

## Cognitive processes notes

### Reading 1: pages 1-31

#### Cognitive psychology

- Internal processes involved with making sense of the environment and decision making
- Includes attention, perception, learning, memory, problem solving, reasoning and thinking
- Involves the attempt to understand human cognition by observing the behaviour of people performing various cognitive tasks
- Argues that we need to study the brain as well as behaviour while people engage in cognitive tasks

#### Cognitive neuroscience

- Attempt to use information about behaviour and about the brain to understand human cognition
- Uses brain imaging techniques
- Study the effects of brain damage on human cognition which tells us about cognitive functioning and locality of function

#### Four main approaches to human cognition

1. **Experimental cognitive psychology:** Trying to understand human cognition by using behavioural evidence
  - **Contributions:**
    - Noam Chomsky: theory of language
    - George Miller: number 7 in short term memory
    - Newell and Simon: general problem solver model
    - First attempt to study concept formation from a cognitive perspective
    - All other four areas derived from cognitive psychology
    - Once relied heavily on the information processing model
  - **Information processing model:**
    - Stimulus is presented which causes certain cognitive processes to occur producing a desired response
    - **Emphasises:**
      - **Bottom up processing:** processing that is directly influenced by environmental stimuli
      - **Serial processing:** assumed that only one process occurs at any moment in time
    - **Limitations:**
    - Oversimplification of complex reality because there is also **top down processing:** processing influenced by the individuals expectation and knowledge
    - Also oversimplified in assuming processing is typically serial. That is, there are many occasions where many processes occur at once known as **parallel processing** (used more for highly practiced tasks)
  - **Impurity problem:**

- Tasks that involve the use of a complex mixture of different processes making it harder to interpret the findings
- Tasks that require inhibitory processes:
  - Stroop
  - Anti-saccade
  - Stop-signal
- **Limitations:**
  - **Ecological validity:** the extent to which lab findings are applicable to everyday life
  - Indirect evidence about internal processes
  - Cognitive psychologists have often put forward theories expressed only in verbal terms
  - Findings can be specific to that paradigm and may not generalise to others
  - Much findings are very specific
- 2. **Cognitive neuroscience: the brain in action:** involves using evidence from the brain to understand human cognition
  - **How is the brain organised and how are the different areas are described**
  - Cerebral cortex is divided into four main divisions or lobes:
    - Frontal
    - Parietal
    - Temporal
    - Occipital.
    - Image on pg 6
  - **Terms used to describe areas of the brain activated during the performance of a task:**
    - **Dorsal:** superior or towards the top
    - **Ventral:** inferior or towards the bottom
    - **Anterior:** towards the front
    - **Posterior:** towards the back
    - **Lateral:** situated at the side
    - **Medial:** situated in the middle
  - **Techniques for studying the brain**
    - **Single-unit recording:** involves inserting a micro-electrode into the brain to study activity
    - **Event related potentials (ERPs):** the same stimulus is presented repeatedly, and the pattern of brain activity recorded by electrodes is averaged to produce a single waveform. This allows us to work out the timing of various cognitive processes
    - **Positron emission tomography (PET):** detection of positrons (atomic particles emitted from some radioactive substances). It has reasonable spatial resolution but poor temporal resolution and only provides an indirect measure of neural activity
    - **Functional magnetic resonance imaging (fMRI):** imaging blood oxygenation using an MRI. Has better spatial and temporal resolution than pet but again, is only an indirect measure.

- **Event-related functional magnetic resonance imaging (EFMRI):** type of fmri that compares brain activation associated with different events. Is seeing whether brain activation on a memory test depending on whether participants respond correctly or incorrectly
  - **Magneto-encephalography (MEG):** brain scanning technique based on the recording of magnetic fields generated by brain activity
  - **Transcranial magnetic stimulation (TMS):** Coil placed on head and a pulse of current is run through it. It generally inhibits brain processing in the affected area known as a **temporary lesion**.
  - All these techniques differ in their ability to determine where and when brain activity occurs
  - Elaborations of techniques in pages 8-16
3. **Cognitive neuropsychology:** involves studying brain damaged patients
- **Lesions:** structural alterations within the brain caused by disease or injury
  - **Patient AC:** 67 year old man who suffered several strokes leading to problems with object knowledge. Although he seemed possess no visual information about objects, he was still able to classify whether animals were dangerous etc correctly 90% of the time, teaching us that:
    - that there is no single object knowledge system.
    - Our stored knowledge of visual objects is separate to auditory etc
  - **Theoretical assumptions:**
    - **Modularity:** the assumption that the cognitive system consists of several fairly independent processors or modules
    - **Domain specificity:** the assumption that a given module responds selectively to certain types of stimuli ie faces, but not others
    - **Anatomical modularity:** assumes that each module is located in a specific and potentially identifiable area of the brain
    - **Uniformity of functional architecture across people:** everyone's brains are similar in function
    - Subtractivity: brain damage can impair function, not add to it
  - **Research techniques in cognitive psychology**
    - **Dissociation:** comparing performance in one task compared to another, where the patient might achieve normal scores in one task and severely impaired performance in another
    - **Double dissociations:** some individuals do well in task A but poorly in B and others show the opposite pattern
    - **Association:** certain symptoms or performance impairments are consistently found in numerous brain damaged patients
  - **Groups vs individual**
    - It is not realistic to expect that people with the same brain deficits are homogenous with respect to the nature of their deficits
    - Group experiments are best done in the early stages of research
  - **Limitations:**
    - **Compensatory strategies:** impact of brain damage camouflaged through different coping strategies
    - **Seriality assumption:** Assumption that processing is serial and proceeds from one module to the next