Mind, Brain & Behaviour 1

Course Notes

- Behavioural Neuroscience
- Sensation and Perception
- Learning and Cognition
- Quantitative Methods

L2: Neurons, Glia and Mechanisms of Communication with the Neuron

Withdrawal Reflex → excitatory effects

→ Occurs when touching something hot/painful

1) Dendrites of a sensory neuron (e.g. in skin of hand) respond to a noxious stimulus (e.g. hot iron) in the environment
2) Signal sent back along axon to the terminal buttons (e.g. located in spinal cord)
3) Terminal buttons release a neurotransmitter into the synapse → this EXCITES an interneuron
4) Interneuron sends a message down its axon, releasing a neurotransmitter to EXCITE the motor neuron
5) Axon of the motor neuron joins a nerve (a bundle of motor neurons) and travels to a MUSCLE in the arm, causing the muscle to CONTRACT and pull hand away from hot surface

Role of Inhibition

→ Inhibition arising from the brain allows you to counteract the withdrawal reflex e.g. to hold the hot dish.

Complex circuits of neurons in brain represent consequences of dropping dish → demonstrates principles of neural communication

Neuron in brain sends message along axon to SPINAL CORD → excited an inhibitory interneuron → releases an inhibitory neurotransmitter → decreases activity of motor neuron → BLOCKING withdrawal reflex

- Shape and Size of a neuron is related to its function

  → Similarly formed ones tend to be clustered in CNS

  → Reflects functioning of that region.

Learning and Cognition

Basic Principles of Learning:

1) Classical Conditioning

- Always involves a reflex behaviour – Response to stimulus
- Reflex is a simple, unlearned response governed by the nervous system that occurs naturally in response to stimulus
- New stimulus-response relationship is leaned by association
- Pairing a neutral stimulus with a natural (unlearned stimulus) that automatically elicits a reflex response

Basic principles of learning: classical conditioning

Unconditioned Stimulus (UCS) = Stimulus that causes an organism to respond in a specific way e.g. food

Unconditioned Response (UCR) = Response that takes place in an organism whenever an unconditioned stimulus occurs (e.g. salivation to food)

Conditioned Stimulus (CS) = An originally neutral stimulus that is paired with an unconditioned stimulus and eventually produces the formerly unconditioned response (the bell)

Conditioned Response (CR) = After conditioning, the CR is the response produced when the CS is present (salivation to bell)

Conditioning is strengthened by (1) frequent pairings of the CS and UCS (2) timing – CS is presented immediately before the UCS to make the CS predictive of the UCS

Extinction in Classical Conditioning = Gradually weakening conditioned responses – occurs when CS is repeatedly presented without the UCS

Spontaneous Recovery = The reappearance of the previously extinguished response – occurs when the dog was allowed a few hours of rest, and after extinction the CS would again elicit the CR

Rapid Acquisition = Once extinction occurred, relearning is substantially faster when a second acquisition phase is introduced

This shows that extinction is not an unlearning of the conditioned response but a learned inhibition of responding. The initial learning is not lost, just inhibited

Quantitative Methods

W1 Measurement Variables and Distributions

Calculation of Standard Deviation

Calculating SD for a **Population**:

CONCEPTUAL FORMULA:

- You want an index that measures average "deviations" from the mean
- Calculate how far each score is away from the mean →(mean – SD) $X - \mu$
- But, if we average this deviation, the positives and negatives will cancel out, and we will end up with 0
- **Square** the difference from the mean (so only positives) $(X - \mu)^2$
- **Sum** all of these (**sum of squares** = SS) $\Sigma (X - \mu)^2$
- **Divide** by N – the variance (the average squared deviation) $\frac{\Sigma (X - \mu)^2}{N}$
- Take the square root – the standard deviation (back to the same measurement scale before we squared the differences)

$$\sigma = \sqrt{\frac{\Sigma (X - \mu)^2}{N}}$$

CALCULATION FORMULA:

(1)

- Calculate the **sum** of all scores ΣX
- **Square** that sum $(\Sigma X)^2$
- **Divide** by N $\frac{(\Sigma X)^2}{N}$

(2)

- **Square** each individual score X^2