model is research shows that STM and LTM are qualitatively different. For example, Baddeley showed that we tend to mix up words that sound similar in our STM. But we mi up words that have similar meanings in our LTM. This clearly shows that coding in STM is acoustic and in LTM it is semantic. So, they are different which supports the idea that in the multi-store memory model the two memory stores are separate and independent.

- The multi-store model states that there is only one type of STM. However, evidence from people suffering from amnesia show that this cannot be true. For example, a patient called KF who had amnesia. Psychologists found that his STM for digits was very poor when they read them out loud to him. But his recall was much better when he was able to read the digits to himself. This suggests that there must be one store to process visual information and another for auditory information and therefore a limitation of the MSM.
- According to the MSM, what matters in rehearsal is the amount of it that you do. However, psychologists found that what matters is actually the type of rehearsal. They discovered that there are two types of rehearsals. Maintenance is the type described in the MSM but this does not transfer information into LTM, it just maintains it in STM. Elaborate rehearsal is needed for long-term storage, which occurs when you link information to your existing knowledge. This is a limitation of the MSM because it is another research finding that cannot be explained by the model.

B)

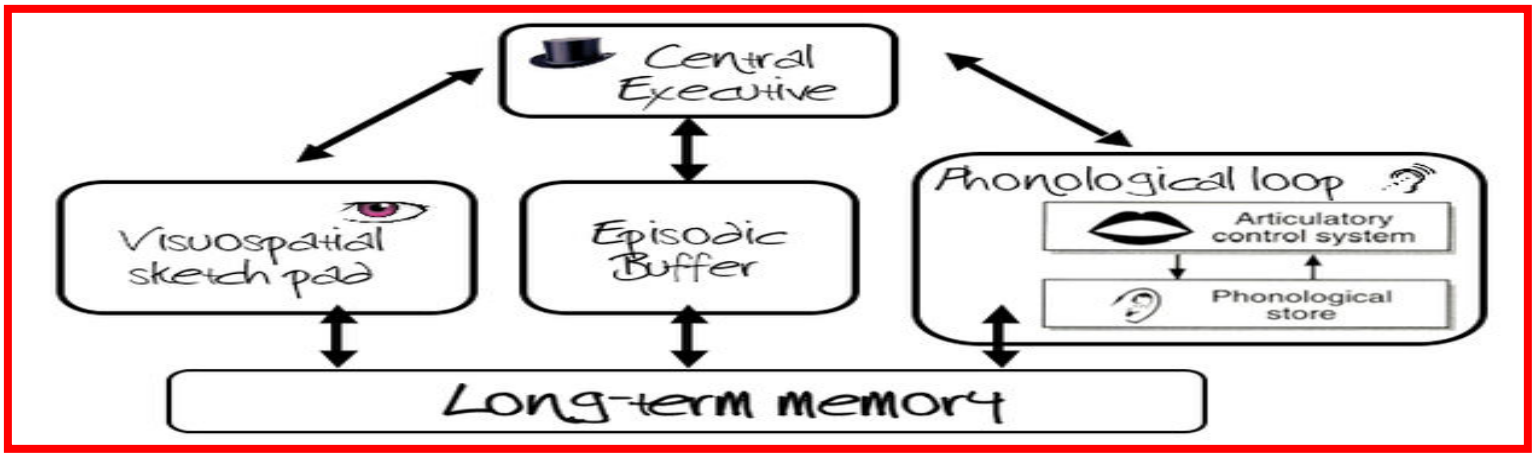
- In 1985 Endel Tulving realised that the MSM's view of LTM was too simplistic and inflexible. He proposed that there are three different LTM stores, containing different types of information.

- **EPISODIC MEMORY:** refers to our ability to recall events from our lives. These memories are time-stamped and include several elements, such as people and places, objects and behaviours. Finally, you have to make a conscious effort to recall them. The case studies of HM and Clive Wearing both support the idea of different stores of LTM. This is shown when both of them had difficulty recalling events that had happened from their past. But, their semantic and procedural memories were working just as normal. This means that the different types of LTM are also stored in different parts of the brain.
- **SEMANTIC MEMORY:** this store contains out knowledge of the world. For example, the taste of a certain food and the meaning of words. These memories are not time-stamped. Semantic memory is less personal and more about facts we all share. It contains an immense collection of material which, given its nature, is constantly being added to. Cohen and Squire disagree with Tulving's division of LTM into three types. They argue that episodic and semantic memories are stored together in one LTM store called declarative memory i.e. memories that can be consciously recalled. In contract procedural memories are non-declarative.
- **PROCEDURAL MEMORY:** our memory for actions, skills or how we do things. We can recall these memories without conscious awareness or a great deal of effort. For example, driving a car. In 1994 Tulving got their participants to perform various memory tasks while their brains were scanned using a PET scanner. They found that episodic and semantic memories were both recalled from an area of the brain known as the prefrontal cortex. This area is divided in two, one on each hemisphere of the brain. The left prefrontal cortex was involved in recalling semantic memories and episodic memories were recalled from the right prefrontal cortex. This is a strength because it supports the view that there is a physical reality to the different types of LTM, within the brain. It has also been confirmed many times in later research studies, further supporting the validity of this finding.

C)

- The working memory model is an explanation of how short term memory is organised and how it functions. The model consists of four main components, each of which is qualitatively different especially in terms of capacity and coding.

- **CENTRAL EXECUTIVE:** is essentially an attentional process that monitors incoming data, makes decisions and allocates slave systems to tasks. The central executive has a very limited storage capacity.
- **PHONOLOGICAL LOOP:** this is one of the slave systems. It deals with auditory information and preserves the order in which the information arrives. The phonological loop is subdivided into the phonological store, which stores the words you hear and the articulatory process, which allows maintenance rehearsal in a 'loop' to keep them in working memory while they are needed. The capacity of this 'loop' is said to be two seconds' worth of what you can say.
- **VISUO-SPATIAL SKETCHPAD:** this stores visual and/or spatial information when required. It also has a limited capacity, which according to Baddeley in 2003 is about three or four objects. The visuo-spatial sketchpad is subdivided into the visual cache, which stores visual data and the inner scribe, which records the arrangement of objects in the visual field.
- **EPISODIC BUFFER:** this was added to the model by Baddeley in 2000. It is a temporary store for information, integrating the visual, spatial and verbal information processed by other stores and maintaining a sense of time sequencing- basically recording events that are happening. It has limited capacity of about four chunks. The episodic buffer links working memory to LTM and wider cognitive processes such as perception.



- **EVALUATION:**
  - KF suffered brain damage which resulted in poor STM ability for verbal information but could process visual information normally. This suggests that just his phonological loop had been damaged leaving other areas of memory intact. This supports the existence of a separate visual and acoustic store. However, evidence from brain-damaged patients may not be reliable because it concerns unique cases with patients who have had traumatic experiences.
  - In 1975 Baddeley showed that participants had more difficulty doing two visual tasks than doing both a visual and verbal task at the same time. This increased difficulty is because both visual tasks compete for the same slave system whereas, when doing a verbal and visual task simultaneously, there is no competition. This means there must be a separate slave system that processes visual input and so this study supports the separate existence of the visuo-spatial sketchpad.
  - Cognitive psychologists suggest that the central executive component is unsatisfactory and doesn't really explain anything. The central executive needs to be more clearly specified than just simply being attention. For example, some psychologists believe it may consist of different components. This means that the working memory model hasn't been fully explained.

D)

- **INTERFERENCE THEORY:** interference occurs when two pieces of information conflict with each other, resulting in forgetting of one or both, or in some distortion of memory. It is likely that the conflicting memories were stored at different times and this thought lead psychologists to recognise that there are two types of interference.
    - Proactive interference- occurs when an older memory interferes with a newer one. For example, your teacher has learned so many names in the past that she has difficultly remembering the names of her current class,
    - Retroactive interference- occurs when a newer memory interferes with an older one. For example, your teacher has learned so many new names this year that she has difficultly remembering the names of the students last year,

In both cases, the interference is worse when the memories are similar, as discovered by McGeoch and McDonald in 1931. They studied retroactive interference by changing the amount of similarity between two sets of materials. Participants had to learn a list of 10 words until they could remember then with 100% accuracy. They then learned a new list. There were six groups of participants who had to learn different types of lists: synonyms, antonyms, words unrelated to the original ones, nonsense syllables, three-digit numbers and a control group. They found that when the participants then recalled the original list of words, their performance depended on the nature of the second list. The most similar material (synonyms) produced the worst recall. This shows that interference is strongest when the memories are similar.

- Thousands of lab studies have been carried out into interference theory. Most of these studies show that both types of interference are very likely to be common ways we forget information from LTM. This is a strength because lab experiments control the effects of irrelevant influences and thus give us confidence that interference is a valid explanation for at least some forgetting.
- The stimulus materials used in most studies are lists of words. However, in everyday life this is not realistic to what we learn. This is a limitation because the use of artificial tasks makes interference much more likely in the lab. Interference may not be as likely an explanation for forgetting in everyday as it is in the lab.
- In 1977 Baddeley and Hitch wanted to find out if interference was a better explanation for forgetting than the passage of time. They asked rugby players to try to remember the names of the teams they had played so far in that season, week by week. The results clearly showed that accurate recall did not depend on how long ago the matches took place. Much more important was the number of games they played in the meantime. This study shows that interference explanations can apply to at least some everyday situations. Therefore, increasing validity.

- **RETRIEVAL FAILURE THEORY** this is forgetting due to insufficient cues. If these cues are not available at the time of recall, it may make it appear as if you have forgotten the information but, in fact, this is due to retrieval failure- not being able to access memories that are there. In 1983 Tulving discovered a consistent pattern to his findings in which he called the encoding specificity principle. This states that if a cue is to help us recall information it has to be present at encoding (when we learn the material) and at retrieval (when we are recalling it). If the cues at encoding and retrieval are different or absent there will be some forgetting. Some cues are encoded at the time of learning but not in a meaningful way. There are two types of this
    - Context-dependant forgetting- In 1975 Godden and Baddeley carried out a study on scuba divers. The divers learned a list of words either underwater or on land and then were asked to recall the words either under water or on land. This created four conditions: 'learn on land, recall on land,' 'learn on land, recall underwater,' 'learn underwater, recall underwater,' 'learn underwater, recall on land.' In the two conditions where the environment contexts of learning and recall matched the accurate recall was 40% higher. This is because when the contexts of learning and recall did not match the external cues available at learning were different from the ones at recall and this led to retrieval failure.
    - State-dependant forgetting- In 1998 Carter and Cassaday gave anti-histamine drugs to their participants. The anti-histamines had a mild sedative effect making their participants

slightly drowsy. This creates an internal physiological state different from the 'normal' state of being awake and alert. The participants had to earn lists of words and passages of prose and then recall the information. There were four conditions: 'learn on drug, recall when on it,' 'learn on drug, recall when not on it,' 'learn not on drug, recall when on it,' 'learn on drug, recall when not on it.' In the conditions where there was a mismatch between internal state at learning and recall, performance on the memory test was significantly worse. So when cues are absent, there is more forgetting.

- Lots of research supports the retrieval failure explanation for forgetting such as the studies listed above. In 2010 Michael Eyesenck argues that retrieval failure theory is perhaps the main reason for forgetting LTM. This is a strength because supporting evidence increases the validity of an explanation. This is also good because it shows that retrieval failure occurs in real-life situations as well as in the highly controlled conditions in the lab.
- Baddeley argues that context effects are actually not very strong, especially in real life. Different contexts have to be very different indeed before an effect is seen. For example, learning something in one room and recalling it in another is unlikely to result in much forgetting because these environments are generally not different enough. This is a limitation because it means that the real-life applications of retrieval failure due to contextual cues don't actually explain much forgetting.
- The context effect may be related to the kind of memory being tested. Godden and Baddeley replicated their underwater experiment but used a recognition test instead of recall- participants had to say whether they recognised a word read to them from the list, instead of retrieving it themselves. When this was tested there was no context-dependant effect; performance was the same in all four conditions. This is a further limitation of context effects because it means that the presence or absence of cues only affects memory when you test it in a certain way.

E)

- **MISLEADING INFORMATION:** this is the incorrect information given to the eyewitness - usually after the event. It can take many forms, such as leading questions and post-event discussion between co-witnesses and/or other people.

  - Leading Questions- Loftus and Palmer in 1974 arranged for participants (students) to watch film clips of car accidents and then gave them questions about the accident. In the critical question (leading question) participants were asked to describe how fast the cars were travelling: 'About how fast were the cars going when they ***hit*** each other?' There were five groups of participants; each was given a different verb: hit, contacted, bumped, collided, smashed. The verb contacted resulted in a mean estimated speed of 31.8mph. The verb smashed was 40.5mph. The leading question biased the eyewitness recall of an event. The response-bias explanation suggests that the wording of the question has no real effect on the participants' memories, but just influence how they decide to answer. A leading question using the word ***'smashed'*** encourages them to choose a higher speed estimate. However, Loftus and Palmer then conducted a second experiment that supported the substitution explanation- the wording of the leading question actually changes the participants memory of the film clip. This was demonstrated because participants who originally heard 'smashed' later were more likely to report seeing broken glass (there was none) than those who heard 'hit'. The critical verb altered their memory of the incident.
  - Post-event discussion- when co-witnesses to a crime discuss it with each other, their eyewitness testimonies may become contaminated. This is because they combine (mis)information from other witnesses with their own memories. Research has demonstrated how this happens. In 2003 Fiona Gabbert studied participants in pairs.

Each participant watched a video of the same crime, but filmed from different points of view. This meant that each participant could see elements in the event that the other could not. Both participants then discussed what they had seen before individually completing a test of recall. The researchers found that 71% of the participants mistakenly recalled aspects of the event that they did not see in the video but had picked up in the discussion. The corresponding figure in the control group where there was no discussion was 0%. Gabbert concluded that witnesses often go along with each other, either to win social approval or because they believe the other witnesses are right and they are wrong. They called this memory conformity.

- Any research into misleading information has hugely important practical uses in the real world, where the consequences of EWT can be very serious indeed. Therefore, police officers need to be very careful about how they phrase their questions when interviewing eyewitnesses. Psychologists believe that these real-life applications can make an important positive difference to the lives of real people, for instance by improving the way the legal system works and by appearing in court trials as expert witnesses.

- A limitation of Loftus and Palmer's study is that their participants watched film clips of car accidents and this is a very different experience from witnessing a real accident, mainly because such clips lack the stress of a real accident. There is some evidence that emotions can have an influence on memory. This is a limitation because studies that use such artificial tasks may tell us very little about how leading questions affect EWT in cases of real accidents or crimes. This means that EWT could be more reliable than many studies suggest.

- There is evidence that older people are less accurate than younger people when giving eyewitness reports with all age groups being more accurate when identifying people of their own age group- own age bias. Research studies often use younger people as the target to identify and this may mean that some age groups appear less accurate but in fact this is not true. This means that individual differences play a big factor in EWT.

- **ANXIETY** this is a state of emotional and physical arousal. The emotions include having worried thoughts and feelings of tension whilst physical changes include an increased heart rate and sweatiness. It is not clear whether these effects make eyewitness recall better or worse.
  - Anxiety has a negative effect on recall- Anxiety creates physiological arousal in the body which prevents us paying attention to important cues, so recall is worse. One approach to study this is to look at the effect of weapons on accuracy of recall of the witness. In 1976 Johnson and Scott led participants to believe they were taking part in a lab study. While seated in a waiting room participants heard an argument in the next room. In the low-anxiety condition a man then walked through the waiting area, carrying a pen and with grease on his hands. In the high-anxiety condition a man walked out of the room carrying a paper knife that was covered in blood. The participants later had the chance to pick out the man from a set of 50 photos. 49% of the participants in the low-anxiety condition identified him. The corresponding figure for the high-anxiety condition was just 33%. The tunnel theory of memory argues that witness's attention narrows to focus on a weapon, because it is a source of anxiety.
  - Anxiety has a positive effect on recall- The stress of witnessing a crime creates anxiety through physiological arousal of the body. The flight-or-fight response is triggered which increases our alertness and improves our memory for the event because we become more aware of cues in the situation. In 1986 Yuille and Cutshall conducted a study of a real-life shooting in a gun shop in Vancouver, Canada. The shop owner shot a thief dead. There were 21 witnesses and 13 of them agreed to take part in the study. The interviews were held 4-5 months after the incident and were compared with the original police interviews made at the time of the shooting. Accuracy was determined by the number of details reported in each account aswell as the witnesses being asked to report how

stressed they had felt at the time of the incident. They found that the witnesses were very accurate in their accounts and there was little change in the amount of accuracy after 5 months. Those participants who reported the highest levels of stress were most accurate- about 88% compared to 75% for the less stressed group.

- According to Yerkes and Dodson the relationship between emotional arousal and performance looks like an 'inverted U'. Lower levels of anxiety produce lower levels of recall accuracy. But memory becomes more accurate as the level of anxiety experienced increases. However, there comes a point where the optimal level of anxiety is reached which is the maximum accuracy. If an eyewitness experiences any more stress than this, then their recall of the event suffers a drastic decline.

- The study of Johnson and Scott on the weapon focus may test surprise rather than anxiety and so the reason why the participants focus on the weapon may be because they are surprised rather than scared. This suggests that the weapon focus effect is due to unusualness rather than anxiety and therefore tells us nothing specifically about the effects of anxiety on EWT.
- Researchers usually interview real-life eyewitnesses sometime after the event. All sorts of things will have happened to the participants in the meantime that the researchers have no control over. This is a limitation of field research because it is possible that these extraneous variables may be responsible for the accuracy of recall. The effects of anxiety may be overwhelmed by these other factors, and impossible to assess by the time the participants are interviewed.
- Creating anxiety in participants is potentially unethical because it may subject people to psychological harm purely for the purposes of research. This is why real-life studies are so beneficial because there is no need to create such distress.

F)

- In 1992 Fisher and Geiselman argued that eyewitness testimony could be improved if the police used better techniques when interviewing witnesses. They recommended that such techniques should be based on psychological insights into how memory works, and called these techniques collectively the cognitive interview. There are four main techniques: report everything, reinstate the context, reverse the order and change perspective.
- In 1987 Fisher developed some additional elements of the CI to focus on the social dynamics of the interaction. For example, the interviewer should know when to establish eye contact. This is known as the enhanced cognitive interview.

- The CI is time-consuming and also requires special training but many forces have not been able to provide more than a few hours worth. This means it is unlikely that the proper version of the CI is actually used, which may explain why police have not been that impressed by it,
- Research shows that some parts of the CI are more useful than others. This finding is a strength because it suggests at least two elements should be used to improve police interviewing of eyewitnesses even if the full CI isn't used. This in turn increases the credibility of the CI amongst those who use it- police officers.
- A meta-analysis by Kohnken in 1999 combined data from 50 studies. The enhanced CI consistently provided more correct information than the standard interview used in police. This is a strength because studies such as this one indicate that there are real practical benefits to the police of using the enhanced version of the CI. The research shows that it gives the police a greater chance of catching and charging criminals, which is beneficial to society as a whole.