Psychology Memory Revision Notes

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Saul McLeod, PhD July 10, 2025

Multi-Store Model

> The multi-store model of memory: sensory register, short-term memory and long-term memory. Features of each store: coding, capacity and duration.

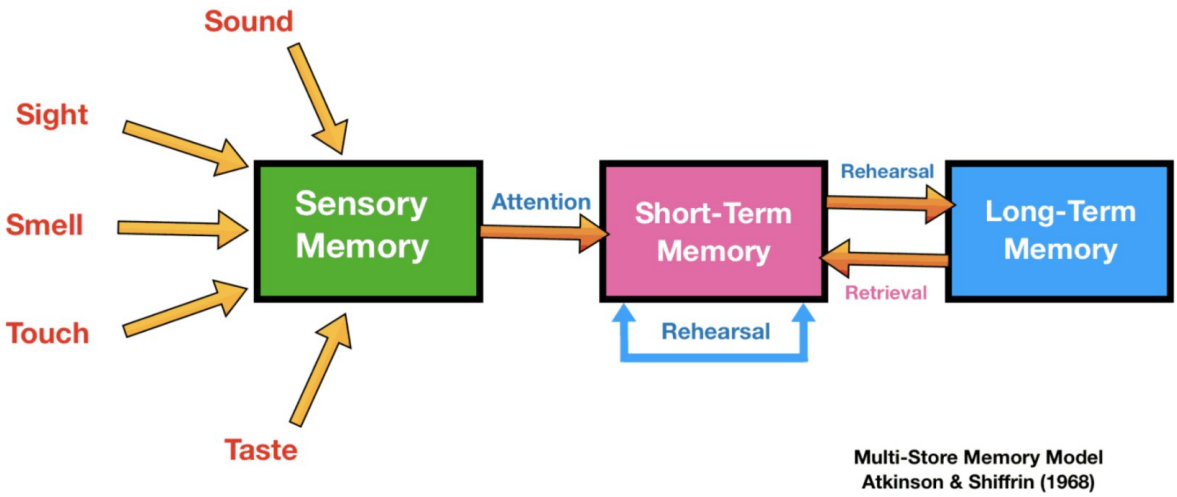
AO1

The multistore model of memory was proposed by Atkinson and Shiffrin and is a structural model.

They proposed that memory consisted of three stores: sensory register, short-term memory (STM), and long-term memory (LTM).

The model suggests that information flows through a series of distinct stages in a linear and sequential way, from one store to the next

Both short-term memory (STM) and long-term memory (LTM) are initially considered to be unitary stores within this model, meaning they form a single unit or store.



Multi-Store Memory Model
Atkinson & Shiffrin (1968)

Sensory memory is the information you get from your sense, your eyes, and ears.

When attention is paid to something in the environment, it is then converted to short-term memory.

Information from short-term memory is transferred to long-term memory only if that information is rehearsed (i.e., repeated).

Maintenance rehearsal is repetition that keeps information in STM, but eventually, such repetition will create an LTM.

If maintenance rehearsal (repetition) does not occur, then information is forgotten and lost from short-term memory through the processes of displacement or decay.

Each store has its own characteristics in terms of encoding, capacity, and duration.

- **Encoding** is the way information is changed so that it can be stored in memory. There are three main ways in which information can be encoded (changed): 1. visual (picture), 2. acoustic (sound), and 3. semantic (meaning).
- **Capacity** concerns how much information can be stored.
- **Duration** refers to the period of time information can last in-memory stores.

Sensory Register

The sensory register is the initial store where all sensory information, such as sights, sounds, smells, tastes, and touch sensations, is first received and briefly held.

- **Coding**: Information in the sensory register is coded according to the specific sense or modality in which it is received. This is referred to as **modality specific** coding. For visual information, it's called iconic coding, and for auditory information, it's called echoic coding.
- **Capacity**: The sensory register has a **very large** or potentially **unlimited** capacity. This is because your brain needs to be able to detect all the sensory input from your eyes, ears, nose, tongue, and skin in each moment.
- **Duration**: The duration of sensory memory is very short. Iconic (visual) memories are thought to last around **250 milliseconds** (or a quarter of a second), while auditory information might last slightly longer, around 3 to 4 seconds. Information fades away extremely quickly if no attention is paid to it.

Short Term Memory

Short-term memory (STM), also sometimes referred to as working memory, is where information is held temporarily after being paid attention to in the sensory register.

- **Coding**: The coding of short-term memory is primarily **acoustic**. This means information is stored based on its sound. Baddeley's (1966) research supports this, finding that participants had more difficulty remembering acoustically similar words in the short term, suggesting that STM relies heavily on sound-based encoding.
- **Capacity**: STM has a **limited capacity**. George Miller's (1956) research suggested the "magic number seven," proposing that people can typically hold **7 plus or minus 2 items** (between 5 and 9 items) in their short-term memory. Joseph Jacobs' (1887) digit span task also found the average capacity for letters was 7.3 and numbers 9.3. This capacity can be increased through a process called **chunking**, where individual items are grouped together into meaningful units.
- **Duration**: The duration of short-term memory is **short**, approximately **18 to 30 seconds** without rehearsal. Peterson and Peterson's (1959) study demonstrated this by having participants remember consonant trigrams while counting backwards to prevent rehearsal; recall significantly dropped after about 18 to 30 seconds. Maintenance rehearsal (repeating information) is crucial for keeping information in STM.

Long Term Memory

Long-term memory is the final store in the model, where information is stored for extended periods, potentially permanently.

- **Coding**: Long-term memory is primarily encoded **semantically**, meaning it stores information based on its meaning. Baddeley's (1966) study found that participants had more difficulty recalling semantically similar words after a delay (20 minutes later), suggesting that LTM stores information based on meaning rather than sound or appearanc.
- **Capacity**: The capacity of long-term memory is considered to be **unlimited**. No research to date has been able to find a limit to its capacity.
- **Duration**: The duration of long-term memory is **potentially forever** or very long-lasting. Bahrick et al. (1975) found that participants could remember names and faces of classmates from high school even up to 50 years later, demonstrating the long duration of some LTMs.

AO2 Scenario Question

The multi-store model of memory has been criticised in many ways. The following example illustrates a possible criticism.

Some students read through their revision notes lots of times before an examination but still, find it difficult to remember the information. However, the same students can remember the information in a celebrity magazine, even though they read it only once.

Explain why this can be used as a criticism of the multi-store model of memory.

(4 marks)

Answer

“The MSM states that depth of memory trace in LTM is simply a result of the amount of rehearsal that takes place.

The MSM can be criticised for failing to account for how different types of material can result in different depth memory traces even though they’ve both been rehearsed for a similar amount of time.

For example, people may recall information they are interested in (e.g., information in celebrity magazines) more than the material they are not interested in (e.g., revision notes) despite the fact that they have both been rehearsed for a similar amount of time.

Therefore, the MSM’s view of long-term memory can be criticised for failing to take into account that material we may pay more attention to or is more meaningful/interesting to us may cause a deeper memory trace which is recalled more easily.”

Strengths of the Multi-Store Model

AO3

1. Influential as a Foundational Model:

The Multi-Store Model was the **first cognitive explanation of memory**, shifting focus from purely biological explanations.

It provided a coherent framework for understanding memory processes and stimulated significant research and interest in the field of memory.

Its structural nature and clear distinctions between stores laid the groundwork for subsequent, more complex memory models.

2. Acknowledges Qualitative Differences:

The MSM accurately identifies and represents the qualitative differences between STM and LTM, such as their primary coding methods (acoustic for STM, semantic for LTM), and differences in capacity and duration.

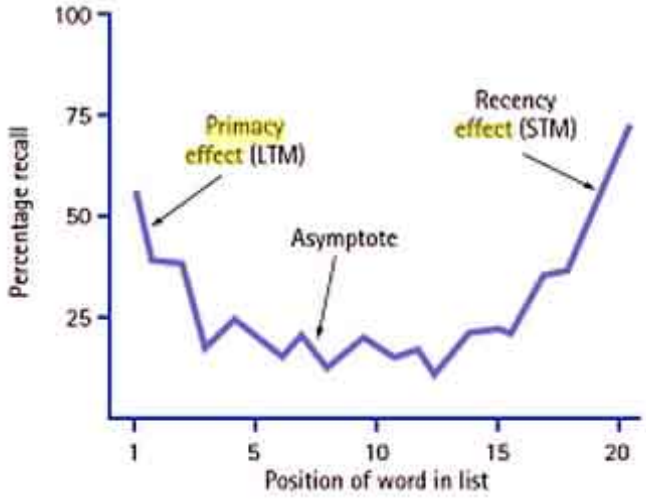
This distinction, supported by research like Baddeley's studies on coding, contributes to its accurate portrayal of memory.

3. Empirical Evidence for Separate Stores:

AO1 or AO3

Research studies can either be knowledge or evaluation:

- If you refer to the procedures and findings of a study, this shows knowledge and understanding (AO1).
- If you comment on what the studies show and what it supports and challenges the theory in question, this shows evaluation (AO3).



Glanzer and Cunitz (1966) and Murdock (1962)

When presented with a list of words, participants tend to remember words at the beginning (primacy effect) and at the end (recency effect) of the list, but struggle with those in the middle.

When presented with a list of words, participants tend to remember words at the beginning (**primacy effect**) and at the end (**recency effect**) of the list, but struggle with those in the middle.

This phenomenon suggests that the initial words are rehearsed more and transferred to a long-term store, while the last words are still present in a short-term store, supporting the idea of functionally separate memory stores.

Case studies of individuals with brain damage

A well-known example is Patient HM, who, after brain surgery to treat epilepsy, was unable to form new long-term memories but retained his short-term memory.

This suggests that damage to one store (LTM) does not necessarily affect the other (STM), providing evidence for their separate existence.

Weaknesses/Criticisms of the Multi-Store Model

AO3

1. Oversimplification of Short-Term Memory (STM):

A significant criticism is that the MSM presents STM as a **single, unitary store**. However, evidence from case studies challenges this view.

For instance, Shallice and Warrington (1970) studied patient KF, who, after a motorbike accident, suffered impaired short-term memory for verbal information but retained his visual short-term memory.

This suggests that STM is not a monolithic entity but rather comprises multiple components, perhaps for different types of information (e.g., verbal and visual).

This limitation directly led to the development of the more complex **Working Memory Model** by Baddeley and Hitch (1974), which elaborated on the idea of an active, multi-component short-term memory system.

2. Oversimplification of Long-Term Memory (LTM):

The MSM is criticized for oversimplifying LTM as a **single, unitary store**. Subsequent research has revealed that LTM is composed of multiple distinct types:

- **Procedural memory**: memory for actions and motor skills (e.g., tying shoelaces, riding a bike).
- **Episodic memory**: memories of personal, experienced events (e.g., a birthday party, first day of school).
- **Semantic memory**: memories for knowledge or factual information (e.g., capital of Sweden).

The case study of Clive Wearing, who suffered severe damage to his episodic memory but retained his procedural memory (e.g., playing the piano), strongly contradicts the idea of LTM being a single store.

Because the MSM lacks this detail about the different types of LTM, its explanatory power regarding how memory fully works is limited.

3. Over-Emphasis on Rehearsal:

The MSM suggests that **maintenance rehearsal** (repetition) is the primary mechanism for transferring information from STM to LTM.

However, this is considered an oversimplification. Craik and Lockhart (1972/1973) argued that the **type of rehearsal** or **depth of processing** is more critical than the amount of rehearsal.

A common criticism illustrates this: students might read revision notes many times but struggle to remember them, yet easily recall information from a celebrity magazine read only once.

This suggests that meaningfulness or interest in the information, leading to deeper processing (elaborative rehearsal), is more important for LTM transfer than mere repetition, contradicting the MSM's linear view of rehearsal.

4. Artificiality of Supporting Research (Lack of Ecological Validity):

Many studies that support the MSM, such as Peterson and Peterson's (1959) research on STM duration using consonant trigrams and backward counting, are conducted in highly controlled laboratory settings with **artificial tasks**.

These tasks often bear little resemblance to how memory is used in daily life.

This **lack of ecological validity** limits the extent to which the findings can be generalized beyond the laboratory, raising questions about the real-world applicability of the model's conclusions.

5. Passive Nature of Stores:

The MSM portrays memory stores as **passive containers** that simply hold information.

This contrasts with later models like the Working Memory Model, which describe STM as an **active processor** that manipulates and works with information.

This more dynamic view of short-term memory is seen as a significant improvement over the MSM's simpler, passive representation.

6. Linear and Unitary Assumptions:

The model assumes a strictly **linear flow of information** from one store to the next.

However, it is plausible that some information might bypass STM and go directly to LTM, or that more complex interactions occur.

The model's assertion that STM and LTM are entirely **unitary stores** is a core aspect that has faced significant challenge from subsequent research and models, such as the Working Memory Model, which offers a much more detailed and accurate account of short-term memory.

Working Memory Model

> The working memory model: central executive, phonological loop, visuo-spatial sketchpad and episodic buffer. Features of the model: coding and capacity.

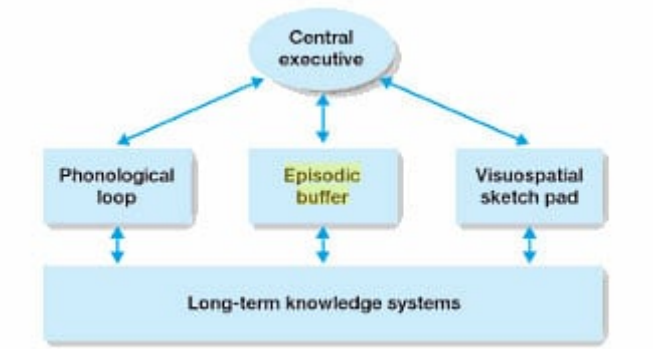
AO1

The working memory model (Baddeley and Hitch, 1974) replaced the idea of a unitary STM.

Unlike the Multi-Store Model's idea of STM as a passive, unitary store, the WMM views it as an active, multi-component system that not only stores information but also processes and manipulates it

Components of the Working Memory Model

The WMM consists of four key components: the central executive, the phonological loop, the visuo-spatial sketchpad, and the episodic buffer.



1. Central Executive (CE):

This is considered the “control center” or “boss” of the working memory system, responsible for its supervisory function.

It directs information to the other components (known as “slave systems”) and allocates attention to tasks.

It’s crucial for higher-level thinking processes such as concentration, planning, and problem-solving.

The central executive decides what information to pay attention to and what to ignore, especially when dealing with a lot of information that could overload working memory.

It can process information from any sensory modality.

2. Phonological Loop (PL):

This component stores and processes verbal and auditory information.

It functions as a limited-capacity, temporary storage system for holding verbal information in a speech-based form.

It also plays a key role in the development of reading.

Sub-components:

The phonological loop is split into two parts:

1. **Phonological Store (Inner Ear)**: This part holds speech-based information and receives and stores sounds.
2. **Articulatory Control Process (Inner Voice)**: This is where verbal information is rehearsed, helping to prepare speech and think in words. For example, when you repeat a phone number to remember it, your “inner voice” is at work.

3. Visuo-Spatial Sketchpad (VSS):

This component stores and manipulates visual and spatial information, acting like an “inner eye”.

It helps you picture things, such as the layout of a room or the architecture of a famous landmark, by combining visual and spatial information from other stores to create a “complete picture”.

Sub-components:

Some researchers, like Logie, suggest the VSS can be broken down into two processors:

1. **Visual Cache**: A passive store for forms and color.
2. **Inner Scribe**: An active store that holds information about the relationship between objects in 3D space, records their arrangement, and rehearses/transfers information to the central executive.

4. Episodic Buffer (EB):

This component was added to the model by Baddeley in 2000 to address some shortcomings and explain how information is effectively combined.

It acts as a “backup” or temporary store.

Its primary function is to integrate and synthesize different types of data (auditory, visual, spatial) processed by the other slave systems, as well as information retrieved from Long-Term Memory (LTM), into a single, coherent sequence or representation.

This makes it crucial for linking STM to LTM. It is “modality free,” meaning it can store and process both visual and verbal short-term memories.

For example, when reading a book, it helps recall and integrate visual images and other details from LTM into your current working memory.

Features of the Model: Coding and Capacity

Coding:

- The **Phonological Loop** primarily uses **acoustic** coding (sound-based).
- The **Visuo-Spatial Sketchpad** uses **visual and spatial** coding.
- The **Central Executive** can process information from **any sensory modality**.
- The **Episodic Buffer** is **modality free**, integrating various types of coded information.

Capacity:

- The **Central Executive** has a **very limited capacity**, able to manage only one stream of information at a time. Some sources suggest it’s limited to 4 items plus or minus one.

- The **Phonological Loop** has a **limited capacity**, typically what can be articulated or rehearsed in about 2 seconds. This is supported by the “word length effect,” where people recall more short monosyllabic words than longer polysyllabic ones.
- The **Visuo-Spatial Sketchpad** also has a **limited capacity**, estimated at around 4-5 chunks.

Supporting Evidence and Strengths

The Working Memory Model is supported by several lines of research:

1. Case Studies (e.g., KF):

The case study of patient KF, who suffered brain damage from a motorcycle accident, provides strong support for the WMM.

KF showed impaired short-term memory for verbal information but relatively intact visual short-term memory.

This suggests that the components of memory that process auditory and visual stimuli (the phonological loop and visuo-spatial sketchpad) are separate systems, as proposed by the WMM.

2. Dual-Task Studies:

These experiments demonstrate that people can perform two tasks simultaneously without significant interference if the tasks utilize different components of working memory (e.g., one verbal and one visual task).

However, performance is impaired if both tasks compete for resources within the same component.

For instance, Claire can search photos (visual) and listen to music (auditory) at the same time, but finds it difficult to read emails (verbal) while talking on the phone (verbal), as both require the phonological loop.

Similarly, Bryan (experienced driver) can drive (visuo-spatial) and hold conversations (phonological loop) simultaneously, unlike Bob (novice driver) whose driving demands all his attention.

This supports the idea of separate slave systems and the central executive’s role in allocating resources.

AO1 or AO3

Research studies can either be knowledge or evaluation:

- If you refer to the procedures and findings of a study, this shows knowledge and understanding.
- If you comment on what the studies show and what it supports and challenges the theory in question, this shows evaluation.

Baddeley and Hitch conducted an experiment in which participants were asked to perform two tasks at the same time (dual task technique).

A digit span task required them to repeat a list of numbers, and a verbal reasoning task which required them to answer true or false to various questions (e.g., B is followed by A?).

Results: As the number of digits increased in the digit span tasks, participants took longer to answer the reasoning questions, but not much longer – only fractions of a second.

And they didn't make any more errors in the verbal reasoning tasks as the number of digits increased.

Conclusion: The verbal reasoning task made use of the central executive, and the digit span task made use of the phonological loop.

3. Brain Scanning Evidence:

Studies using techniques like PET scans and fMRI provide physiological evidence.

Paulesu et al. (1993) used PET scans and found that different parts of the phonological loop activated distinct brain areas (e.g., articulatory control process in Broca's area, phonological store in a different area), supporting the separation of its sub-components.

Braver et al. (1997) found increased activity in the prefrontal cortex as the cognitive load on the central executive increased, supporting its role in task allocation and its limited capacity.

Neuroscanning research has also shown different brain areas are active when a person performs a verbal task versus a visual task, linking these activities to different parts of the working memory model, such as the visuo-spatial sketchpad for visual tasks and the phonological loop for verbal tasks.

Parapacaran's fMRI study suggested the physical location of the episodic buffer in the prefrontal cortex when information was integrated.

4. Active Processor View:

The WMM's view of STM as an active processor, capable of manipulating information, is a significant strength over the Multi-Store Model's passive view.

It provides a better account of STM than the Multi-Store Model.

Limitations and Criticisms

Despite its strengths, the Working Memory Model also faces criticisms:

1. Vague Nature of the Central Executive:

A common criticism is that the central executive is too vague and poorly defined.

Its exact role, particularly in terms of attention and decision-making, remains unclear and largely untestable.

Even Alan Baddeley, one of the model's proposers, admitted it's the "most important but the least understood component".

Some psychologists suggest it might be divided into separate sub-components for different functions like focusing or switching attention.

2. Reliance on Lab Studies:

Many of the studies supporting the WMM, especially dual-task experiments, are conducted under highly controlled laboratory conditions.

This can lead to a lack of ecological validity or mundane realism, meaning the tasks might be unrealistic and the findings may not accurately reflect how memory works in everyday life.

Demand characteristics, where participants behave differently because they know they are being studied, can also be a problem.

3. Unitary Nature of the Visuo-Spatial Sketchpad:

Some research challenges the idea of a single, unitary visuo-spatial sketchpad.

For example, Walber et al. (2011) found that people blind from birth could understand spatial layouts using touch, activating similar brain areas to sighted individuals.

This suggests that spatial awareness might be separate from visual processing, implying the VSS may need to be further divided into distinct visual and spatial components.

4. Limited Explanation for LTM and Musical Memory:

The model has been criticized for not fully explaining the link between working memory and Long-Term Memory.

Additionally, it fails to account for musical memory; for instance, people can listen to instrumental music without impairing performance on other acoustic tasks, which the model struggles to explain.

5. Limitations of Case Study Evidence:

While case studies like KF provide valuable insights, they involve unique individuals with traumatic experiences, making it difficult to generalize findings to the wider population. T

The trauma itself might contribute to the cognitive changes, making it hard to pinpoint the exact cause of the memory deficits.

AO2 Scenario Question

Bryan has been driving for five years. Whilst driving, Bryan can hold conversations or listen to music with little difficulty.
Bob has had four driving lessons. Driving requires so much of Bob's concentration that, during lessons, he often misses what his driving instructor is telling him.
With reference to features of the working memory model, explain the different experiences of Bryan and Bob. (4 marks)

> A tricky question – the answer lies in Bryan being able to divide the different components of his STM because he is experienced at driving and doesn't need to devote all his attention to the task of driving (controlled by the visuospatial sketchpad).

Answer

"Because Bryan has been driving for five years it is an 'automated' task for him; it makes fewer attentional demands on his central executive, so he is free to perform other tasks (such as talking or listening to music) and thus is able to divide resources between his visuospatial sketch pad (driving) and phonological loop (talking and listening to music).

As Bob is inexperienced at driving, this is not the case for him – his central executive requires all of his attentional capacity for driving and thus cannot divide resources effectively between components of working memory."

AO3

Working memory is supported by dual-task studies. It is easier to do two tasks at the same time if they use different processing systems (verbal and visual) than if they use the same slave system.

For example, participants would find it hard to do two visual tasks at the same time because they would be competing for the same limited resources of the visuospatial sketchpad.

However, a visual task and a verbal task would use different components and so could be performed with minimum errors.

The KF Case Study supports the Working Memory Model. KF suffered brain damage from a motorcycle accident that damaged his short-term memory. KF's impairment was mainly for verbal information – his memory for visual information was largely unaffected.

This shows that there are separate STM components for visual information (VSS) and verbal information (phonological loop).

However, evidence from brain-damaged patients may not be reliable because it concerns unique cases with patients who have had traumatic experiences.

One limitation is the fact that little is known about how the central executive works. It is an important part of the model, but its exact role is unclear.

Another limitation is that the model does not explain the link between working memory and LTM.

Explanations for Forgetting

> Explanations for forgetting: proactive and retroactive interference and retrieval failure due to absence of cues.

Interference

AO1

Interference is an explanation for forgetting from long-term memory – two sets of information become confused.

Interference theory suggests that forgetting occurs because other information confuses or disrupts our memories.

This is more likely to happen when the information is similar. Interference can involve two sets of information becoming confused with each other

1. **Proactive interference** (pro=forward): his occurs when old or existing memories in our long-term memory affect new memories. The old information "moves forward in time" and disrupts the recall of more recently learned information. For example, if you consistently park your car in the same spot at work, and then one day you have to park in a new space, your old habit of parking in the usual spot might interfere with remembering where you parked that particular day.
2. **Retroactive interference** (retro=backward): This occurs when new memories from new learning affect old or existing memories. In this case, later learning interferes with earlier learning, meaning new memories disrupt old ones. For instance, if you get a new bank card with a new PIN, learning this new PIN might make it harder to remember the PIN for your older card

Research Evidence for Proactive Interference:

AO3

Greenberg and Underwood (1999): Participants learned four word lists with 48-hour intervals between testing each list.

The percentage of correctly recalled words decreased as more word lists had been learned previously (from 69% for the first list to 25% for the fourth list). T

his suggests that previously learned information moves forward and interferes with the recall of new information, demonstrating proactive interference.

Research Evidence for Retroactive Interference:

AO3

- **McGeoch and McDonald (1931)**: Participants learned a list of 10 words until they could recall them perfectly. Then, different groups were given a second list to learn that varied in similarity to the first (e.g., synonyms, antonyms, unrelated words, numbers, consonant syllables). When asked to recall the original 10 words, forgetting was most significant (recall was worst) when the new list was similar to the old list, especially when it consisted of synonyms. This supports the idea that interference, particularly retroactive interference, causes forgetting, and is more potent the more similar the material is.
- **Baddeley and Hitch (1977)**: They investigated interference in a real-life setting by asking rugby players to recall the names of teams they had played against during a season. They found that the number of games played *since* a particular match (interfering information) was more influential in forgetting details of earlier games than the actual time that had passed. This demonstrates that retroactive interference can explain forgetting in real-world situations.
- **Schmidt et al (2000)**: This study showed people aged 11-79 a map of their childhood neighborhood, omitting street names. They found that the more times an individual had moved homes, the fewer street names from their childhood neighborhood they could recall. This suggests that the new information of more recent street names interfered with the recall of older street names (retroactive interference).

Limitations of Interference Theory:

- **Artificiality of Lab Studies**: Many interference studies use artificial tasks, such as learning lists of random or similar-sounding words, which lack personal meaning and ecological validity. This means findings may not accurately reflect how memory works in real-life situations. Baddeley states that the tasks given to subjects are too close to each other and, in real life; these kinds of events are more spaced out.
- **Mechanism Unclear**: Interference theory tells us *that* forgetting occurs but provides little information about the underlying cognitive processes involved or *how* and *why* interference occurs. It's unclear if interference involves overwriting information or merely temporary inaccessibility.
- **Limited Scope**: Interference primarily explains forgetting when information is similar and learned close together in time. It struggles to explain many everyday examples of forgetting that don't involve similar competing information.
- **Can Be Overcome by Cues**: Research suggests that interference effects can be overcome with the use of cues. This implies that the information is still available in long-term memory, challenging the idea of permanent loss due to interference.

Retrieval failure

AO1

Retrieval failure theory suggests that forgetting occurs not because memories have disappeared, but because we lack the appropriate cues to access them at the time of recall.

The information is available in long-term memory, but it's not accessible.

This concept is known as the **Encoding Specificity Principle (ESP)**, which states that cues available at the time of encoding (learning) need to be present at the time of recall to trigger the memory.

Types of cues that have been studied by psychologists include context, state, and organization.

- **Context-Dependent Forgetting:** This occurs when external environmental cues at the time of learning are different from the external cues present at recall. For example, you might go to the kitchen to get something, forget what it was, and then remember as soon as you return to the room you were in where the thought first occurred. The cues available at encoding in your bedroom were not present in the kitchen, hindering retrieval.
- **State-Dependent Forgetting:** This happens when internal cues (e.g., physiological bodily state or mood) at the time of learning differ from those at recall. For instance, if you learned something while in a highly anxious state, you might struggle to recall it when you are calm, and vice versa. Similarly, if you learn something while under the influence of alcohol, you might recall it better when in the same intoxicated state.
- **Organisational/Category-Dependent Cues:** The way information is organized can also act as a cue. Providing categories or a structure can provide triggers for recall.

According to retrieval-failure theory, forgetting occurs when information is available in LTM but is not accessible. Accessibility depends in large part on retrieval cues.

Forgetting is greatest when context and state are very different at encoding and retrieval. In this situation, retrieval cues are absent, and the likely result is cue-dependent forgetting.

Research Evidence for Context-Dependent Forgetting:

AO3

- **Godden and Baddeley (1975)**: Scuba divers were asked to memorize a list of words either underwater or on land. They found that recall was significantly better when the learning and retrieval contexts matched (e.g., learning underwater and recalling underwater, or learning on land and recalling on land). This indicates that environmental cues promote recall.
- **Grant et al. (1998)**: Participants read an article in either silent or noisy conditions, and then recalled it in either matching or mismatching conditions. They found that the ability to retrieve information was better when the conditions matched, showing how forgetting can occur if contextual cues (like silence or noise) are absent at recall.

Research Evidence for State-Dependent Forgetting:

AO3

- % higher rates of accurate recall in matching conditions (e.g., medicated at both learning and recall, or sober at both) compared to non-matching conditions. This supports that internal cues promote recall.
- **Overton (1964)**: Information learned while drunk was recalled better when drunk again, and information learned sober was recalled better when sober. This supports the idea that recall is better if performed in the same internal state as when the information was encoded.
- **Carter and Cassaday (1998)**: They used antihistamines to alter participants' internal states during learning and recall of a word list and passage. hey found 40% higher rates of accurate recall in matching conditions (e.g., medicated at both learning and recall, or sober at both) compared to non-matching conditions. This supports that internal cues promote recall.

Research Evidence for Organisational Forgetting:

Research Evidence: **Tulving and Pearlstone (1966)** gave participants 48 words to learn.

Those asked to recall the list with cues based on four-word categories performed significantly better than those who used free recall.

This suggests categories act as effective cues for recall.

Limitations of Retrieval Failure Theory:

- **Ecological Validity**: A common criticism is that the context or state differences in laboratory experiments (e.g., underwater vs. on land, sober vs. drunk) are often dramatically different from everyday forgetting experiences. This raises questions about whether these findings accurately reflect why we forget in less extreme, daily circumstances.
- **Limited Scope (Recognition vs. Recall)**: Godden and Baddeley (1975) found no significant difference in *recognition* accuracy between matched and non-matched conditions when they repeated their diver experiment using recognition instead of recall. This suggests that retrieval failure may only explain forgetting for certain types of memory, tested in specific ways, and may not be a universal explanation.
- **Cyclical Reasoning**: The Encoding Specificity Principle can suffer from cyclical reasoning by assuming that differences in cues *cause* retrieval failure, rather than exploring alternative explanations.

Strengths and Applications of Retrieval Failure Theory:

- **Strong Evidence**: Retrieval failure has been consistently supported by laboratory experiments using controlled conditions, which increases confidence in its conclusions.
- **Practical Applications**: Understanding retrieval failure has significant practical applications, especially in improving memory. For example, students can use this knowledge to develop effective revision strategies by creating memorable cues for their notes.
- **Cognitive Interview**: The concept of context reinstatement, a key component of the cognitive interview, is directly based on the encoding specificity principle. This police interviewing technique encourages eyewitnesses to mentally return to the crime scene, recalling environmental and emotional details to trigger memories, which has been shown to improve the amount and accuracy of information recalled.

Eyewitness Testimony

> Factors affecting the accuracy of eyewitness testimony: leading questions, post-event discussion, and anxiety; the use of the cognitive interview.

Leading questions

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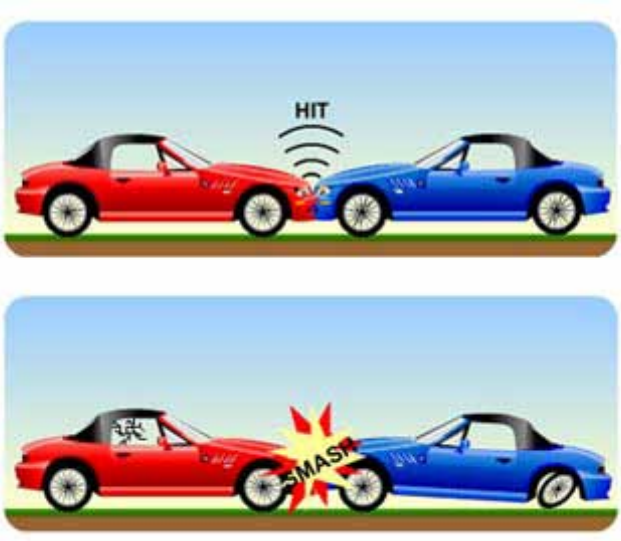
A leading question is one that prompts or encourages a certain answer, often used by police or lawyers.

The way a question is phrased can subtly suggest how participants should respond, often in a way that supports the researcher's ideas.

Loftus and Palmer investigated how misleading information could distort eyewitness testimony accounts.



- **Experiment 1 (Speed Estimates)**: Forty-five American students were shown films of traffic accidents. They were asked to describe what happened and then a critical question about the car's speed, using different verbs: "smashed," "collided," "bumped," "hit," or "contacted". Results showed that the verb used affected the estimated speed; "smashed" led to a much higher speed estimate (40.8 mph) than "contacted" (31.8 mph). This indicates that simply changing one word in a question can lead to markedly different responses and influence recall.
- **Experiment 2 (Broken Glass)**: In a second experiment, 150 students watched a film of a multiple car accident. One critical question asked, "Did you see any broken glass?". Even though there was no broken glass in the film, participants who heard the word "smashed" in the speed question were more likely to falsely recall seeing broken glass. This demonstrates how leading questions can not only distort memory of details like speed but also create false memories of events that never happened.

Conclusion:

The effects of leading questions can be explained by either a "response bias" (where questions only influence participants to give a certain answer) or a "substitution explanation" (where leading questions actually change the eyewitness' memory of the crime).

Loftus and Palmer's second study supports the substitution explanation.

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The research lacks mundane realism, as the video clip does not have the same emotional impact as witnessing a real-life accident, and so the research lacks ecological validity.

A further problem with the study was the use of students as participants.

Students are not representative of the general population in a number of ways. Importantly they may be less experienced drivers and, therefore, less confident in their ability to estimate speeds. This may have influenced them to be more swayed by the verb in the question.

A strength of the study is it's easy to replicate (i.e., copy). This is because the method was a laboratory experiment that followed a standardised procedure.

Post-Event Discussion

Post-event discussion refers to conversations that take place between co-witnesses or other individuals after an event has occurred.

These discussions can significantly influence and distort the original memory of the event before recall, even when witnesses believe they are sharing accurate information.

Here's how post-event discussion can affect eyewitness testimony:

- **Memory Conformity and False Memories**: When witnesses discuss what they have seen, their testimonies can alter to match the accounts of others, a phenomenon known as memory conformity. This occurs because individuals are more likely to adopt incorrect details or ideas if they believe the other person is right or to avoid social disapproval. This process can lead to the reconstruction of memories, the incorporation of misleading information, and even the creation of false memories where details that never happened are recalled.
- **Information Blending**: Information obtained during post-event discussions can be unconsciously integrated into a witness's memory, making it difficult for them to distinguish between what they personally witnessed and what they learned from others. A witness might later report something like, "my friends and I have talked about what happened so many times since that I'm almost not sure what I did see," illustrating this blending of memories.

Key Research Supporting the Effects of Post-Event Discussion:

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- **Gabbert et al. (2003)**: This study clearly demonstrated the impact of post-event discussion. Participants viewed a film clip of the same crime scene, but each member of a pair was shown different details. After engaging in a post-event discussion with their partner and then individually completing a test of recall, researchers found a 71% inaccuracy rate for information gained through these discussions, compared to a 0% inaccuracy rate in a control group who worked alone. Shockingly, 60% of participants in the co-witness group even reported a detail that only their partner had seen and was completely absent from their own video, such as a girl being guilty of a crime, despite not witnessing it themselves. This illustrates how post-event discussion can lead to the assimilation of unobserved information and the creation of false memories.
- **Bodner et al. (2009)**: This research provided a potential way to mitigate the negative effects of post-event discussion. They found that if witnesses are explicitly warned about the potential distorting effects of post-event discussion, the accuracy of their recall can be improved.

Evaluation of Post-Event Discussion Studies:

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- **Strengths**: Similar to leading questions, Gabbert et al.'s study benefited from a highly controlled experimental setting, allowing for careful control of extraneous variables and establishment of cause and effect. This high level of control also enables replication to check reliability.
- **Weaknesses**: These studies also face criticisms regarding artificiality and lack of ecological validity, as participants watch videos rather than experiencing real crimes. In real-life situations, factors like post-event discussion and media reports are often uncontrolled and can influence eyewitness memory, making it difficult to establish a clear cause and effect relationship between the factor and memory accuracy.

Anxiety

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Anxiety is a mental state of arousal that includes feelings of extreme concern and tension, along with physiological changes such as increased heart rate and sweating.

Research suggests that anxiety can have both negative and positive effects on the accuracy of EWT.

Negative Effects of Anxiety:

Some research indicates that anxiety can negatively affect recall, as the "fight-or-flight" response may narrow attention and impair memory.

- **Weapon Focus Effect**: This phenomenon describes how a witness's attention is drawn to a weapon, reducing their ability to remember other details of the crime.
- **Johnson and Scott (1976) Study**: Participants in a waiting room overheard a discussion before witnessing an event. In a low-anxiety condition, a man left with a pen. In a high-anxiety condition, a man left with a knife covered in blood. When asked to identify the man from photographs, those in the high-anxiety (knife) condition were less accurate (33%) compared to those in the low-anxiety (pen) condition (49%). This study demonstrates the negative effect of anxiety, possibly due to weapon focus.
- **Loftus and Burns (1982)**: Found that participants who saw a violent version of a crime (boy shot in the face) had impaired recall for events leading up to the incident.
- **Peters (1988)**: Found that participants visiting a healthcare centre were better able to recognise a researcher than a nurse who gave an injection, suggesting weapon focus for the syringe reduced accuracy.

Positive Effects of Anxiety:

Conversely, some research suggests anxiety can have a positive impact on EWT, as heightened alertness from the "fight or flight" response can strengthen memories of stressful events.

- **Yuille and Cutshall (1986) Study**: This real-life study investigated eyewitnesses to a shooting in Vancouver. They found that witnesses who had been most distressed at the time of the shooting gave the most accurate account five months later (93% accuracy). This challenges laboratory research and suggests anxiety can have a positive effect in real-life situations.

- **Christianson and Hubinette (1993)**: Studied 22 real bank robberies and found no evidence that high arousal negatively impacted recall. Victims were more accurate in their recall than bystanders and accurately remembered details even 4 to 15 months later, suggesting highly emotional events may enhance memory.

Explaining Contradictory Findings:

The **Yerkes-Dodson Law of Arousal** suggests an "inverted-U" relationship between anxiety/arousal and performance (EWT accuracy).

Moderate anxiety is associated with better recall than very high or very low anxiety.

However, this law can be seen as an oversimplified explanation because it doesn't account for the multiple factors that make up arousal (cognitive, behavioural, emotional, etc.).

Evaluation of Anxiety Studies:

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- **Strengths (Real-Life Studies)**: Studies by Yuille and Cutshall (1986) and Christianson and Hubinette (1993) were conducted in real-life settings, providing more ecologically valid results compared to artificial lab studies. Participants experienced actual stress and anxiety, making their EWT more applicable to real-world situations.
- **Weaknesses (Lack of Control)**: While offering high ecological validity, real-life studies often lack control over extraneous variables. For example, in Yuille and Cutshall's study, witnesses could have been influenced by post-event discussion or news reports. Proximity to the crime might also be a confounding variable, as those experiencing higher stress might have been closer to the event. This lack of control makes it harder to establish a clear cause and effect relationship between anxiety and memory accuracy.
- **Weapon Focus Criticism**: The weapon focus effect may be testing for the effects of *surprise* rather than anxiety. Pickel (1998) found that identification was least accurate in conditions with high unusualness (e.g., a raw chicken in a hairdressing salon) rather than high threat (e.g., a handgun).
- **Ethical Issues**: Exposing participants to distressing images or traumatic recollections can breach ethical guidelines (e.g., protection from psychological harm and informed consent). A cost-benefit analysis might be needed to weigh the ethical costs against the benefits of increased knowledge.

Cognitive Interview

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The cognitive interview (CI) is a questioning technique developed to improve the information an eyewitness can retrieve about a crime, based on psychological research into memory improvement and the importance of cues.

It helps to reduce the influence of schemas, leading to more reliable evidence.

> **Background**: Police have often received little training on effective interview techniques, and incorrect eyewitness identifications have led to many miscarriages of justice. Fisher (1980s) observed standard police interviews, noting that witnesses were bombarded with direct, closed questions, were frequently interrupted, and could not talk freely. Geiselman and Fisher designed the CI to address these problems.

The cognitive interview involves a number of techniques:

1. Context Reinstatement

The eyewitness is encouraged to mentally return to the crime scene, recalling environmental (sights, sounds, weather) and personal (emotional state, feelings) details.

This is based on Tulving's encoding specificity principle, where recall is enhanced when cues at recall are similar to those present during encoding.

2. Recall from a Changed Perspective

The witness is asked to recall the event from various perspectives, such as from another witness, the victim, or even the perpetrator.

This technique is also designed to disrupt the effect of schemas and encourage a fuller report.

3. Recall in Reverse Order

The interviewer asks the witness to recall events in a different chronological order (e.g., from the end to the beginning).

This helps to counteract the recency effect (where recent events are remembered best) and disrupts the influence of schemas, which might cause people to reconstruct what “must have happened” based on prior knowledge.

It also makes it harder for the eyewitness to lie.

4. Report Everything

The interviewer encourages the witness to report every single detail of the event, even if it seems irrelevant or unimportant.

Small details may trigger the recall of other, more important memories.

The Enhanced Cognitive Interview

Developed by Fisher et al (1987), the ECI builds on the original CI by focusing on the social dynamics of the interaction between the eyewitness and the interviewer.

Additional features include:

- Encouraging the witness to relax and speak slowly.
- Building rapport with the eyewitness to ensure they feel psychologically comfortable and are more likely to recall accurate details.
- Offering comments to help clarify witness statements.
- Adapting questions to suit the understanding of individual witnesses.
- Allowing the witness to control the flow of information and using open-ended questions.

Supporting Evidence:

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- **Geiselman et al. (1985)**: Found that participants interviewed using the CI recalled more details (average 41.2 correct facts) compared to those using a standard interview (29.4 facts), with no significant difference in errors made.
- **Fisher et al. (1989)**: In real-life cases of robberies, detectives trained in the CI gained 63% more information than untrained detectives, with over 90% accuracy. This suggests the CI effectively enhances memory in real-world situations.
- The development of the CI demonstrates a practical application of cognitive psychology research, leading to decreased inaccuracy of EWT and potentially fewer wrongful convictions. It helps the police record more accurate EWT.

Limitations:

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- **Increased Errors**: Kohnken et al. (1999) conducted a meta-analysis of 42 studies (nearly 2,500 interviews). While the CI increased correct recall, the enhanced cognitive interview led to more errors than the original version. This suggests that while quantity of information increases, accuracy might not improve proportionally, and can even result in a similar accuracy rate (CI 85%, standard 82%).
- **Time-Consuming and Resource Intensive**: The CI is time-consuming, requiring longer interview durations and additional officer training. Police forces may lack the time and resources for adequate training, which can limit its practical value. Kebbel and Wagstaff argued that a few hours of training are insufficient.
- **Effectiveness of Individual Components**: Milne and Bull (2002) suggested that the entire CI need not be used to reap benefits. They found that “context reinstatement” and “report everything” produced the greatest accuracy of recall. This implies that even gradual changes from the standard interview can improve EWT accuracy.
- **Limited Usefulness in Some Situations**: The CI is not effective in identity parades or identifying subjects from photographs.
- **Age of Witness**: Not all CI techniques are appropriate for use with children, for example, changing perspective may not be possible until children are no longer egocentric.