Memory

Coding

Coding can depend on the sensory organ - for vision it's called iconic and for hearing it's called echoic.

Sperling (1960) flashed a grid of 20 letters onto a screen for a 20th of a second. When participants were asked to recall random rows of letters the recall was strong. This suggests that the iconic store in the sensory register has a large capacity.

Information can be coded/ encoded in different ways; visually, acoustically or semantically.

Visual processing is a term that is used to refer to the brain's ability to use and interpret visual information from the world around us. When we encode information visually, we take note of the way it is presented, either as it appears on the page, or by colour, shape or size.

Acoustic processing is how information we hear is processed by the brain and attended to in memory.

Semantic processing takes note of the meaning of the information, in order to remember it more effectively.

Baddeley (1966) gave four 10-word lists to participants. The words were either acoustically similar/dissimilar or semantically similar/ dissimilar. He found that immediate recall was worst for acoustically similar words and recall after 20 minutes was worst for semantically similar words. This suggests that information in STM is coded acoustically, and LTM semantically.

Capacity

Capacity in memory is how much information we can retain.

Short-term memory has a limited capacity of 7 +/- 2 items and new information can displace old information, leading to forgetting.

The capacity of STM can be significantly altered by factors such as age (reduces) and practice (increases).

Chunking is a way to improve capacity of STM by grouping items so that each group is treated as one item by the short-term memory, improving recall as the overall number of 'items' is reduced.

Miller (1956) proposed that the capacity of short-term memory is around seven 'items', plus or minus two.

Miller (1956) suggested that short-term memory stores 'chunks' of information, rather than individual numbers or letters. However, Miller did not specify the size of each 'chunk', so the exact capacity of short-term memory is still unknown.

The immediate digit span is supported by early research from Jacobs (1887) who found that participants had an average span of 7.3 letters and 9.3 words.

Cowan (2001) concluded that the capacity of STM is 4 +/-1 chunks suggesting Miller's lower limit is more accurate.

Shallice & Warrington (1970) studied the case of K.F who had amnesia following a motorbike accident. His STM was severely impaired, instead of 7 items, KF was only able to recall 1 or 2 items from a list.

Duration

Duration in memory is how long information can be retained for.

The duration of short-term memory is minimal, less than 30 seconds without rehearsal.

Peterson & Peterson (1959) conducted a laboratory experiment to investigate the duration of short-term memory. They had 24 psychology students recalling three-letter trigrams at different intervals (3, 6, 9, 12, 15, or 18 seconds) while counting backwards. Peterson & Peterson found that recall accuracy decreased as the interval increased, with only 10% of trigrams correctly recalled at 18 seconds. They concluded that short-term memory has a limited duration of approximately 18 seconds.

However, Peterson & Peterson's study has low population validity as the sample does not represent the wider population and using students in the sample limits generalisation. Also the use of Psychology students in particular may introduce demand characteristics and decrease validity. The study has a lack of ecological validity which raises questions about its applicability to everyday memory situations. Despite this, in their duration study there were high levels of control and replicability, which contribute to its reliability.

Bahrick (1975) investigated the duration of long-term memory using 392 American university graduates. He showed participants photographs from their high-school yearbook. They were then given a group of names and asked to select the name that matched the photographs. The results showed that 90% of the participants were able to correctly match the names and faces, 14 years after graduating. Bahrick also found that 60% of the participants were able to correctly match the names and faces 47 years after graduation.

However, Bahrick's research used a sample of 392 American university graduates and therefore lacks population validity. Also the research is culturally biased (ethnocentric), which limits generalisation. Moreover, using students decreases the ability to generalise. Nevertheless, Bahrick's study has high levels of ecological validity as the study used real life memories.

General Evaluation

Many of the memory experiments can be replicated easily so have high reliability.

Many of the tasks on capacity and duration do not reflect real life so lack mundane realism.

Many of the supporting studies are lab experiments so lack ecological validity.

Other factors, such as age, may also affect short-term memory capacity.

Wagenaar (1986) kept a diary over the course of six years which recorded over 2,400 events. He tested himself on the events and found a 75% recall after 1 year and a 45% recall after 5 years, suggesting that the capacity of the long-term memory is very large, potentially limitless.

Multi-Store Model of Memory

The Multi-Store Model (MSM) was devised by Atkinson & Shiffrin (1968).

According to Atkinson & Shiffrin, memory is a linear process where information is processed by the senses, then transferred to short-term memory if attended to, and finally rehearsed into long-term memory.

The sensory register, short-term store, and long-term store are the three main components of the Multi-Store Model of memory.

All stimuli from the outside world if attended to passes into the sensory register. If information is attended to it passes from the sensory store into short-term memory. If the information is rehearsed it passes from short-term into long-term memory.

Research has highlighted two different types of rehearsal in memory; maintenance and elaborative. Maintenance is pure repetition, whereas elaborative is adding more meaning to the information, maybe by grouping it together or adding categories. However, maintenance rehearsal is effective in STM, but less so in LTM. Craik & Watkins (1973) found that elaborative rehearsal is needed for LTM.

To use the information in LTM we need to bring it out of the long-term memory and back into STM. This process is called retrieval.

Evaluation

The case of brain-damaged patient H.M supports the MSM of memory. H.M had problems with his short-term memory, but his long-term memory remained mostly intact. This supports the idea that STM and LTM are separate stores.

Glanzer & Cunitz (1966) conducted a laboratory experiment to test memory recall using a list of words. They suggest that the first few words on a list are rehearsed and pushed into LTM, whereas the last few words are still being rehearsed in STM. Glanzer & Cunitz demonstrated the 'primacy' and 'recency' effect in memory. This supports the idea that STM and LTM are separate stores.

The MSM is believed to be too simplistic, as memory is thought to be a complex process.

The MSM of memory has been useful in helping our understanding of how memory works, and most psychologists support the existence of separate stores for short-term and long-term memory.

Many of the supporting studies are conducted under controlled conditions in the lab, so have high reliability.

Many of the studies supporting the MSM are lab experiments so lack ecological validity.

Many of the supporting studies use students as their participants so lack population validity.

Working Memory Model

The working memory model (WMM) was devised by Baddeley & Hitch (1974).

The working memory model focuses on STM as an active process.

There are four separate components in the working memory model; the central executive, the phonological loop, the visuo-spatial sketch pad, and the episodic buffer.

The central executive is involved in problem solving, decision-making, attention control, planning, and synthesising information. The central executive manages attention, and controls information from the two 'slave stores'.

The visuo-spatial sketch pad stores visual and spatial information and is responsible for setting up and manipulating mental images. The visuo-spatial sketch pad ('inner eye') is also called the visual cache, which stores visual information. It also has an inner scribe for recording information.

The phonological loop stores speech-based sounds for brief periods and consists of the phonological store and the articulatory control process. The phonological store ('inner ear') holds auditory speech for a short duration in STM. The articulatory control process ('inner voice') allows maintenance rehearsal (repetition). The capacity of the articulatory control loop is believed to be about two seconds.

An additional component called the episodic buffer was added later in the year 2000, following criticism about the lack of explanation of how information transferred to and from LTM.

Baddeley (2000) argued the need for a separate buffer capable of representing and integrating inputs from all subcomponents of working memory and from long-term memory systems in a multidimensional code.

Baddeley (2000) added the episodic buffer as a temporary store to hold information before it passes into LTM. The episodic buffer relies heavily on executive processing and is responsible for recalling material from long-term memory and integrating it into working memory. The episodic

buffer integrates and manipulates material, binds information from different sources ready for LTM.

Evaluation

The WMM provides an explanation for dual tasks/ processing. Baddeley (1975) offered support for the WMM using dual task experiments, showing when both tasks are visual or both are verbal, performance declines.

Much of the supporting evidence for the WMM was conducted by Baddeley himself, which is subjective.

Shallice & Warrington (1970) reported that brain-damaged patient K.F could recall visual but not verbal information immediately after its presentation. This supports the WMM.

Like Baddeley, research by Shallice & Warrington (1970) support the WMM and the existence of separate visual and acoustic stores.

Laboratory experiments researching the WMM have low ecological validity. However, the WMM was developed based on evidence from lab experiments, so variables could be carefully controlled to produce reliable results.

The WMM has been criticised for being too simplistic and vague, e.g. it is unclear what the central executive is, or its exact role in attention is. Nevertheless, this is the model of memory that is used to explain processing today.

Types of Long-Term Memory

Tulving (1985) proposed the idea that there are three LTM stores.

The three types of long-term memory are episodic, semantic and procedural.

Episodic memory is our memory of personal experiences and significant events. Episodic memory refers to any events that can be reported from a person's life. These are episodes in your life that are emotionally significant to you that act as a mental diary of events.

Flashbulb memories are detailed autobiographical episodic memories that are stored permanently in LTM when they are first learned, often because they were of emotional/ historical importance in that person's life.

Semantic memory is the memory of facts, meanings, and concepts from our experiences in the world.

Procedural memories are motor/ muscle memories of how to do things, like ride a bike. Procedural memories are implicit in that we are typically unable to consciously recall them. We often do them without thinking.

LTM is the storage of memories over a long period of time. The two main types are Declarative/ Explicit (knowing what something is) and Non-declarative/ Implicit (knowing how something happens/is done).

Declarative memories are explicit memories that can be inspected and recalled consciously.

Some research studies have shown different areas of the brain responsible for each of the three LTM stores. This might explain why people with localised brain-damage only have certain parts of their memory affected.

Tulving et al (1994) suggest that episodic memories are encoded in the left prefrontal cortex and retrieval on the right.

Buckner & Peterson (1996) suggest that semantic memories are encoded in the left side of the prefrontal cortex and episodic memories on the right. They challenge Tulving's suggestions about where in the brain memories are encoded.

Evaluation

Tulving (2002) takes the view that episodic memory is a specialised category of semantic memory - now essentially the same store.

Belleville et al (2006) devised a real-world application by developing an intervention to help older people memorise episodic memories more effectively.

Hodges & Patterson (2007) found that people with Alzheimer's disease could form new episodic memories but not semantic ones.

Vicari (2007) did a case study of CL, an 8-year-old girl with brain damage. He found problems with her episodic LTM, but she had no trouble creating or recalling semantic memories. This shows that semantic and episodic memories are separate and use different brain areas.

A disadvantage of studying brain damaged patients is the inability to generalise.

H.M had brain damage following an operation for epilepsy. His episodic memory was damaged, but his semantic memory remained mostly intact.

Clive Wearing suffered from amnesia from a viral infection in his brain but he could still play the piano as before suggesting good procedural memory. Clive Wearing could not recall personal information from his life, like the names of his children, suggesting problems with his episodic memory.

Explanations for Forgetting

Interference

Interference is an explanation for forgetting in long-term memory.

Interference occurs when information that is similar in format gets in the way of recalling desired information.

There are two types of interference; retroactive and proactive.

Proactive interference is when new memories are forgotten.

Retroactive interference is when old memories are forgotten.

Therefore retroactive interference is when more recent information interferes with recalling older information and proactive is the opposite.

Support from McGeoch & McDonald (1931) who found that interference is worse for similar memories, especially when the new information is replacing old information (retroactive).

Danaher et al (2008) found that both recall, and recognition of an advertiser's message were impaired when participants were exposed to two advertisements for competing brands within a week.

Keppal & Underwood (1962) found that participants typically remembered trigrams that were presented first, suggesting proactive interference occurred.

Underwood (1957) showed proactive interference in that the more lists' participants learn, the worse their overall recall.

Tulving & Psotka (1971) supports retroactive interference in that forgetting is more of an accessibility issue.

Baddeley & Hitch (1977) support interference in a real-life setting using rugby players.

Muller & Pilzecker (1900) showed when participants were given a list of nonsense syllables, followed by a task, their recall is decreased.

Kane & Engle (2000) showed that individuals with greater working memory span were less susceptible to proactive interference.

Ceraso (1967) found that interference occurs because memories are temporarily not accessible rather than forgotten.

Coenen & van Luijtelaar (1997) suggest that if you reduce interference, you reduce forgetting.

Many of the experiments testing interference are lab based which lack ecological validity.

Other theories of forgetting may better explain why people forget, like cue dependency.

Researchers have questioned if interference causes a memory to disappear or if these effects are just temporary.

There is evidence for individual differences as some people are less affected by proactive interference than others.

Interference in everyday life does not occur that often as two memories need to be quite similar for forgetting to occur.

Retrieval Failure

Cue-dependent forgetting is a theory for why we cannot recall from long-term memory.

Forgetting in long-term memory is attributed to a lack of access to a memory rather than the availability of a memory.

A cue is a trigger of information that allows us to access a memory. A cue acts as a reminder and helps aid our memory. A lack of cues results in retrieval failure.

Eysenck & Keane (2010) suggest that retrieval failure is the main reason for forgetting in LTM.

Cues are used to help us remember information such as mnemonics (where each letter of a word represents something). People can forget information because of insufficient cues.

Internal and external cues, such as mood state, temperature, and smell, can facilitate recall of a long-term memory.

Retrieval due to absence of cues is sometimes called cue-dependent forgetting. Context-dependent cues are in the environment. Whereas state-dependent cues can be within the individual, how they feel.

Similar context and feelings during recall increase the chances of recalling a memory.

Support from Godden & Baddeley (1975) who found that divers improved their recall when using context-dependent cues. Godden & Baddeley found that when learning and recall was in the same context, memory was better. This study had high ecological validity as it was conducted in a real-life setting.

Baddeley (1997) argues that context effects are not very strong, at many times in life we learn and recall information in different contexts.

Carter & Cassaday (1998) gave antihistamine drugs to their participants creating a different internal physiological state to normal. Carter & Cassaday found when participants were in the same state for learning and recall, memory was better.

Aggleton & Waskett (1999) found that smell can act as a cue in helping people remember more.

Baker et al (2004) conducted the gum-gum study and found support for state-dependent forgetting.

Cues can help people retrieve information and have useful applications in real life.

Cues can aid memory recall and can be applied to useful strategies for students to learn.

Helpful to forensic and police work as it can facilitate recall from eyewitnesses more effectively.

Changing someone's state to test state-dependency can be unethical at times.

More research is needed into how cues are encoded in memory.

Tulving (1983) found that for cues to be helpful, they must be present at encoding (learning) and present at retrieval (recall). He subsequently developed the encoding specificity principle after his research into retrieval failure. The encoding specificity principle is the general principle that matching the encoding contexts of information at recall assists in the retrieval of episodic memories.

Factors affecting Eyewitness Testimony

Misleading Information

Memory contamination may affect EWT following post-event discussion.

Post-event discussion can have a powerful effect on the accuracy of eyewitness testimony.

One reason for the effects of post-event discussion could be conformity, especially in group situations.

Gabbert et al (2003) investigated the effect of post-event discussion on the accuracy of eyewitness testimony. The participants watched a video of a girl stealing money from a wallet. They were either tested individually (control group) or in pairs (co-witness group). All the participants in the co-witness group discussed the crime together. The results showed 71% of the witnesses in the co-witness group recalled information they had not actually seen. Also 60% of the witnesses in the co-witness group said that the girl was guilty, despite not seeing her commit a crime. In contrast the control group with no discussion gave 0% of mistaken information.

Lab experiments tend to lack ecological validity, and lab experiments like Gabbert, show videos which are arguably less emotionally arousing than witnessing real incidents.

Lab experiments on EWT usually use students which means the findings lack population validity. Gabbert tested two different populations; university students and older adults, so has higher validity. However, lab experiments do have high control over variables, so have high internal validity.

Eyewitnesses usually want to be helpful so are more likely to give desired responses, increasing demand characteristics. Lab experiments like Gabbert have a higher risk of demand characteristics.

Zaragoza & McCloskey (1989) argue that many answers in lab experiments are subject to demand characteristics.

Distortion could be the result of poor memory not post-event discussion.

Skagerberg & Wright (2008) suggest that memory is distorted more through contamination than post-event discussion.

Bodner et al (2009) found the effects of post-event discussion can be reduced if participants are warned of their impact.

Leading Questions

Misleading information like leading questions can distort people's memory of events.

Loftus & Palmer (1974) conducted their 1st experiment with 45 American students to investigate the effect of leading questions on the accuracy of eyewitness testimony. In the 1st study participants watched a video of a car crash and were asked about the speed of the cars using different verbs. There were five conditions in experiment 1; smashed, hit, bumped, contacted and collided. The verb smashed makes participants feel the car is travelling faster than it was. Loftus & Palmer found that participants estimate of speed for the smashed condition (40.5mph) was greater than the others. Loftus & Palmer's results demonstrate that leading questions can significantly affect the accuracy of eyewitness testimony and distort memory of the original event.

Loftus & Palmer did a 2nd experiment with 150 American students, who were asked about the speed of the cars using different verbs and then asked a critical question about seeing broken glass. There were three conditions in the 2nd experiment; smashed, hit and the control group. The results showed that students who were questioned using the verb "smashed" were more likely to report seeing broken glass, even though there was no broken glass in the video.

Loftus & Palmer's results demonstrate that leading questions can significantly affect the accuracy of eyewitness testimony and distort memory of the original event.

Loftus & Palmer concluded that estimated speed was affected by the verb used, suggesting leading questions affect memory.

The wording of questions can 'lead' people to give certain answers.

Experiments like Loftus & Palmer have high control and standardised procedures making them high in reliability. They also have high levels of control over the IV so are said to have high internal validity. However, lab experiments like Loftus & Palmer often use students so lack population validity, and the unrealistic settings mean they lack ecological validity.

Clifasefi et al (2013) used leading questions to implant a memory that never happened. They managed to implant a false memory that alcohol had previously made participants sick.

Laney et al (2008) led participants to believe they liked asparagus as a child, when in fact they did not. This shows how easily memory can be distorted.

To improve the accuracy of eyewitness testimony, the police should avoid the use of leading questions.

Sutherland & Hayne (2001) showed how central, important information is more likely to be recalled by witnesses, even if leading questions are used.

Yuille & Cutshall (1986) suggest that people are reliable witnesses in real life. They found accurate information from witnesses was recalled months later.

Foster et al (1994) suggest that information provided from real witnesses has more consequences than that from participants in studies.

Leading questions has many applications in real life, such as the use by the police or courts with real witnesses.

Anxiety

When anxiety/ arousal is too extreme or too little, memory accuracy will be reduced.

Clifford and Scott (1978) found individuals who witnessed a violent attack remembered fewer details about the event compared to a control group who saw a less stressful version.

Clifford & Hollin (1981) examined the relationship between the level of violence and recall. They found that the higher the level of violence depicted, the poorer participants' recall of an assault.

Valentine & Mesout (2009) support the negative effects of anxiety on memory in their study in the London Dungeons.

Loftus (1975) coined the term weapon focus. Loftus suggested when a person witnesses a crime in which a weapon was used, their attention tends to focus on the weapon.

Clifford and Scott (1978) found that witnesses to violent incidents generally recall less than witnesses to non-violent incidents, regardless of whether a weapon was used or not.

Yuille and Cutshall (1986) contradicts the importance of weapon focus in influencing eyewitness memory.

According to the Yerkes-Dodson Law, an increase in arousal improves performance but only up to a point. Once arousal has passed a critical point called the optimum, performance tends to decline.

Deffenbacher (1983) found the stress-performance relationship follows an inverted-U function (Yerkes Dodson Curve), where performance increases with stress up to an optimal point and then declines.

Bothwell et al (1987) found that “stable” participants showed rising levels of accuracy as stress levels increased. In contrast, the accuracy for “neurotic” participants decreased as stress increased.

Anxiety can, however, have a positive effect on accuracy of memory.

Yuille and Cutshall (1986) conducted a study on witnesses of a real-life incident and found that recall accuracy of a stressful event involving weapons was remarkably accurate, even after a long time. They reported that witnesses were accurate even 4-5 months after an event.

Christianson & Hubinette (1993) questioned 58 witnesses of real-life bank robberies in Sweden 4-15 months after the event and found that those threatened in some way (high anxiety) had improved recall and remembered more details.

Individual differences play a large part in the effects of anxiety on eyewitness testimony. There is no 'one size fits all' rule about the effects of anxiety on accuracy of EWT, everyone is different.

Halford & Milne (2005) found victims of violent crimes were more accurate in their recall of crime scene information than victims of non-violent crimes.

Real levels of anxiety cannot be created in a lab, this reduces the validity of the findings, and many real-life cases cannot be replicated, so the outcomes lack reliability.

Parker et al (2006) claims that lab experiments only test high or low anxiety, not moderate.

Laboratory experiments also have low external validity (e.g. ecological).

Pickel (1998) suggest that unusualness of an object can influence memory more than anxiety.

Improving Eyewitness Testimony

Cognitive interview is a questioning technique used by the police to enhance retrieval of information from the witnesses' memory.

The cognitive interview involves techniques such as mentally reinstating the context of the crime, considering different perspectives, recounting the incident in a different narrative order, and reporting every detail.

The interviewer will ask witnesses to mentally reinstate the environmental and personal context of the crime scene. Witnesses are asked to report the incident from different perspectives. Witnesses are then asked to recount the incident in a different narrative order. Lastly, witnesses are asked to report every detail, even if they think that detail is trivial.

Geiselman et al (1985) compared the cognitive interview with a standard police interview and hypnosis. They found that the cognitive interview led to better memory recall compared to standard interviews and hypnosis. The results showed the average number of correctly recalled facts for the cognitive interview was 41.2, but for hypnosis it was 38.0 and for a standard interview it was 29.4.

Geiselman & Fisher (1985) proposed that due to the recency effect, people tend to recall more recent events more clearly than others.

The cognitive interview leads to better memory for events, with witnesses able to recall more relevant information compared with a traditional interview method.

Köhnken et al (1999) found that the cognitive interview gained 34% more information than the standard police interview.

Fisher et al (1990) found that witnesses reported greater detail in their accounts of crimes when American detectives had been trained to use the cognitive interview technique.

Milne & Bull (2002) found that individual components of the cognitive interview are as effective as the standard interview (mentally reinstate).

Stein & Memon (2006) used female cleaners in Brazil to test the accuracy of the cognitive interview. They watched a video of an abduction and found that more accurate information was recalled after using the cognitive interview.

The cognitive interview is a standardised procedure so has high reliability in practice.

The cognitive interview can be used in real life, so has good practical applications.

The technique is more structured than the standard interview and seems more appropriate for crime-related interviews.

Not all police forces use the cognitive interview, making it less reliable.

The cognitive interview is far more time-consuming than the standard interview.

Kebbell & Wagstaff (1996) found that using the cognitive interview takes much more time, which is not effective.

Individual differences play a part in memory recall. Mello & Fisher (1996) found the cognitive interview produced more accurate information when used with older participants.

The enhanced cognitive interview devised by Fisher et al (1987) added detail to focus on the social dynamics of the interview interaction. This is believed to result in more accurate recollection of events.