8.4 Methods of investigating brain function – alteration

ALTERATION/EXPERIMENTAL TECHNIQUES

ACCIDENTAL DAMAGE
Researchers use these natural experiments to compare the alteration in psychological functioning with the location of damage (by scan, surgery or autopsy). Damage may be caused by

- strokes/tumours – e.g. blood clot damage has revealed much about the location of motor, sensory, and linguistic functioning in the brain.
- head trauma – e.g. a railroad construction accident blew a 3 foot long metal rod through Phineas Gage’s left frontal lobe in 1848, changing his personality to make him impulsive and irritable.
- virus – e.g. the virus herpes simplex damaged the temporal lobe and hippocampus of Clive Wearing causing anterograde amnesia.

EVALUATION
Advantages
- The altering damage occurs ‘naturally’ so there are less ethical problems compared to other methods.

Disadvantages
- Lack of precision – the exact extent of damage is not controllable and may be difficult to assess.
- Comparison problems – comparison of the functioning in the individual before and after the damage is less objective, since it is often based on retrospective accounts of previous behaviour and abilities.
- Confounding variables – other non-physical effects of the damage may be responsible for behavioural differences. Social reactions to Phineas Gage’s physical deformity may have affected his personality.

DELIBERATE DAMAGE
ABLATION/LESION STUDIES – aim to investigate function by removing areas of the brain or destroying links between areas. Some of the psychological functions investigated have included

- Motivation – ablation studies on the hypothalamus of rats have caused disrupted eating behaviour.
- Aggression – removing the amygdala of some animals has reduced their aggression.
- Memory – Lashley removed large portions of rat brains to find the location of memory.
- Consciousness – Sperry cut the corpus callosum of epileptic patients, producing a ‘split mind’.
- Psychopathology – prefrontal lobotomy was performed on mental inmates to control behaviour.

EXPERIMENTAL EXPOSURE EFFECTS – aim to influence brain physiology by using environmental distortion or deprivation. Common examples are found in perceptual studies, e.g. Blakemore and Cooper’s study of the visual cortex of cats exposed to an environment of vertical lines.

EVALUATION
Advantages
- Greater control – greater precision in the location of damage and the ability to compare behaviour before and after alteration leads to higher certainty over the effects of the damage.

Disadvantages
- Ethical problems of intervention – the deliberate change of behaviour is radical and irreversible.
- Non-human findings – may not be legitimately generalised to humans due to qualitative differences.
- Plasticity – the brain is a very flexible system which can compensate for damage. Removing one part of it will only show the performance of the rest of the system, not necessarily the missing part.

STIMULATION OF THE BRAIN
ELECTRICAL STIMULATION – aims to stimulate brain areas with microelectrodes to reveal their function through behavioural change. Examples include

- animal studies – Delgado stimulated areas of the limbic system to provoke aggression in monkeys and inhibit aggression in a charging bull while standing in front of it by remote control.
- human studies – Penfield stimulated areas of the cortex in patients undergoing brain surgery and found locations that would produce body movement (primary motor cortex), body sensations (primary sensory cortex), memories of sound (temporal lobe) and visual sensations (visual cortex).

EVALUATION
Advantages
- Less harmful – the aim is to stimulate the brain rather than damage it (therefore more ethical).
- More valid – stimulation seems a better way of investigating the ‘living’ function of brain areas.

Disadvantages
- Invasive technique – the techniques still involve surgical operation, which can be risky.
- Interconnectedness – it is not easy to know exactly how far the stimulation has spread to other areas and the behaviour produced may not be natural, indeed it is often more stereotyped.