

Neural Bases of Memory

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History of Memory

- Science of memory began in 1885 when Hermann Ebbinghaus announced the study-test method and experimental results obtained with it
- Reciprocal interactions between clinical observations and experimental research stimulated further advances
- Ex: recent distinction between declarative and nondeclarative kinds of memory arose from research to find what kind(s) of memory is lost and what is spared after certain kinds of brain damage

History cont'd

- In 1793, the possibility of testing experimentally whether mental exercise can induce growth of brain was discussed
- A man named Michele Vincenzo Malacarne agreed to undertake a test of hypothesis, using an experimental design that anticipated one used 180 years later

Hypothesis tested

- He chose as subjects 2 dogs and a pair of birds
- In each pair, he gave one animal intensive training with the other received none, over a few years
- He then sacrificed the animals and compared the brains in each pair
- The trained animals were reported to show more folds in the cerebellum than the untrained

Memory Systems

- Memory is not a single entity, but instead consists of several functions supported by independent brain regions.
- The independence of memory functions is disclosed when damage limited to a particular brain region leads to dissociations between impaired and intact memory abilities

Memory and Learning

- Can be dissociated into several behavioral components
 - Registration storage (encoding)
 - Retention
 - Retrieval (recall)
 - Recall can be declarative (verbal report of conscious memories); procedural (the learning of a motor skill); or autonomic (the visceral response associated with the experience)

Cont'd

- Can be classified according to modality
 - Visual
 - Auditory

Cont'd

- Can be classified according to material
 - Verbal
 - Non-verbal

Types of Memory

- Declarative memory and Nondeclarative
 - Declarative encompasses the acquisition, retention, and retrieval of knowledge that can be consciously and intentionally recollected
 - Examples: memory for events (episodic) or facts (semantic memory)

Cont'd

- Nondeclarative is known as procedural kinds of memory which encompass the acquisition, retention, and retrieval of knowledge expressed through experience-induced changes in performance

Working Memory

- Characterized as the ability to keep a limited amount of information “on line” for immediate use during short intervals
- Refers to a system involved in the temporary storage and processing of information
- It supports higher cognitive brain function such as language comprehension, learning and reasoning

Memory Systems

- An issue of fundamental importance in memory research has to do with the classification of memories.
- 4 major systems examined are episodic, semantic, perceptual representation (PRS), and procedural

Episodic Memory System

- Enables people to recollect personally experienced events
- Ex. Free recall, cued recall and recognition

Semantic Memory System

- Involved in the acquisition and retention of general knowledge of the world
- Ex. Word fluency, vocabulary and primed and unprimed category associations

Perceptual Representation System

- Facilitates identification of perceptual objects
- Ex. Primed stem completion, primed fragment completion and primed identification of degraded words

Procedural Memory System

- Concerned with the acquisition and the expression of motor, perceptual and cognitive skills, and simple conditioning
- Ex: mirror reading, serial reaction time and rotor pursuit