PSYC1002

COGNITIVE PROCESSES

What is cognitive psychology?

Historical forerunners

Behaviourism

Behaviourism rejected internal mental structures, describing all behaviours as complex stimulus-response (S-R) associations.

Tolman

Tolman performed the maze rat experiments. He suggested that the rats were **not** learning S-R associations or making connections between input and output but rather were forming a mental 'map' of the environment. Importantly, the rats did this without a reward.

Computer metaphor and the information processing approach

Technology has allowed us to understand human limitations in mental processing through **attentional overload**. Computers can be used as a **model for human information-processing systems** and for scientific investigation of mental processes.

Methods of investigating unobservable processes

Why do we need to investigate cognitive processes so indirectly?

- Introspective data does not provide valid insight
- Not all processes are conscious or under our control
- Our interpretation of events can be erroneous and cognitively biased

Mental chronometry

Mental chronometry measures the **speed and organisation** of mental processes. It can be used to infer the nature of processes such as memory scanning. Searching memory can be done in a **parallel or serial**, and **exhaustive or self-terminating** fashion. Humans engage in serial, exhaustive searches.

Limitations on cognitive processing

Selective attention

The locus of selection

The locus of selection is the point at which information is selected for further processing.

- Early locus – information is selected/rejected based on its **physical** characteristics
- Late locus – information is selected/rejected based on more complex characteristics like **meaning**

Attentional resources

For information to be processed, the individual needs to pay attention. A divided attention reduces the information processed as we have limited attentional 'resources'. When you are not paying attention at all, **inattentional blindness** may result.

Change blindness – our eyes are open but we don't 'see'. We do not encode all information about what we are seeing and so we must pay close attention to a scene before the information is processed and we notice a difference. E.g. noticing out of place items in movies

Automatic processing

Attention can be:

- Involuntary, exogenous, stimulus-driven – an easy and 'parallel' search e.g. when an object pops out and catches our attention
- Voluntary, endogenous, goal-directed – an effortful and 'serial' search e.g. when we try to find an object

Memory: knowledge and processes

Types of memory

Sensory memory: iconic and echoic – literal copies of sensory events (iconic – visual, echoic – auditory)

Short term memory – 'buffer' for the temporary maintenance of information

Long term memory – facts, episodes, and procedures

Short term vs. long term memory

Type of memory	Sensory	Short term	Long term
Capacity	Unlimited	Limited (7±2	Unlimited
Rate of forgetting	Very quick (Iconic: 50-500ms, echoic: 8-10s)	Decays within 20s if not rehearsed	Forgetting occurs due to interference rather than decay
Type of code	Literal copy	Phonological	Semantic

Phonological – relating to how sounds are organised and used

Semantic – relating to meaning

Working memory

Working memory is a cognitive system with a limited capacity that is responsible for temporarily holding information available for processing. Our working memory consists of:

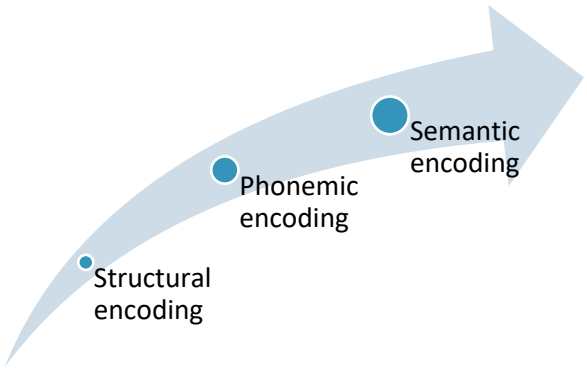
- **Central executive** – manipulation and elaborative processing required for long-term retention, reasoning and planning
- **Episodic buffer** – communicates with working memory and long term memory
- 'Slave' systems
    - **Phonological loop** – information is rehearsed in speech code, memory span dependent on how long it takes to repeat the information
    - **Visuospatial sketchpad** – information is physically simulated and visualised

Encoding and retrieval in long-term memory

Rehearsal

Levels of processing

More 'deeply' processed stimuli are better remembered.



Transfer appropriate processing

Memory is best when encoding and retrieval format match. Implicit and explicit memory tasks involve different encoding processes and therefore benefit from different retrieval processes.

The architecture of long-term memory

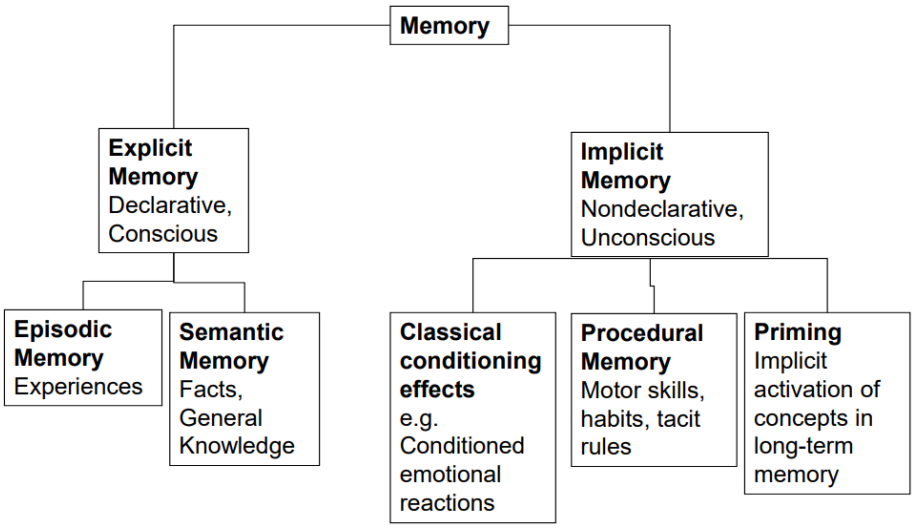
Episodic and semantic memory

Episodic memory

- Memories and how they relate to specific moments in time
- Important occasions and personal experiences

Semantic memory

- Sense of 'knowing' rather than remembering
- General knowledge



Explicit and implicit memory

Nondeclarative/procedural memory is implicit e.g. skills, actions. It is learnt through incremental experience, it operates automatically, and is hard to verbalise.

Declarative memory (inclusive of semantic and episodic) **is explicit** e.g. factual information

Network models of memory

Hierarchical network models

Hierarchical network models are logical structures with interconnected nodes. There is **no redundancy** as concepts are stored once at the highest level possible, and meaning is retrieved via **spreading activation**.

Example: sentence verification task in which time to verify connection between two words is effected by the distance between concepts, the typicality and the category size.

Schema

Schema are **generalised mental concepts**. They make encoding memory more efficient but also distort new information to fit existing schema.

A **stereotype** is a '**person schema**' often formed in childhood, that allows for ease of understanding.

Scripts are '**event schemas**', generalised mental representations of events in time.

Memory dysfunctions

Amnesia and its implications

Infantile amnesia

We usually don't have memories from the first three years of our life. Why?

- Freud's trauma theory

- Underdeveloped emotional encoding
- Underdeveloped schemas

Reminiscence bump

A surprisingly substantial number of memories come from the years between 15-25. This may be due to being more impressionable during this period, with brain changes and first-time experiences occurring.

Aging

Across our lifespan, neurons die and myelination is reduced, affecting processing speed. BUT, encoding and retrieving memories always requires effort all the way throughout life. Thus, it is not our ability to remember that changes, but rather out attitude (as we assume like most things memory should become easier over time).

False memories

False memories may form because of:

- Misleading post-event information
- Social pressure
- Source confusion

Hypnosis improves confidence but not memory accuracy.

Flashbulb memories

People have vivid memories about dramatic world events which are not necessarily any more permanent or accurate than normal memories.

Memory theories and exam preparation

In order to remember better…

- Avoid interference (retroactive – new material effects old, and proactive – old material effects new)
- Avoid auditory distractions
- Memory is best when encoding and retrieval format match
- Hoarding/'saving' material reduces memory
- Recall vs. recognition – recall is more effortful and requires a deeper level of understanding

NEUROSCIENCE

Anatomy, physiology and neurochemistry of the nervous system