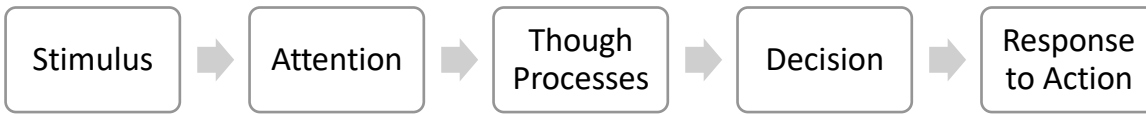


# Psy246: Cognitive Processes

## 1. APPROACHES TO HUMAN COGNITION

### Information Processing Approach



^Bottom-up (from simple to more complex) and serial processing (step by step)

Types of processes – serial vs parallel

- Serial = one process after the other e.g. driving car
  - Cascaded (overlap)
  - Discrete (separate)
- Parallel = two process occurring at same time

Types of processes – Bottom up vs top-down

- Bottom up = external stimulus causes internal cognitive processes to occur, producing the desired response (externally)
- Top-down = Processing influences by the individual's expectations and knowledge (internally)

### Approaches to study of cognition

- Cognitive psychology = **experimental method** to test research hypothesis
- Cognitive neuroscience = study of brain and cognition
  - Event related potentials
  - Functional magnetic resonance imaging (fMRI) = measures changed in the blood flow during cognitive activity – non-invasive indirect measure, spatial resolution is high but temporal resolution is low
  - Magneto-encephalography (MEG) = measure magnetic field produced by the brains electrical activity – high temporal resolution and moderate spatial resolution
    - \***Temporal resolution** = the accuracy with which one can measure **when** an event occurs in the brain
    - \***Spatial resolution** = the accuracy with which one can measure **where** an event occurs in the brain
    - \***Invasiveness** = whether equipment is located internally or externally
- Computational cognitive science – the attempts to use computational models to further understanding of human cognition
- Cognitive neuropsychology = patterns of cognitive performance (intact and impaired) shown by brain-damaged patients

## 2. WORKING MEMORY

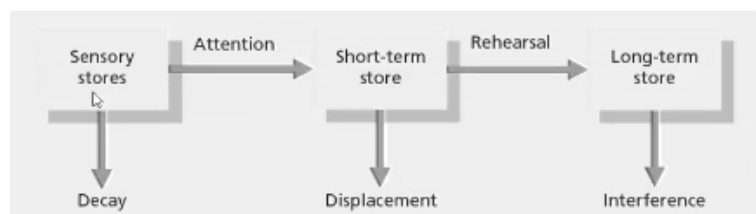
### Memory: architectures and processes

- **Architecture** (structure) = the way the memory system is organised
- **Processes** = activities occurring within the memory system

### Criticisms of the original multistore model

#### **The Original Multistore Model of Memory**

- Sensory store = original modality (visual / auditory)
- Short term memory = limited capacity – storage is fragile
- Long-term memory = essentially unlimited capacity – holds information for long period



\*This model shows that all 3 stores operate in a unitary fashion and are associated with different mechanisms

## Criticisms:

- Sensory store, STM store and LTM store are **not unitary**
  - Each store does not operate in a single uniform fashion but has subcomponents – STM replaced by working memory; LTM replaced by episodic memory and semantic memory
- **Over-emphasis of structural** aspects of memory
- STM is not the gateway to LTM
  - These systems are interconnected – STM tasks make use of knowledge in LTM e.g. chunking
  - Rehearsal may not = learning
  - Impairment of STM not necessarily = impairment in LTM

## Short term and long-term memory: evidence of independence = **A double-Dissociation**

- *Patient KF* = accident to damage to back of head (impairment of auditory verbal short-term memory) – verbal IQ was low, Performance IQ very good. Main deficit was to repeat verbal material (e.g. digit/letter/word)
  - *Amnesic* = damage to medial temporal lobe = impaired long-term memory but intact short-term memory
- \*Double – both  
 \*Dissociation – the opposite direction

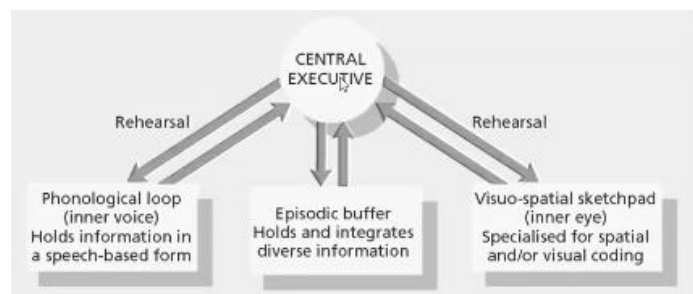
## Baddeley's working memory model

### Baddeley and Hitch's Model

- Replaced the concept of 'short-term store' with 'working memory'

Central Executive	Phonological Loop	Visuo-Spatial Sketchpad	Episodic Buffer
<ul style="list-style-type: none"> <li>• Modality free</li> <li>• Resembles attention</li> <li>• Deals with any cognitively demanding task</li> <li>• Co-ordinates the peripheral storage systems</li> </ul>	<ul style="list-style-type: none"> <li>• Holds info in speech-based form</li> </ul>	<ul style="list-style-type: none"> <li>• Specialised for spatial and visual coding and manipulation</li> </ul>	<ul style="list-style-type: none"> <li>• Temporary storage system</li> <li>• Holds and integrates information from phonological loop, visuo-spatial sketchpad and LTM</li> </ul>

- Phonological loop and visuo-spatial sketchpad = Modality specific
- All components of the system are thought to be **limited** in capacity and relatively **independent**



### Phonological Loop

- **Finding related to the phonological loop**
  - Phonological similarity effect (Conrad 1964) = tested immediate serial (in order) recall of visually presented letters. There were letters sounding the same (G,V,T) and letters sounding different (R,M,Q) Errors seem to be acoustic, resembling letter names heard against noisy backgrounds.  
Conclusion **Recall will be worse for similar sounding letters than differently sounded letters.**  
**This means that short term memory uses a phonological code, even for visually presented stimuli**
  - (Baddeley 1966) = immediate serial recall of visually presented words with a phonologically similar list (e.g. fee, he, knee), compared to a dissimilar list.  
Conclusion: suggested that we use speech-based rehearsal processes within the phonological loop
  - Word length effect = lists of words spoken that we have to recall in order after the list.  
 Finding: memory span is lower for words taking a long time to say
    - Digit span across language – varies = word length affects digit span

Conclusion: capacity of phonological loop is determined by articulatory duration (how long it takes to say word – not phonological complexity/number of syllabus)

**\*\*Concurrent articulation** (Articulatory suppression) prevents articulatory rehearsal which refreshed the decaying memory trace. It eliminates the phonological similarity effect for visually presented stimuli but not auditory presented stimuli – this is because auditory presentation allows direct access to the phonological store.

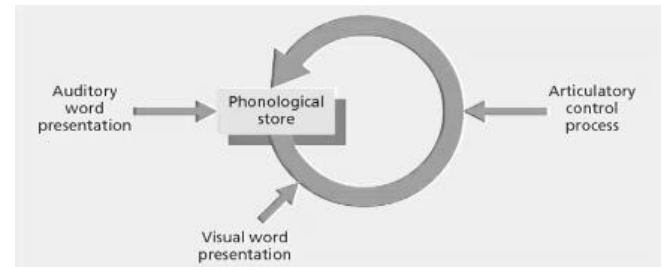
▪ **Phonological store and articulatory control process**

- Passive phonological store

- Holds verbal information
- Auditory information has direct access, bypassing articulatory rehearsal
- Visual presentation has indirect access

- Articulatory control process

- Like sub-vocal speech
- Maintains phonological information by rehearsal
- Provides indirect access to the phonological store for visual input



▪ **What is the phonological loop for?**

- Used in temporary storage and manipulation of phonological (speech) information
- Involved in learning new words (e.g. foreign vocabulary) – learning the sound forms of language
  - Articulatory suppression disrupts foreign-native (e.g. Italian-Russian) word pairings but not native-native (Italian-Italian)
  - Loop's capacity predicts vocabulary size – people with bigger phonological loop capacity are better in learning word forms – particularly strong for item order memory and vocabulary size