PSYC2013

COGNITIVE PSYCHOLOGY

INTRODUCTION

DEFINITION

Understanding of mental processes & how they influence behaviour
"The internal processes involved in making sense of the environment & deciding what action might be appropriate" (Eysenck & Keane 2015)
Includes attention, perception, learning, memory, language, problem solving, reasoning & thinking
Central to all human behaviour – theories/methods used across a broad range of psychological fields
Mental processes are not directly observable (they occur in the brain) – cognitive psychology draws on many other disciplines to provide metaphors & methods for measuring these unobservable processes
Mental processes occur in the brain – what is the role of understanding brain structure/function

FRAMEWORKS/METAPHORS IN COGNITIVE PSYCHOLOGY

Cognitive psychology began to be more studied after WWII, 1956 was an important year
1950s-80s (+): INFORMATION PROCESSING
Computer Metaphor: The mind is a symbol processing system, like a computer – uses symbols to represent things in the world
Information Processing: Acquisition, storage & manipulation of symbols to meet task demands

1980s – NOW: CONNECTION FRAMEWORK
Neural Metaphor: The mind is a network of interconnected processing units (neurons)
Processing consists of transmission of activation & inhibition within these networks
Connectionist 'neural networks'
Computational model of semantic memory developed from this framework

1990s – NOW: COGNITIVE NEUROSCIENCE
Neuroimaging: Many cognitive functions can be localised to particular neural regions
Identifying & investigating how these areas respond to experimental manipulations provides insight into the brain mechanisms underpinning cognitive processes

MIND VS. BRAIN

Do we need to understand the brain to be able to understand the mind?

⇒ Need to use evidence from a variety of sources

Cognitive Neuroscience: Using information about behaviour & the brain to understand human cognition
It is assumed the patterns of cognitive impairment shown by brain-damaged patients can inform normal cognitive functioning

WEISBERG STUDY
'The curse of knowledge' – when subjects are aware of a fact they believe an inaccurately large number of subjects also are aware of that fact

⇒ Novices & early students rated two different explanations for this in study by Weisberg as either good or bad
⇒ When neuroscience was involved in the explanation novices rated bad neuroscience explanations as good much more of the time
⇒ Suggests both novices & early students could discriminate between good & bad explanations but were 'seduced' by neuroscience

Cognition happens in the brain but 'what turns on knowing how far north of the neck it happens' (Fodor, 1999)

⇒ Suggests don't need to know about brain processes

OR
The mind is 'the activity of the brain at a certain level of description' (Green 1996)

MARR'S LEVELS

'Levels of description of complex systems' (Marr, 1982)

1) Computational – what needs to be computed for the task to be carried out?
2) Conceptual (representation & algorithm) – the form in which information is represented & the steps or procedures that occur to transform inputs into outputs
3) Hardware – physical means by which the representation & algorithm are realised

Can investigate important aspects of cognitive processes without analysis of hardware such as the brain

BRUCE & YOUNG (1986) – CONCEPTUAL MODEL OF FACE PROCESSING

Computational modeller would attempt to implement it as a computer program

MEASURING COGNITIVE PROCESSES

Each approach makes its own contribution & are often used in combination

Experimental Cognitive Psychology	Develop theories of cognitive processes underlying a task Use behavioural evidence to test theories – behavioural methods for investigating face processing – face inversion effect ⇒ Face recognition depends on holistic/configural processing (relationship between features, shape etc.), not processing of features However, theories are often abstract & tests rely on inferences **Ecological Validity:** The applicability of the findings of laboratory studies to everyday settings Measures are only providing indirect evidence of internal cognitive processes **Paradigm Specificity:** Occurs when the findings with a given experimental or paradigm are not obtained (some findings in cognitive psychology are narrow in scope & applicability) Comprehensive theoretical framework lacking (although some progress has been made – e.g. Adaptive Control of Thought-Rational (ACT-R)
Cognitive Neuropsychology	Use patterns of impairment after brain injury to infer the functional organisation of the brain Max Coltheart – leading cognitive neuropsychologist Theoretical assumptions: o Modularity – numerous modules/processors operate fairly independently of each other (however this is not always supported by neuroimaging) ⇒ Domain specificity – these modules respond to only one given class of stimuli o Anatomical modularity – each module is located in a specific brain area o Uniformity of functional architecture across people – allows generalisation of findings o Subtractivity – brain damage does not change or add anything Search for *dissociations* (intact performance on one task but severely impaired performance on another) between different tasks implies that they rely on different neural systems (especially if double dissociations – can identify faces but not objects or vice versa)) ⇒ Proposopagnosia – inability to individuate faces **Double Dissociation:** Finding that some brain-damaged individuals have intact performance on one task but poor another, whereas other individuals exhibit the opposite pattern (solution to problem of task difficulty being the reason for performance differences) **Associations:** Finding that certain symptoms or performance impairments are consistently found together in numerous brain-damaged patients (evidence for syndrome) N.B. Have to rely on 'single cases' – assumes isomorphism between physical/functional brain organisation (must be a functional aspect of the brain responsible for facial recognition) ⇒ Use of case-series study (several patients with similar cognitive impairments) allows for assessment of variation
Computational Modelling	Create a computer program based on model of task performance – requires precise specification of all details of the model Shows how a given theory can be specified & allows prediction of behaviour in new situations Bruce & Young model

	Types of models: o Connectionist models – networks exhibit learning through experience, consist of interconnected networks of simple units o Production systems – consist of large numbers of 'if…then' production rules & a working memory containing information **Back-Propagation:** Learning mechanism in connectionist models based on comparing actual responses to correct ones Whilst an important mechanism, cognitive neuroscience has found little evidence of back-propagation in humans N.B. Often have to specify details that are not part of theory (fact that the task can be done that way doesn't mean it's how people do it) ⇒ Issue of reaction times in humans compared to computers
Cognitive Neuroscience	Take 'snapshots' of brain activity while people are performing cognitive tasks Seems to provide direct measure of brain regions underlying performance, magneto-encephalography, transcranial magnetic stimulation Major techniques used to study the brain include single-unit recording, event-related potentials, positron emission tomography, fMRI, efMRI, magneto-encephalography & transcranial magnetic stimulation Cognitive neuroscience has helped resolve theoretical controversies N.B. Different measures reflect different aspects of brain function & techniques require effective application of cognitive psychological methods This field has a reliance on reverse inference however (backwards argument from a pattern of brain activation to the presence of a given cognitive process)

N.B. Developmental prosopagnosia is when born with the inability to recognise faces

THEORIES & METHODS OF COGNITIVE SCIENCE

Cognitive Models:

- Behaviour – computational modelling → cognitive psychology
- Brain – neuroscience → neuropsychology

Different methods involve different levels & directions of inference & different strengths & weaknesses
Need converging evidence (& a method of integrating it – how to map) to be able to understand cognitive process
Cognitive models provide a mediating, *functional* level of description that helps to integrate data & test hypotheses
Initially most cognitive psychologists subscribed to the information-processing approach, processing directly affected by the stimulus input is often described as bottom-up processing
Bottom-Up Processing: Processing that is directly influenced by environmental stimuli
Serial processing was typically assumed
Serial Processing: Processing in which one process is completed before the next one starts
However, this traditional approach was very over-simplified, task processing also typically involves top-down processing and rather than serial, parallel processing occurs
Top-Down Processing: Stimulus processing that is influenced by factors such as the individuals past experience & expectations
Parallel Processing: More than one process typically occurs at the same time, this is much more likely when performing a highly practiced task over a new one

TASK PROCESSES

The task impurity problem is an important issue for cognitive psychologists – <u>most cognitive tasks require a complex mixture of processes making interpretation difficult</u>