

Patient data

- Naturally occurring lesions.
- Single dissociation, e.g. short-term memory is changed but long-term memory stays constant.
- Double dissociation, e.g. both short-term and long-term memory are affected.

Computerised axial tomography (CAT)

- Multiple x-rays.
- Computer constructs a 3D map.
- Good for identifying large abnormalities.
- Poor temporal resolution.

How do we examine functional changes?

- Method of subtraction – which region of the brain is involved in the comprehension and understanding of words.
- Difference in activity represents region involved.

Positron emission tomography (PET)

- Inject radioactive isotope into bloodstream.
- Scanner detects location of tracer – changes in rCBF.
- Better spatial resolution.
- Temporal still slow – 40 seconds.

Functional magnetic resonance imaging (fMRI)

- Magnetic properties of haemoglobin.
- Ratio of oxygenated/deoxygenated.
- Better spatial.
- Better temporal – down to a few seconds.

Transcranial magnetic stimulation (TMS)

- Method of disrupting neural function.
- Test the integrity of motor pathways.
- Stimulate visual cortex.
- Effect is limited to cortical surface.

The electroencephalograph (EEG)

- Monopolar (referential) – active and a reference electrode.
- Bipolar (sequential) – two active electrodes.
- Key point – difference in activity is what is measured.

Spectral components of the EEG

- Delta (0.5 – 4Hz) – associated with deep sleep, increase related to internal processing.
- Theta (4 – 7Hz) – mental calculation and word recognition.
- Alpha (8 – 12Hz) – relaxation and internal processing.
- Beta (12 – 30Hz) – relaxed yet focused.
- Gamma (30 – 50Hz) localised, binding and associative learning.

Extraction of the ERP

- Averaging epochs of the EEG.
- Endogenous – internal events.
- Exogenous – external events.
- ERPs are “phase-locked”.

Some ERP components

- Event preceding negatives – contingent negative variation (CNV).
- Readiness potential.

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- Compelling evidence that a form of memory could be passed between generations (Pembrey et al., 2014).

Types of amnesia

- Amnesia – any partial or complete loss of memory.
- Retrograde amnesia – memory loss of events before onset.
- Anterograde amnesia – memory loss of events after onset.
- Medial temporal lobe amnesia – memory impairment linked to MTL and impaired memory and intact perception and intelligence.
- Amnesia of Korsakoff's syndrome – thiamine deficiency: confabulation, meagre conversation content and apathy.
- Amnesia of Alzheimer's disease – deficits in both explicit and implicit and reduced level of acetylcholine (Pinel, 2009).
- Concussive amnesia – a blow to the head produces coma; when victim regains consciousness, there is a period of confusion; when the period of confusion ends, the victim has retrograde amnesia for events that occurred during the period just before the blow and anterograde amnesia for events that occurred during the period of confusion.

Cerebral asymmetry and lateralisation of function

Outline

- Cerebral asymmetry.
- Lateralisation of function.
- Theories of lateralisation.
- Factors that influence asymmetry/lateralisation.
- Some intriguing effects.

Cerebral asymmetry – anatomical asymmetry

- Temporal lobe of left hemisphere larger, more grey matter in left hemisphere – Geschwind & Levitsky, 1968.
- Greater connectivity of the left thalamus – Eidelberg & Galaburda, 1982.
- Broca's area larger in the left hemisphere – Geschwind & Galaburda, 1985.
- Different dendritic patterns in left and right hemispheres – Scheibel et al., 1985.
- Asymmetries found in the fetus and new-born – Geschwind & Galaburda, 1985.
- Rodent right hemisphere cortex larger – Stewart & Kolb, 1994.
- Asymmetries in the brains of mice, rats, cats, dogs, monkeys and dolphins – Ya Balonov et al., 1984.

Limitations to laterality studies

- Indirect measure and are not always consistent – Mohr et al., 2005.
- Measures of laterality do not correlate perfectly with imaging/electrocortical measures, measure several things – Strauss et al., 1983.
- Measures of laterality don't always correlate highly with one another, different strategies.
- Repeated testing doesn't always produce the same results, practice effects (Effron, 1990) and task difficulty (Weissman & Banich, 2000).

Theories of lateralisation

- Wernicke-Geschwind model – based on neurological data.
- Local-global approach – LH functions as a collection of focal regions whereas the RH functions more diffusely, LH is logical and analytical, RH is a synthesiser and more concerned with overall configuration.
- Approach-withdrawal and emotion – anterior LH associated with "approach" and RH with "withdrawal".
- Hemispheric encoding and retrieval asymmetry (HERA) – PET research shows lateralisation of memory processes (Nyberg et al., 1996), LH predominantly involved in encoding and RH in retrieval (Tulving et al., 1994), true for both verbal and non-verbal material (Habib et al., 2003).