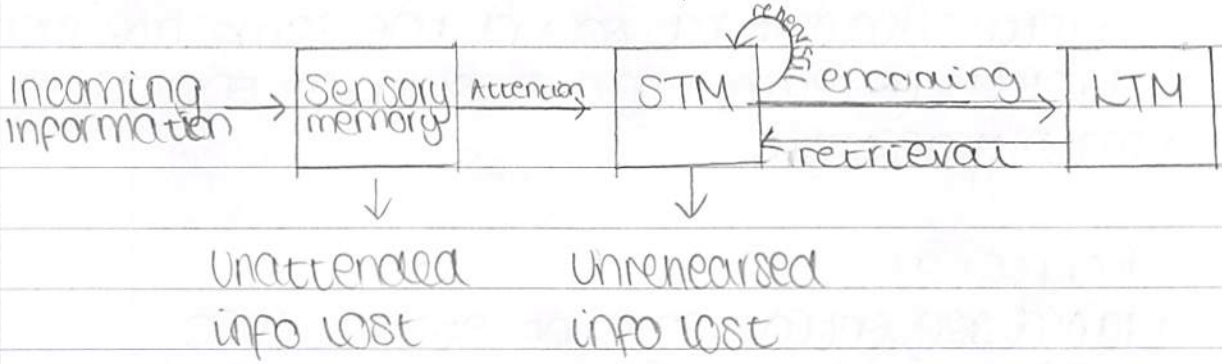
The Multi-Store Model of Memory

↓

Atkinson and Shiffrin, 1968



Sensory Memory/Register

- uses all 5 senses
- visual tested by:
  - Sperling (1960, 1963)
  - visual array of letters through tachtiscope
- recall precise immediately - decays if delay
  ↳ capacity: limited
  duration: few 100 milliseconds.

Short Term Memory

Duration

- info has to be attended to enter
- info decays after 15-30 secs if not rehearsed
- the experiment:
  - Peterson and Peterson (1959)
  - remember trigram w/ interference task
- performance dropped after 15-18 sec

Capacity

- Miller (1956)
- 7 ± 2

Encoding

- phonological similarity effect
  ↳ letters/words that sound the same are more difficult to recall than dissimilar sounding
- mainly acoustic.

Retrieval

- rapid sequential scan of stored info.
- digit span exp. suggest can hold 7±2 items
  ↳ as more info enters, older info (or info w/ weaker memory trace) is displaced
- rehearsal strengthens memory trace

The Transfer (STM → LTM)

- rehearsal → leaves weak memory trace
- mnemonic → more durable memory trace
  → eg. ROYGBIV

Long Term Memory

Duration

- potentially a lifetime
- the experiment:
  - Bahrick et al (1975)
  - yearbooks → diff ages, recall names + faces
    → 90% 15yrs after schl, 70-80% 48yrs after
- LTM fairly resilient despite some deterioration

Capacity

- potentially infinite
- the experiment:
  - Brady et al (2008)
  - shown pics, then pair, which did you see?

- hardly any difference if pics similar or not
- 1000s of images can be maintained well in LTM

Encoding

- depend on rehearsal process.
- if info linked to prior knowledge info easier to search for
- the experiment:
  - Atkinson + Shiffrin (1965)
  - graduate + capitals of states
  - couldn't imed. recall wash. but when he recalled another he remembered because he learnt them together
- recalled as an associated pair - semantically or temporally related

Retrieval

- not stored as one memory trace but multiple copies
  - tip of the tounge → can recognise a correct answer but not recall
    → peel when receiving a partial copy
- partial copy can be used to access more complete through associative process.

Evaluation of MSM

Brain Damaged Patients

Henry Molaison
- amnesia after brain surgery for epilepsey
- severe impairment to LTM but STM largely intact.
- stores differentially affected
- STM + LTM located in different regions of brain?

Clive Wearing
- LTM impairment after encephalitis but STM unaff.
- separation between STM + LTM
  - ↳ support distinction shown in MSM
  - ↳ but are they connected? (like MSM shows)
- couldn't recall past events but could remember how to play piano
  - ↳ too simplistic - more than 1 LTM store?

KC (Kent Cochrane)
- severe memory impairment for personal events but could recall facts
  - ↳ too simplistic - more than 1 LTM store?

KF
- digit span of 2 items → SR/STM not working
- but can form LTM memories
  - ↳ STM not needed for LTM → is memory linear?

Serial Position Effect

- evidence FOR separate STM and LTM stores
- Murray Glanzer and Anita Cunitz (1966)

- exp. to see if word position in a list affected recall
- Ps recalled more words from beg. (primacy effect) and end (recency effect) than middle.
- words at beg → chance to be rehearsed - move to LTM
- words at end → displace middle words in STM
  → left in STM

Coding

- diff coding in STM + LTM (acoustic + semantic)
  ↳ 2 separate memory stores
- Baddeley (1966b) - key study

Alternative Explanations

Over Simplistic

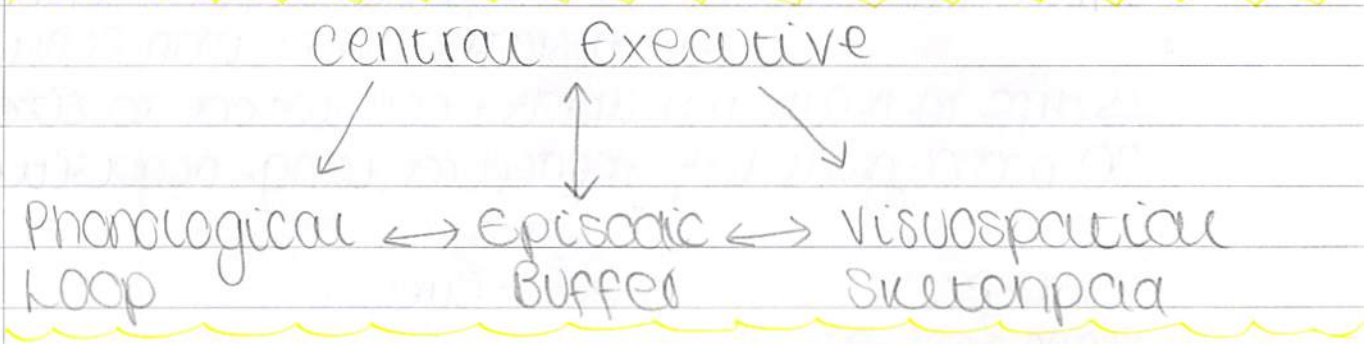
- doesn't explain dynamic nature of STM
  performance on dual-task experiments
- WMM can explain

Emphasis on Rehearsal

- we do use rehearsal as memory strategy but it is NOT essential
- we are able to learn new skills/info without conciously trying to learn
- imagery leaves a strong LT trace (NO rehearsal)
- Craik + Lockhart - diff levels of processing transfer info from STM to LTM

Working Memory Model
↓
Baddeley and Hitch

- Working memory = STM
- Noted problems about MSM so tried to understand STM as a complex and active working memory



The Central Executive
- Limited capacity
- Problem solves
- ability to deal with all sensory info
  ↳ it is modality free
- Monitors overall system
- Attentional controller → can ÷ and switch attention
- Decides how slave systems should function

The Phonological Loop
- Slave system
- Deals with temporary storage of verbal info

Phonological Store - Ear
- Limited capacity + duration but can be extended if refreshed using articulatory rehearsal system
- explains the phonological similarity effect
- Relies on acoustic encoding for storage

Articulatory Rehearsal System - Voice
- explains word length effect

- monosyllabic words recalled better than polysyllabic
  ↳ longer words filled up limited capacity of ARS.
- can also explain deterioration in recall when rehearsal was prevented through articulatory supression → (eg. repeating 'the' when learning list)

*
- Children with specific language impairment (SLI)
  ↳ lang. skills lower than other (eg. IQ)
  ↳ diff. to recall non-words + correlated to size of vocab
  SO phonological loop needed for lang. acquisition.

Visuospatial Sketchpad - Eye

- Slave system
- Temporarily holds + manipulates verbal and spatial info
- deal either → directly through observing images
  → retrieving visuospatial info from LTM
- ROLE → maintain + integrate visual+spatial info using a visual code
- Spatial span tested w/ Corsi block tapping task
- visuospatial info in LTM - route home

Episodic Buffer

- limited research
- subcomponent
- interfaces with LTM
- integrates info from other subcomponents

Key Info

- if 2 tasks use same component ~~bec~~ they can't be performed sucessfully together
- LTM is passive store - holds prev. learned material for use of STM when needed
- STM is not a unitary store (assume)

June 2016 AS Exam: Working Memory

Explain the function of the 'central executive' in this model (3 marks)

The central executive processes (not function) information ~~through~~ received from all senses (modality free). It then decides whether to attend the information and then ~~process~~ allocates transfers information to the relevant slave system. If needed, it will draw information from the long-term memory for use.

Mark Scheme:

- monitor overall memory system
- rather than acting as an info storage system
- allocates cognitive tasks to other slave systems
- problem solving

Functions = Responsibilities

Evaluating the Working Memory Model

Neurophysiological Evidence

William's Syndrome

- normal language ability but impaired visual + spatial ability
  ↳ separate slave systems
- struggle to create sentences w/ spatial prepositions (above, behind etc.)
  ↳ link between visuospatial memory + lang. acquisitio

KF

- digit span of 1 → impaired phonological store
  → visual memory intact
  ↳ 2 separate stores

HM

- impaired spatial memory but STM for verbal info unaffected
  ↳ 2 separate stores

Neuroimaging

- Different subcomponents
- uses PET scan
- Broca's area activated during subvocal rehearsal task
- Supramarginal gyrus activated when phonological store used
- Central executive hard to locate - diffuse across cortex

Experimental Evidence

- dual task experiments
- track moving light on screen, tracking edges of 'F'

+ saying if angles are at top or bottom
- Ps can do each separately but find it difficult to do them simultaneously
  ↳ 2 visual tasks compete for limited resources of VSSP
- asked to perform visual + verbal task → performance unaffected
  ↳ support separate visual + verbal slave systems

Research into separate visual + spatial memory systems

- visual tasks more interrupted by visual interference
- spatial tasks more interrupted by spatial interference
  ↳ separate components to VSSP?
- Darling et al → 30 white squares, 1 with 'P' in
  either → recall appearance of P - visual
  → location within a square on a screen - spatial

THEN HAD visual & spatial interference
disrupted memory for appearance ↳ disrupted spatial memory

Alzheimer's and the role of the central executive

- decreased central executive as disease has progressed

Baddeley (1991)
- young + old (Alz.) group do visual + verbal tasks
- tasks separate = no diff. between groups
- tasks together - sig. difference (Alz worse)
  ↳ problem w/ central exec. functioning as is responsible for coordination of slave systems

Episodic Buffer

- easier to remember sentences as tied by meaning (than words)
- later added to provide explanations ↕
- now verbal + visual encoding could be combined.

Evaluation Summary

Strengths	Weaknesses
• more plausible • rehearsal is optional • applies to real life setting	• role of CE is unclear • doesn't account for musical memory • doesn't offer a complete understanding

Explanation of Long Term Memory - Episodic + Semantic Memory

↓

Tulving (1972)

Basics:

- proposed that LTM could be divided into 2 memory stores → episodic - memory for events
  → semantic - memory for facts
- the ~~dissociation~~ dissociation between episodic + semantic was based on evidence that each store was different in the nature of stored memories, time referencing + more!

The nature of episodic and semantic memory

- Semantic Memory
  - mental encyclopedia (words, facts, rules etc)
  - memories are associated with other facts that link concepts together (school + learning)

- Episodic Memory
  - mental diary
  - info about experiences or events
  - memories are linked to time and context

Time Refrencing (Temporal)

- episodic memory dependent on time refrencing (events are linked to the time they occurred)
- semantic memory detached from any temporal link (don't need to know WHEN a fact was learned to recall)

Spatial References (spatial)

- input into episodic memory is continuous

- input into semantic memory can be fragmented
  ↓
  can learn info at diff times + piece together
  ↳ stored independently + pieced together in a temporal form.

Retrieval

- recall of episodic memory depends on context (of when the event was learned or experienced)
  - ↳ context aids retrieval
- semantic memory does NOT depend on context
  ↳ can be based on inferences, logical thought + generalisations

*

- Recall from semantic leaves memory trace unchanged
- Episodic memory is susceptible to transformation

Are the stores interrelated?

- semantic memory is not dependent on episodic (don't need to remember lesson to remember eqn)
- episodic memory usually uses semantic. (need to use prev knowledge of people etc to understand)

Tulving said:
- although systems overlap they can be treated as independent stores.

Evaluating Explanations of LTM

Brain Damage

↓

Amnesia patients provide evidence for the dissociation of stores

+ Ostegaard (1987)
  - 10yr old boy - anoxic episode (lack of oxygen)
  - intelligence intact, episodic + semantic impaired
  - made educational progress + could create semantic memories

+ KC (1951-2014)
  - motorbike accident
  - impaired episodic - can't form or recall personal events
  - recollection of factual info intact
  - also suggests regions where stores are in brain

− HM and Clive Wearing
  - unable to retain + recall episodic
  BUT
  - both able to remember how to perform tasks
    ↳ another long term store for practised skills?
      ↳ Tulving added procedural memory in other versions

− Interrelationship
  - work together with an episodic memory task (eg. learning wordlist)
  - so research into separate stores is problematic as they can't be studied in complete isolation

− Experimental Studies
  - eg. learning wordlists

- don't take into account guesses when recalling
- guess would represent recall from semantic
- likelihood of semantic recall in episodic memory test is high
- testing states independently is problematic

Reconstructive Memory
↓
Bartlett 1932

Bartlett's Beliefs
- memory is not perfectly formed, encoded + retrieved
- a retrieved memory is unlikely to be the same as the original
- memory is an active process (not passive)

Perception
- how you perceive an object/shape affects how it is remembered.
- verbal label/name assigned to shape/object influences how its drawn after

Imaging
- ink blots
- Ps often searched their memory for images that fit the ink blot rather than describing.
- 'effort after meaning' - connect stimulus to knowledge or experience.
- after stimulus has meaning to the individual it can be easily encoded + stored

Experiments
- Bartlett's experiments focused on images of faces and stories that Ps had to describe or repeat
- he wanted to move away from 'artificial non-sense' tests (eg. trigrams)
- story used → War of the ghosts. *

Remembering

- War of the ghosts → lacks rational story order
  → dramtic → visual imaging
- Ps read story twice
- REPEATED REPRODUCTION used to test the effect of time lapse on recall
- interested in form reproduced story would take.
- after recall - story became shorter
  - phrases reflected modern concepts
  - story became more coherent
  - bits were left out
- didn't understand ghosts → omit or rationalise presence
- 'hunting seals' → fishing

Concl
- memory is reconstructed each time it's recalled

A theory of memory

- constructive in nature
- prev knowledge used to interpret info to store reconstruct memories to recall
- like a notepad → interpret + write brief note
- use experiences to fill gaps + reinterpret events

Schema theory

- schema → parcel of stored knowledge
  → contains fixed info + variable info
- we don't remember all we perceive → use schemas when we recall to fill the gaps
- so recall is an active reconstruction of an event strongly influenced by prev knowledge, expectations + beliefs.
- can explain 'effort after meaning' → trying to find correct schema.

Evaluating Reconstructive Memory

- War of ghosts → little relevance to everyday memory
  → deliberately trying to orchestrate evidence

BUT

- Bartlett did repeated reproduction experiments with 8 different stories → found same shortening, omission, transformation and familiarisation

- When does a schema take effect?
  - Bartlett believed it affects at recall - we actively reconstruct when retrieving
  - Some argue a schema affects at the point of learning as we use the schema to comprehend the situation

Bartlett overstated that memory is inaccurate + flawed → this lead to lots of research about eye witness testimonies (EWT)

↓

Steyvers + Hemmer (2012)

- experimental conditions of EWT research induces recall errors
- in real context, schematic recall can be very accurate

↓

Should handle EWT with caution

↙ ↘

don't use as sole source of evidence	don't assume its completely unreliable

Evaluating Reconstructive Memory

- need to be able to compare as well!

Models / Theories & explanations : EMMA

Evidence For

P A supporting study is the war of ghosts.
E This supports reconstructive memory as participants replaced parts of the tale with schemas.
E For example, they replaced canoe (the original word) with boat (which is similar).
L This shows the use of schemas which is an essential part of Bartlett's theory.

Evidence Against

* dont have for this atm *

Method Strengths

P Bartlett (and other supporting studies) used field experiments and research on four tales from which recall was assessed repeatedly in order to discover errors made.
E This is a strength because it is realistic and can be applied to real life more easily.
E
L

Method Weakness

Application

Eye Witness Testimony

Individual Differences + Memory

Processing speed differs between individuals
eg. when copying from a whiteboard depends on
- speed at which information is processed
- ~~store~~ capacity of short-term store.

Processing speed and capacity are also affected by age
- younger = shorter digit span
- memory capacity increases with age

Schemas and episodic memory:

Schemas

Bartlett says we all have similar schemas but that they can be heavily influenced by experience → affects how we perceive info from senses + retrieve info from memory

Episodic Memory

Daniela Palombo (2012) divided autobiographical memory into 4: episodic, semantic, spatial, prospectiv

- High episodic = high semantic ⇒ good/poor memory overall
  (low / low)
- Men scored higher on spatial memory
- Depression (self-report) = low episodic + semantic

Ps could have been inaccurate w/ self-appraisal

Developmental Psychology + Memory

Alzeihmer's Disease

↓

progressive, degenerative, neurological disorder associated with age

- memory loss
- concentration loss
- confusion
- changes in mood

Impairs certain cognitive systems rather than cognitition globally.

Initially ~~deteted~~ deteriorates memory for new events + info whilst old is preserved

Affects working memory: central executive and visuospatial processing becams impaired

Inability to recall autobiographical info (both STM and LTM)

Memory loss associated w/ depletion of brain matter: hippocampus + temporal cortex

Loss of executive functioning = lack of general coordination + difficulty w/ attention
↳ Dual attention esp. hard - Baddeley (2001)

Dyslexia

↓

reading disorder: problem w/ learning to recognise + decode printed words

More prevalent in boys than girls

Particular difficulty w/ phonology - critical to read.

Poor verbal short-term memory
↳ phonological similarity effect
↳ word length effect

Alloway (2009) - difficulty because of poor working memory
Can't bind sounds for long enough to make a word

McDougall (1994) - poor readers have lower memory span for words + slower reading rate

Underlying cognitive impairment → shorter memory span + difficulty processing + storing verbal info in STM

Dyslexia is comorbid with other learning difficulties so is hard to isolate phonological issues as a reason for reading impairment