



**UNIT 3 PSYCHOLOGY**  
**SUMMARY NOTES FOR THE VCAA EXAMS**  
**WRITTEN BY A STUDENT WHO OBTAINED A**  
**NEAR PERFECT STUDY SCORE**

## CHAPTER 1: RESEARCH METHODS IN PSYCHOLOGY

An **aim** identifies the purpose of the investigation. It is a straightforward expression of what the researcher is trying to find out from conducting an investigation.

A **research hypothesis** is a testable prediction about the relationship between two or more variables (events or characteristics).

A **theory** is a general explanation of a set of observations or findings about behaviour and/or mental processes which seem to be related.

A **model** tends to focus more on representing how some behaviour and/or mental processes could, should or does occur.

### EXPERIMENTAL RESEARCH

An **experiment** is used to test a cause-effect relationship between variables under controlled conditions.

**For example**, an experiment would be used to find out if the variable of anxiety (a possible cause) has an effect on the variable of exam performance.

In research, a **variable** is something that can change ('vary') in amount or type and is measurable.

The **independent variable (IV)** is the variable that is systematically manipulated or changed in some way by the researcher in order to measure its effects on the dependent variable. **For example**, in an experiment looking at the effects of studying on test scores, studying would be the independent variable.

The **dependent variable (DV)** is the variable that is used to observe and measure the effects of the independent variable. **For example**, in an experiment looking at the effects of studying on test scores, test scores would be the dependent variable.

#### Operationalising independent and dependent variables

**Operationalising** the independent and dependent variables involves defining and explaining them in terms of the specific procedures ('operations') used to measure them.

**For example**, consider an experiment to investigate whether exercise provides relief from depression. 'Exercise', which is the IV, might be operationalised as 'walking at a particular pace for a specified period of time on an automated treadmill'. 'Depression', which is the DV to be measured, might be operationalised as the number of negative words used in writing a creative story, as it has been found through previous research studies to be related to the severity of depression.

#### Experimental groups and control groups

One group of participants, called the **experimental group**, is exposed to the experimental condition in which the IV under investigation is present.

A second group of participants, called the **control group**, is exposed to the control condition in which the IV is absent.

The control group provides a standard or 'baseline' against which the performance of the experimental group can be compared to determine whether the IV has caused some change in, or affected in some way, the behaviour or event being measured (the DV).

### Extraneous variables

An **extraneous variable** is any variable other than the IV that can cause a change in the DV and therefore affect the results of the experiment in an unwanted way.

### Confounding variables

A **confounding variable** is a variable other than the IV that has had an unwanted effect on the DV, making it impossible to determine which of the variables has produced the change in the DV.

### Identifying extraneous and potential confounding variables

#### Individual participant differences

**Individual participant differences**, also called *participant variables*, are the unique combination of personal characteristics, abilities and backgrounds each participant brings to an experiment.

**For example**, age, gender, intelligence, religious beliefs.

#### Use of non-standardised instructions and procedures

When the research procedures (including instructions) are **non-standardised**, this means that they are not uniform, or the same, for all participants (except for exposure to the IV by participants in the experimental group).

#### Order effects

An **order effect** occurs when performance, as measured by the DV, is influenced by the specific order in which the experimental tasks, treatments or conditions are presented rather than the IV.

#### Experimenter effect

The **experimenter effect** is an unwanted influence(s) on the results which is produced consciously or unconsciously by a person carrying out the research. In an experiment, the effect occurs when there is a change in a participant's response because of the experimenter's expectations, biases or actions, rather than the effect of the IV.

#### Placebo effect

The **placebo effect** occurs when there is a change in the responses of the participants due to their belief that they are receiving some kind of experimental treatment and they respond in accordance with that belief, rather than to the effect of the IV.

## Ways of minimising extraneous and confounding variables

### Participant selection

**Random sampling** is a sampling procedure that ensures every member of the population of research interest has an equal chance of being selected to be part of the sample.

**For example**, if this method were used to select a sample of five students from a box with the names of all 20 students in a psychology class, any group of five names is equally likely to be selected as any other group of five names.

**Advantages:** Helps ensure a highly representative sample.

**Limitations:** Needs a complete and up-to-date list of the target population. It is also difficult and time-consuming.

**Stratified sampling** involves dividing the population to be sampled into distinct subgroups, or *strata*, then selecting a separate sample from each stratum in the same proportions as they occur in the target population.

**For example**, age, sex, religion and cultural background are examples of characteristics that may be used to divide a population into strata.

**Advantages:** Enables the researcher to sample specific groups (strata) within populations for comparison purposes.

**Limitations:** Needs a complete and up-to-date list of the target population. More time-consuming than random sampling.

**Convenience sampling**, also called *opportunity sampling*, involves selecting participants who are readily available without any attempt to make the sample representative of a population.

**For example**, a representative sample of illegal drug users or homeless teenagers is not often readily available. Consequently, the researcher may go to locations known to be frequented by the required participants and simply select the first individuals they meet who are in the target population and who are willing and available to participate.

**Advantages:** It is quick, easy and inexpensive.

**Limitations:** Produces a biased sample as only the people available at the time and location of the study will have a chance of being included in the sample. Results of the study cannot be generalised to the entire population.

### Participant allocation

**Random allocation**, also called *random assignment*, is a procedure used to place participants in groups so that they are as likely to be in one group as the other. **For example**, drawing 'names out of a hat' or flipping a coin are also appropriate ways of randomly allocating participants to groups.

### Counterbalancing

**Counterbalancing** involves systematically changing the order of treatments or tasks for participants in a 'balanced' way to 'counter' the unwanted effects on performance of any one order.

## Single and double-blind procedures

A **single-blind procedure** is when the participants are not aware of (are 'blind' to) the condition of the experiment to which they have been allocated and therefore the experimental treatment (the IV).

A **double-blind procedure** is when the participants and the researcher (or research assistant) directly involved with the participants are unaware of (are 'blind' to) the conditions to which the participants have been allocated.

## Placebos

A **placebo** is an inactive substance or fake treatment, which substitutes for the real substance or treatment.

**For example**, suppose an experimental group is given an alcoholic drink so that its effects on performance of a task can be observed, whereas the control group receives nothing. Impaired performance observed in the experimental group may be due to the alcohol, or it may have arisen because the act of giving the participants alcohol suggested that they were expected to act drunkenly, so they did.

In order to control this potential confounding variable, control groups can be given a placebo, or fake treatment, so that they form the same expectations and beliefs as the experimental group.

## Standardised instructions and procedures

**Standardised instructions** are identical instructions (directions) given to participants, as relevant to the specific group (condition) to which they have been assigned.

**Standardised procedures** is the use and administration of the same procedures for participants, as relevant to the specific group (condition) to which they have been assigned.

## Types of investigations

### Cross-sectional studies

A **cross-sectional study** selects and compares different groups of participants on one or more variables of interest at a single point in time.

**For example**, a study might investigate how performance on a memory task can vary according to age. Groups of people selected at ten- or twenty-year intervals from 5 to 85 year olds could be tested and the results compared.

**Advantages:** Can be used to study change over time, simpler to undertake, less time-consuming, less expensive.

**Limitations:** A cause-effect relationship between different variables cannot be tested or determined.

## Case studies

A **case study** is an intensive, in-depth investigation of some behaviour or event of interest in an individual, small group, organisation or situation. Usually, the case is a person.

**For example**, to study individuals with a relatively rare or unusual disorder, problem, ability or characteristic.

**Advantages:** Useful way of obtaining detailed and valuable information on mental processes and behaviour. Can be a valuable source of hypotheses for further research.

**Limitations:** Cannot be replicated to test the reliability of the results in the way that an experiment can. Analysing data can be time-consuming.

## Observational studies

An **observational study** involves collecting data by carefully watching and recording behaviour as it occurs.

**For example**, a researcher observing aggression outside night clubs in King Street, Melbourne. In **naturalistic observation**, the researcher views behaviour in the natural, 'real-life' environment where it would ordinarily occur.

**For example**, in a study on the social behaviour of pre-schoolers, a researcher might observe children at play in a pre-school centre's outside area at lunchtime.

**Advantages:** Researchers can watch and record behaviour as it usually occurs, without the need of any manipulation or intervention. Does not require the cooperation of participants being observed.

**Limitations:** Can be very time-consuming. Can be difficult to determine the causes of the behaviour of interest that is observed.

## Self-reports

A **self-report** is the participant's written or spoken responses to questions, statements or instructions presented by the researcher.

**For example**, a self-report might take the form of answers about nightly habits before going to bed. Questionnaires, interviews and rating scales are the most commonly used self-report tools.

**Advantages:** Can be an efficient means of collecting data from a large number of people in a short period of time.

**Disadvantages:** People may intentionally give false or misleading answers to create a favourable impression of themselves (social desirability). It is also language dependent.

## Types of data

### Primary and secondary data

**Primary data** is data collected directly by the researcher (or through others) for their own purpose, usually to test a hypothesis.

**For example**, you will collect primary data when you undertake an experiment to test a research hypothesis for the practical investigation which is one of the Unit 4 SACs.

**Secondary data** is data that has been collected by someone other than the original user for their own purpose.

**For example**, if you access data in a journal, book or on a website to complete a SAC, then you will be using secondary data.

### Qualitative and quantitative data

**Qualitative data** is information about the 'qualities' or characteristics of what is being studied. They are descriptions, words, meanings, pictures and so on.

**Quantitative data** is numerical information on the 'quantity' or amount of what is being studied; that is, how much of something there is. They are in the form of units of measurement or numbers.

## Organising, presenting and interpreting data

**Descriptive statistics** are used for analysing, organising, summarising and describing results.

**For example**, calculating the mean score on a memory test for each age group, tables, graphs, percentages, mean as a measure of central tendency, standard deviation.

**Inferential statistics** are used for interpreting and giving meaning to the results.

**For example**, p-values.

### Conclusions and generalisations

A **conclusion** is a decision about what the results obtained from research mean.

A **generalisation** is a decision of judgement about how widely the findings of a research study can be applied, particularly to other members of the population from which the sample was drawn.

## Reliability and validity in research

### Reliability

**Reliability** refers to the extent to which the results obtained from a research study are consistent, dependable and stable.

This means that each time a behaviour or event is measured under the same conditions, the procedure(s) used should produce very similar results at the least.

## Validity

**Validity** refers to the extent to which the procedures used for a research study measure what the research intended to measure. Basically, the research design and the specific procedures used should match the requirements of the investigation to produce results that are relevant to the aims of the research.

**Internal validity** refers to the extent to which the results obtained for a study are actually due to the variable(s) that was tested or measured and not due to some other factor.

**For example**, in an experiment, the researcher needs to be confident that the change in the DV was produced solely by the IV and not any extraneous or confounding variable, nor due to chance.

**External validity** refers to the extent to which the results obtained for a study can be generalised to the population from which the sample was drawn or to other people in other settings.

High external validity – can be generalised.

Low external validity – cannot be generalised.

## Ethics in psychological research and reporting

**Ethics** refers to standards that guide individuals to identify good, desirable or acceptable conduct.

**For example**, it would be unethical for a psychologist to reveal information discussed in a counselling session.

## National Statement on Ethical Conduct in Human Research

**Research merit and integrity** generally refers to research that is scientifically worthwhile and conducted with a genuine scientific commitment.

**Beneficence** refers to the likely benefits of the research to participants or the wider community.

**Justice** refers to the use of fair procedures and ensuring fair distribution of the costs and benefits of the research.

**Respect for human beings** refers to when the researcher recognises and takes account of the rights, beliefs, perceptions and cultural backgrounds of all participants.

## Role of the experimenter

**Protection and security of participants' information** ensures that personal information is secure and protected.

**Confidentiality** refers to the obligation of the researcher not to use or disclose private information for any purpose other than that for which it was given to them.

**Voluntary participation** ensures that participants voluntarily consent to be involved in a study.

**Withdrawal rights** refers to participants having an unconditional right to opt out of a study at any time without giving a reason for doing so.

**Informed consent procedures** refers to information being given about the purpose, method, demands, risks and potential benefits of the research.

**Use of deception** refers to when participants are deliberately misled or not fully informed about the aim or some other aspect of the research.

**Debriefing** involves clarifying each participant's understanding of the research as soon as possible after it has been conducted. It is also to check the wellbeing of each participant and address any harm.

### Use of animals in psychological research

**The main reasons animals are used in psychological research are:**

- Some studies cannot be conducted with humans due to the risk of psychological and/or physical harm that may be caused.
- Bodily systems and all behaviours of some animals are similar to those of humans.
- Animals have practical advantages over people for use as research participants.
- The behaviour of animals can usually be controlled to an extent not possible with human participants.
- When certain experiments require large numbers of participants who have, for example, the same genetic background, animals are more easily obtained than humans.
- Participant expectations can influence the results of an experiment.

### Use of an appropriate experimental research design

#### Independent groups

In an experiment with an **independent groups** design, each participant is randomly allocated to one of two (or more) entirely separate ('independent') groups (and therefore conditions). This experimental design is also called *independent measures* and *between participants*.

**For example**, suppose a researcher is interested in investigating the effects of loud music on problem-solving. The experimental group could be given a problem-solving task to complete while loud music is playing and the control group would be given the task to complete without any music playing.

**Advantages:** Can usually be completed on one occasion which helps to ensure participant attrition (loss) is avoided. There are also no order effects between conditions to control.

**Limitations:** Often a need for a large number of participants to help ensure the spread of participant variables within the sample will match the distribution within the population. There is also less control over participant variables.

## Repeated measures

In an experiment with a **repeated measures** design, each participant is in both the experimental and control groups (and therefore all conditions).

**For example**, consider the researcher interested in loud music and problem-solving. Using the repeated measures design, a group of participants will be given a problem-solving task to complete while loud music was playing, and the same group would then be tested on a similar, equally difficult, problem-solving task but without the loud music playing.

**Advantages:** Eliminates potential confounding variables arising from individual participant differences. Requires a relatively smaller number of participants when compared with other experimental designs because the same participants are in all conditions.

**Limitations:** Does not necessarily control all participant variables that can influence the results. Can also result in unwanted participant loss before the experiment is completed. Another limitation is that order effects are more likely with the repeated measures design and can become a confounding variable if uncontrolled.

## Matched participants

In a **matched participants** design, also called *matched groups*, each participant in one condition 'matches' a participant in the other condition(s) on one or more participant variables of relevance to the experiment.

**For example**, in the loud music and problem-solving experiment, the intellectual ability of each participant could be reasonably assumed as being likely to affect their problem-solving ability. The researcher could administer an intelligence test to each participant after they had been selected for the experiment, but before the experiment began. Each participant would then be paired with someone else with a similar IQ score until all participants had been matched on intelligence. In allocating the participants to groups in the loud music and problem-solving experiment, the two participants with the highest IQ scores would be randomly allocated to the loud music and no music groups respectively.

**Advantages:** Ensures that in every condition there is a participant with very similar or identical scores on the variable(s) the researcher seeks to control. Participant attrition is less common than with the repeated measures design.

**Limitations:** The difficulty of knowing which specific participant variables should be matched. Difficult and time-consuming to recruit participants who are sufficiently alike in the variable.

## CHAPTER 2: NERVOUS SYSTEM FUNCTIONING

### THE NERVOUS SYSTEM

The human **nervous system** is a complex, highly organised network of specialised cells that enables the brain to receive information about what is going on from both inside and outside the body and respond appropriately.

Its three main functions are to:

- **Receive** information
- **Process information**, and
- **Coordinate a response** to information

### THE CENTRAL NERVOUS SYSTEM (CNS)

The **central nervous system** is a division of the nervous system and it comprises of the brain and spinal cord. Its main function is to process information from the body's internal and external environments and activate appropriate responses.

#### The brain

The **brain** is an intricate network of cells that plays a vital role in processing information received through neural pathways from the body and in directing actions within the body. It is responsible for everything we think, feel and do.

#### The spinal cord

The **spinal cord** is the long, thin bundle of nerve tissue that extends from the base of the brain to the lower back.

The two major functions of the spinal cord are to:

- **Receive sensory information** from the body (via the peripheral nervous system) and send these messages to the brain for processing.
- **Receive motor information** from the brain and send it to relevant parts of the body (via peripheral nervous system) to control muscles, glands and internal organs so that appropriate actions can be taken.

### THE PERIPHERAL NERVOUS SYSTEM (PNS)

The **peripheral nervous system** is the entire network of nerves located outside the central nervous system. It extends from the top of the head, throughout the body to the tips of the fingers and toes and to all parts of the skin. Its main function is to transmit information to and from the central nervous system.

## The autonomic nervous system

The **autonomic nervous system** is a subdivision of the peripheral nervous system that connects the central nervous system to the body's internal organs (such as the heart, stomach and liver) and glands (such as sweat, salivary and adrenal glands), providing feedback to the brain about their activities.

The autonomic nervous system is called 'autonomous' because many of the glands and processes under its control are self-regulated and therefore occur without conscious effort and are not usually under our voluntary control.

### Divisions of the autonomic nervous system

#### - Sympathetic

The **sympathetic nervous system** activates internal muscles, organs and glands to prepare the body for vigorous activity or to deal with a stressful or threatening situation.

It is activated by a stressor or fear stimulus and enhances survival by providing an immediate response, in a split second, to any kind of emergency.

#### - Physiological effects of the sympathetic nervous system

- Adrenal glands release hormones (such as adrenaline) into the bloodstream
- Heart rate and blood pressure increases
- Breathing rate increases and bronchioles of lungs expand so more oxygen can be taken in
- Sugar and fat is released from storage to provide instant energy to the skeletal muscles
- Pupils dilate to allow more light to enter the eye and enhance vision
- Sweat glands increase production of sweat to cool the body
- Digestion is slowed down
- Decreased salivation

#### - Parasympathetic

In times of minimal stress and in the absence of threat the **parasympathetic nervous system** helps to maintain the internal body environment in a steady, balanced state of normal functioning.

#### - Physiological effects of the parasympathetic nervous system

- Reduces heart and breathing rates
- Minimises the release of sugar and fats into the bloodstream
- Pupils are constricted
- Decrease in production of perspiration
- Increase salivation

## The somatic nervous system

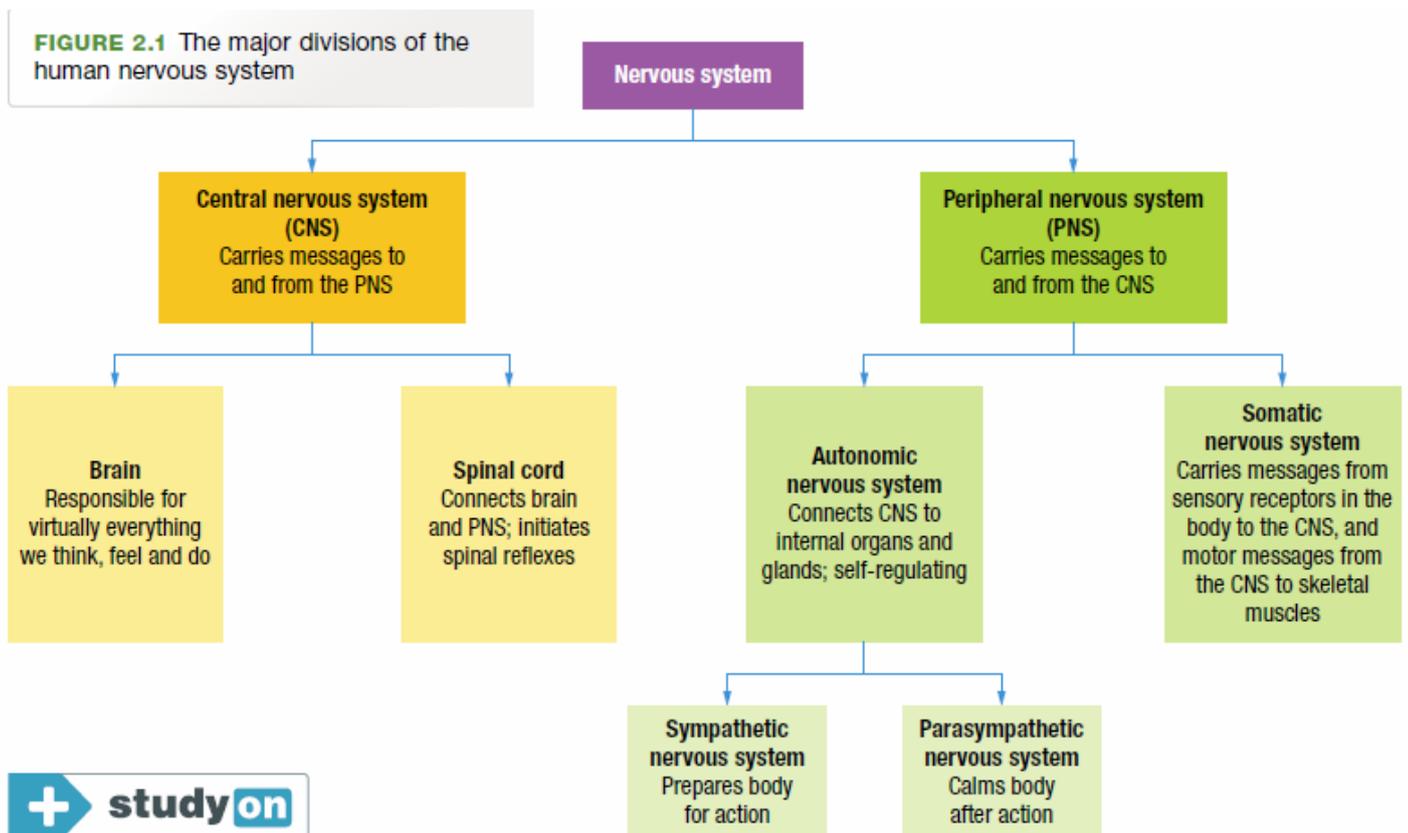
The **somatic nervous system** is a network of nerves that carries sensory information to the central nervous system and motor information from the central nervous system.

**Sensory neurons** carry sensory information received at sensory receptor sites in the body (skin, muscles, joints and tendons), along sensory neural pathways to the central nervous system. (Afferent).

**Motor neurons** carry motor information received from the brain along motor neural pathways to skeletal muscles to control their activity by causing them to contract or relax. (Efferent).

### Afferent and efferent

- The sensory information is **afferent** which are carried along sensory neural pathways by sensory neurons to the central nervous system.
- The motor information is **efferent** which are carried along motor neural pathways by motor neurons to skeletal muscles to perform voluntary movements.



# CONSCIOUS AND UNCONSCIOUS RESPONSES TO SENSORY STIMULI

A **conscious response** to a sensory stimulus is a reaction that involves awareness.

An **unconscious response** to a sensory stimulus is a reaction that does not involve awareness.

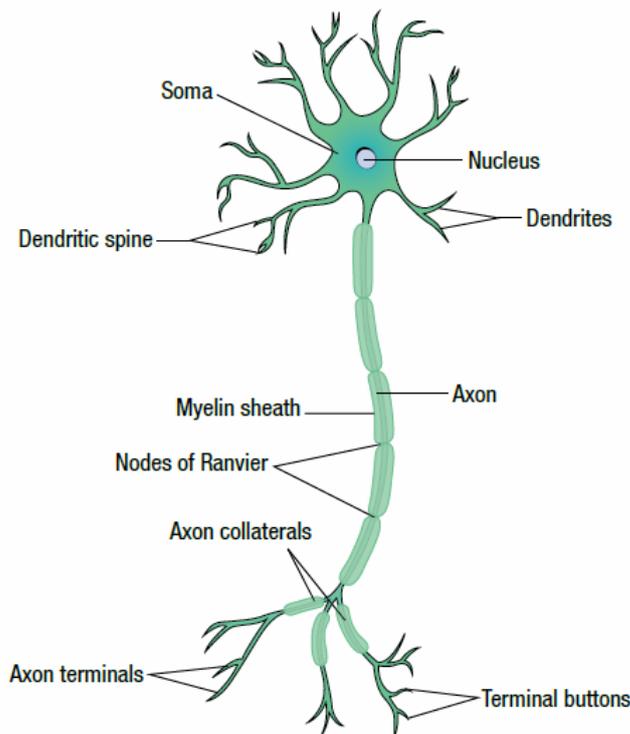
## The spinal reflex

A **spinal reflex** is an unconscious, involuntary and automatically occurring response to certain stimuli without any involvement of the brain.

## THE NEURON

A **neuron** is an individual nerve cell that is specialised to receive, process and/or transmit information.

### Structure of a neuron



### Specific structures of the neuron

A **dendritic spine** is an outgrowth of a dendrite and provides a specific receptor site for neural information.

A **dendrite** is an extension of a neuron that detects and receives information from other neurons.

The **soma** integrates information received by dendrites. The soma contains the nucleus of the neuron.

The **nucleus** acts as the brain of the neuron and processes the information integrated by the soma.

An **axon** is a single, tubelike extension that transmits neural information to other neurons (or cells in muscles and glands).

**Myelin** is a white, fatty substance (made up of certain types of glial cells) that surrounds and insulates the axon.

An **axon collateral** is a small branch at the end of an axon.

An **axon terminal** is the end part of an axon collateral where terminal buttons that store and secrete neurotransmitter are located.

### The synapse

The **synapse** is the site where communication occurs between adjacent neurons.

The **synaptic gap** is the tiny space between the axon terminal of a presynaptic neuron and the dendrite of a postsynaptic neuron.

A **presynaptic neuron** is a nerve cell that releases chemical messengers called neurotransmitters into the synapse.

A **postsynaptic neuron** is the nerve cell that then receives these neurotransmitters from the synapse.

### Neurotransmitters

**Neurotransmitter** is a chemical substance produced by a neuron that carries a message to other neurons or cells in muscles, organs or other tissue.

### Excitatory and inhibitory effects

An **excitatory effect** occurs when a neurotransmitter stimulates or activates a postsynaptic neuron to perform its functions.

An **inhibitory effect** occurs when a neurotransmitter blocks or prevents a postsynaptic neuron from firing and therefore performing its functions.

### Neurotransmitters- Glutamate (Glu) and Gamma-amino butyric acid (GABA)

**Glutamate (Glu)** is the primary excitatory neurotransmitter in the central nervous system.

**Gamma-amino butyric acid (GABA)** is the primary inhibitory neurotransmitter in the central nervous system.

### Lock and key process

The **lock-and-key process** describes chemical neurotransmission as involving neurotransmitter with a distinctive shape (a 'key') that precisely matches the shape of the receptor site (a 'lock') on the postsynaptic neuron where it will bind or attach to its receptors.

# PARKINSON'S DISEASE

**Parkinson's disease** is a central nervous system neurodegenerative disorder characterised by both motor and non-motor symptoms.

## Causes of Parkinson's disease

- Motor symptoms result from the degeneration and loss of neurons in the **substantia nigra**.
- Neurons in the substantia nigra produce the neurotransmitter called **dopamine**, so when the substantia nigra is diseased or damaged, the amount of dopamine available for motor activity reduces as neurons gradually die.
- Brain structures such as the **basal ganglia** and **motor cortex** that are involved in voluntary movements receive slower, fewer and/or irregular dopamine messages about motor activity.
- The primary motor cortex which executes voluntary movements receives inadequate information due to insufficient and impaired activation by dopamine.
- It has no known cause and therefore described as idiopathic.

**Key terms:** Substantia nigra, lower levels of dopamine produced, fewer neurons, basal ganglia, motor cortex, primary motor cortex, voluntary muscle movement.

## Symptoms of Parkinson's disease

### Motor symptoms of Parkinson's disease

- **Tremor** involving continuous, involuntary shaking (trembling) of the body.
- **Muscle rigidity**, whereby the muscles seem unable to relax and are tight, even when at rest.
- **Slowness of voluntary movement** (called bradykinesia) particularly when initiating and executing movement and performing repetitive movements.
- **Postural instability**, balance problems and gait (walking) disturbances tend to occur later in the course of the disorder.

### Non-motor symptoms of Parkinson's disease

- **Decrease or loss of smell** (anosmia)
- **Sweating** and **increased sensitivity to temperatures**
- **Fatigue** that is not relieved by resting
- **Mental health problems** such as confusion, panic attacks, anxiety disorders and depression
- **Problems with cognitive function** (thinking, impaired planning and decision making and memory loss)

## Treatment for Parkinson's

- One of the most commonly used and effective medications is **L-dopa** made from **levodopa**, a chemical that is converted to dopamine by neurons and thereby replaces dopamine that is lost in Parkinson's disease.

## **CHAPTER 3: STRESS AS A PSYCHOBIOLOGICAL PROCESS**

### Stress

**Stress** is a state of physiological and psychological arousal produced by internal or external stressors that are perceived by the individual as challenging or exceeding their ability or resources to cope; may be acute, episodic acute or chronic.

Virtually anything can be a source of stress and therefore a stressor.

- It may be internally or externally sourced.
- It may be psychological or physical in nature.
- It may be a person, object, situation, event or a combination of these.

### Types of stress- Eustress and distress

**Eustress** is a positive psychological response to a stressor, as indicated by the presence of positive psychological states such as feeling enthusiastic and motivated, excited, active and alert.

**Distress** is a negative psychological response to a stressor, as indicated by the presence of negative psychological states such as anger, anxiety, nervousness, irritability or tension.

### Sources of stress

**Daily pressures** (or hassles) are little problems of everyday living that are irritants- events that annoy or bother us and which can make us angry or upset.

**Life event** in relation to stress, is a type of stressor in everyday life involving change that forces an individual to adapt to new circumstances.

**Acculturative stress** refers to the stress people experience in trying to adapt to a culture when living in it for a considerable period of time.

A **major stressor** is an event that is extraordinarily stressful or disturbing for almost everyone who experiences it. **For example**, being a victim of a violent crime.

A **catastrophe** is an unpredictable event that causes widespread damage or suffering. **For example**, an earthquake or tsunami.

## FIGHT-FLIGHT-FREEZE RESPONSE

The **fight-flight-freeze response** is an involuntary, physical response to a sudden and immediate threat (or stressor) in readiness to:

**Fight**- confronting and fighting off the threat

**Flight**- escaping by running away to safety

**Freeze**- keeping absolutely still and silent, avoiding detection

The main stress hormones of the fight-flight-freeze response are **adrenaline and noradrenaline**.

### HPA axis and cortisol

**Hypothalamic-pituitary adrenal**, or **HPA axis**, involves the hypothalamus, the pituitary gland and the adrenal cortex (the outer layer of adrenal glands) in a chain of direct influences and feedback interactions.

The pituitary gland releases ACTH which activates adrenal glands and the adrenal cortex that releases cortisol.

**Cortisol** is a stress hormone that is secreted from the adrenal cortex to primarily energise the body for longer periods of time in response to a stressor.

## PHYSIOLOGICAL EFFECTS OF STRESS

### Physiological effects of fight-flight reactions

- Increased heart rate and blood pressure.
- Redistribution of blood supply from the skin and intestines to the muscles.
- Increased breathing rate (to increase oxygen levels).
- Increased glucose (sugar) secretion by the liver (for energy).
- Dilation of the pupils (so the eyes can take in as much light as possible).
- Suppression of functions that are not immediately essential in order to conserve energy (such as digestion and sex drive) and which can be delayed without damage to the organism.

### Physiological effects of freeze reactions

- Body movements and vocalisations stop
- The racing heart slows very significantly
- Blood pressure drops very quickly
- Tense muscles collapse and become very still
- Extreme alertness (hypervigilance)
- Tonic immobility (playing dead)

## Physiological effects of HPA axis and cortisol

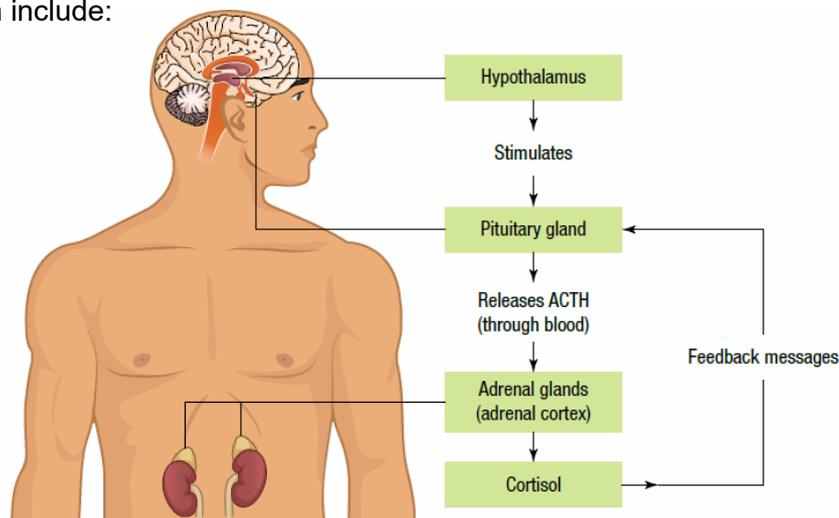
- Increases energy supplies such as blood sugar and enhancing metabolism.
- Secretes glucose from the liver
- Has an anti-inflammatory effect by blocking the activity of white blood cells that contribute to inflammation.
- Retards tissue repair which slows wound healing
- Suppresses activity of the immune system

Prolonged activity of the HPA axis and high levels of cortisol in the bloodstream for a prolonged time can have negative effects.

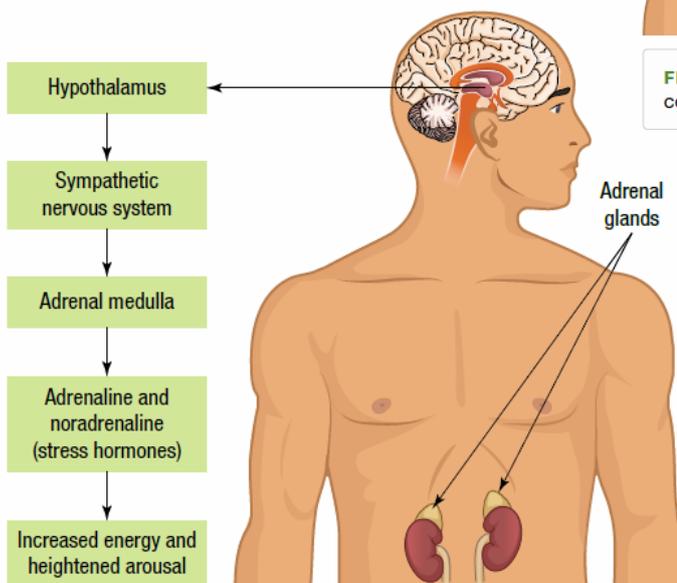
One effect of the excessive amount of cortisol over a prolonged time is impaired immune system functioning and thereby increased vulnerability to disease.

Prolonged levels of cortisol in the bloodstream include:

- Colds and flu
- Hypertension (high blood pressure)
- Blood sugar imbalance (hyperglycemia)
- Atherosclerosis (hardening of the arteries)
- Cardiovascular disease and diabetes



**FIGURE 3.19** The HPA axis is activated if a stressor persists, resulting in the release of cortisol.



**FIGURE 3.17** Fight-flight reactions are initiated in the brain and have the overall effect of arousing and energising the body to deal with an immediate threat. These changes precede the freeze response. The brain-body pathway that activates fight-flight is called the sympathetic-adrenomedullary system (SAM).

# GENERAL ADAPTATION SYNDROME (GAS) HANS SELYE (1930)

The **General Adaptation Syndrome (GAS)** is a three-stage physiological response to stress that occurs regardless of the stressor that is encountered.

## Stages of General Adaptation Syndrome

The **General Adaptation Syndrome** consists of three stages:

- An **alarm reaction stage** (with shock and counter shock)
- A **stage of resistance**
- A **stage of exhaustion**

### Stage 1: Alarm reaction stage

#### Shock

- Occurs when the person (or animal) first becomes aware of the stressor and the body goes into a temporary state of **shock**.
- The ability to deal with the stressor falls below normal level.
- Physiologically, the body reacts as if we were injured; blood pressure and body temperature drop, and a temporary loss of muscle tone occurs.
- Associated signs and symptoms include: fainting and heart attack.

#### Counter shock

- The sympathetic nervous system is activated and the body's resistance to the stressor increases.
- The organism's response is in a fight-flight-freeze response.
- It becomes highly aroused and alert as it prepares to deal with the stressor.
- Adrenaline is released into the bloodstream and the organism's heart and respiratory system respond by accelerating.
- This supplies the muscles with more energy (glucose and oxygen), allowing the organism to 'fight or flee', as needed.
- This initial stage of the GAS is a general defensive reaction to the stressor, and results in a state of tension and alertness, and a readiness to respond to the stressor.

### Stage 2: Resistance

- If the stressor is not dealt with immediately the state of stress continues.
- The body's resistance to the stressor rises above normal.
- The intense arousal of the alarm reaction stage diminishes, but physiological arousal remains above normal.

- All unnecessary physiological processes are shut down. **For example**, digestion, growth and sex drive stall, menstruation stops, and the production of testosterone and sperm decrease.
- Corticosteroids such as cortisol (which support resistance) are released into the bloodstream to further energise the body and help repair any damage that may have occurred.
- If the effort to deal with the initial stressor during the resistance stage is successful, the organism will have adapted to the stressor and the body eventually returns to its normal 'balanced' (homeostatic) state of functioning.
- Cortisol weakens immune system activity.
- Its continuing presence at an abnormally high level interferes with the body's ability to fight disease and to protect itself against further damage.
- Resistance to other stressors, such as illness or disease, may decline. As such, cold, flu and other bacterial infections are more likely.
- Increases in social withdrawal, absence from work/school are also characteristic.
- The person may appear withdrawn, tearful or angry (moody)

### Stage 3: Exhaustion

- If the stressor is not dealt with successfully during the resistance stage, and stress continues, the organism enters an exhaustion stage.
- During the exhaustion stage, some of the alarm reaction changes may reappear, but the body cannot sustain its resistance and the effects of the stressor can no longer be dealt with.
- Because the organism has been trying to deal with the stressor for a prolonged time, its resources have been depleted, its resistance to disease is very weak, and it becomes more vulnerable to physical and mental disorders.
- More commonly, the exhaustion stage brings about signs of physical wear and tear, especially in organs that have been consistently trying to deal with the stressor throughout the resistance stage. These are primarily attributable to the immune-suppression and other effects of higher and more prolonged levels of cortisol in the bloodstream.
- This stage is characterised by extreme fatigue, high levels of anxiety and symptoms of depression, nightmares and impaired sexual performance.
- Physical disorders such as hypertension, gastrointestinal problems (e.g. ulcers) and heart disease may also occur.
- In extreme cases, if the stress continues further, the organism may even die.

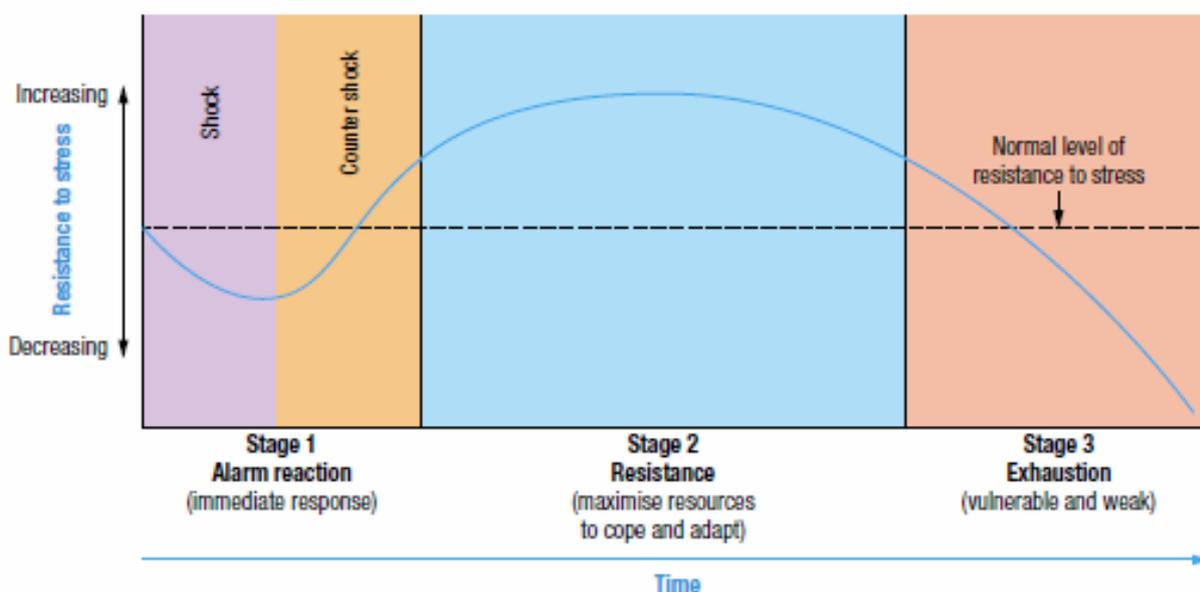
## Strengths and limitations of GAS

### Strengths

- Among the first to suggest stress weakens the body's ability to resist infection and increases likelihood of physical disorder.
- As a model it provides rich information about the physiological processes involved in stress.
- It has provided laboratory evidence for the role of the brain, endocrine system and peripheral nervous system in stress.
- Selye established that the greater the intensity of the stressor, the greater the physiological response of the individual.
- Selye also established a strong connection between extreme prolonged/or chronic stress and certain diseases.
- Results also showed that prolonged stress could lead to death in lab rats.

### Limitations

- One size fits all model...assumes everyone has the same automatic physiological response to stress.
- Overemphasis on biological processes (overlooking our psychological response).
- Selye has not recognised the role of emotions and cognitions in the stress response.
- Generalisations of Selye's findings to humans are limited as his research involved non-human (rat) subjects.
- Rat's responses to stress are less varied and less complex than humans.
- Selye has applied this model to humans without consideration for any psychological and environmental factors.



# LAZARUS AND FOLKMAN'S TRANSACTIONAL MODEL OF STRESS AND COPING

The **Lazarus and Folkman's transactional model of stress and coping** proposes that stress involves an encounter ('transaction') between an individual and their external environment, and that a stress response depends upon the individual's interpretation ('appraisal') of their ability to cope with it.

## Primary appraisal

In a **primary appraisal**, we evaluate, or 'judge', the significance of the event.

The outcome is a decision about whether the event is irrelevant, benign–positive or stressful. If we decide that the situation is stressful, then we engage in additional appraisals that involve deciding if a situation is harmful, threatening or challenging. More specifically, these appraisals involve:

- **Harm/loss** - an assessment of how much damage has already occurred (e.g. 'I have lost my job')
- **Threat** - an assessment of harm/loss that may not have yet occurred but could occur in the future (e.g. 'I might not be able to afford the rent')
- **Challenge** - an assessment of the potential for personal gain or growth from the situation (e.g. 'I'll get any other job I can and will learn to budget and save money').

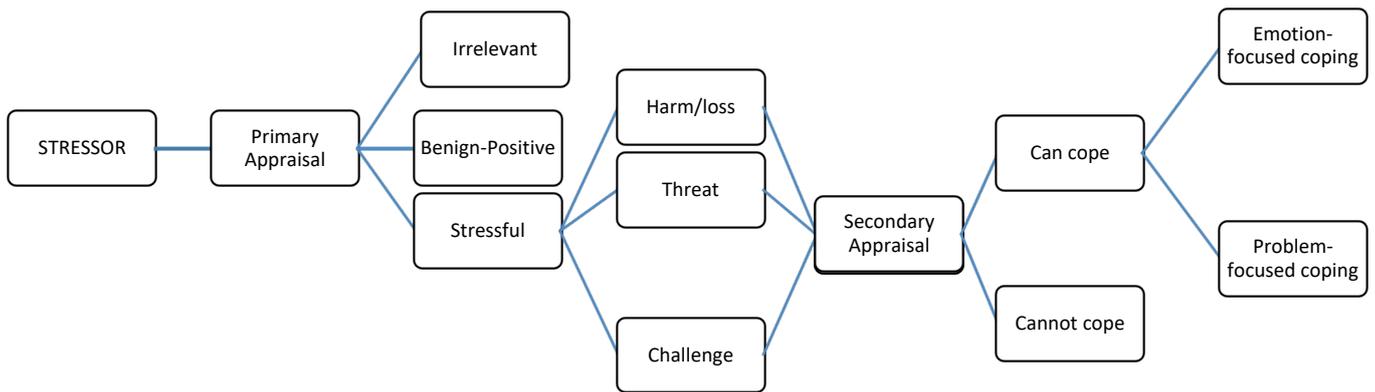
## Secondary appraisal

In a **secondary appraisal**, we evaluate our coping options and resources and our options for dealing with the event.

- The coping options and resources available may be internal (e.g. strength and determination) or external (e.g. money and support from family or friends).
- If the coping demands of the situation are perceived as being far greater than the resources that are available, then we are likely to experience a stress response.
- The discrepancy that is perceived may also trigger a search for additional or new resources that can be used to cope with the stress.

## Coping

- **Emotion-focused coping**
  - Manage our emotional response to the stressor.
- **Problem-focused coping**
  - Managing or changing the cause of the stressor.



## Strengths and limitations of Lazarus and Folkman's model of stress and coping

### Strengths

- Focuses on psychological determinants of the stress response over which we have control, as stress is an interaction with the environment in which the individual has an active role.
- Emphasises the personal nature and unique appraisal/ perception involved in stress.
- Explains why individuals respond in different ways to the same sorts of stressors (accounts for individual differences).
- Allows for the fact that stressors and the circumstances under which they occur can change over time.
- Allows us to change our thinking (reappraise) about a stressor and our response.
- Has led to the development of different methods/strategies for managing psychological responses to stressors.

### Limitations

- Individuals may not always be conscious of all the factors causing them to experience a stress response. **For example**, we can experience a stress response without ever having thought about a situation or event.
- Overlooks physiological responses.
- Difficult to test through experimental research because of the subjective nature of individual responses to stress.
- The linear approach does not allow for individual variation in progression through the stages.
- Primary and secondary appraisals can interact with one another and are often undertaken simultaneously. Thus primary and secondary appraisals are difficult to isolate for study as separate variables.

## STRATEGIES FOR COPING WITH STRESS

**Coping** is a process involving 'cognitive and behavioural efforts to manage specific internal and/or external stressors that are appraised as taxing or exceeding the resources of the person' in a stressful situation.

A **coping strategy** is a specific method, behavioural or psychological, that people use to manage or reduce the stress produced by a stressor.

### Context-specific effectiveness

A coping strategy is considered to have **context-specific effectiveness** when there is a match or 'good fit' between the coping strategy that is used and the stressful situation.

- It considers the situational determinants of coping effectiveness.
- An effective strategy would take account of all the characteristics of the stressful situation. These may relate to the physical environment, the stressor and the individual involved.
- There would be a 'match' between the coping strategy to be adopted, the situationally specific demands of the stressor and relevant personal characteristics of the individual involved.
- A stressful context also includes the person confronted by the stressor.
- Consequently, the coping strategy most likely to be effective will also take account of the personal characteristics of the individual involved, such as:
  - Personality
  - Knowledge
  - Skills
  - Interests
  - Preferences
  - Access to social support from family, friends or community

### Coping flexibility

**Coping flexibility** refers to the ability to effectively modify or adjust one's coping strategies according to the demands of different stressful situations.

Coping flexibility includes the abilities to:

- Recognise whether the use of a flexible coping approach is appropriate for a specific situation,
  - Select a coping strategy that suits the situational circumstances,
  - Recognise when the coping strategy being used is ineffective,
  - Discontinue an ineffective coping strategy, and
  - Produce and implement an alternative coping strategy when required.
- Coping flexibility is considered to be an adaptive personality attribute that enables us to adjust our thoughts, feelings or behaviour according to changing situational circumstances.

### Individuals with high coping flexibility:

- Readily adjust their coping strategies if they are ineffective. They tend to use a variety of coping strategies across situations, and have a good fit between the strategies they deploy and the demands of the situation.

### Individuals with low coping flexibility:

- Rely on the same coping strategies across different situations, and persist with them, even in the face of ineffectiveness. Essentially, these individuals are not very adaptable.

## Exercise

**Exercise** is physical activity that is usually planned and performed to improve or maintain your physical condition.

- Physical exercise increases demands on the body for energy and in the process uses up the stress hormones. This helps the body return to normal functioning sooner.

- Exercise can also help 'work out' tension that has built up in the muscles.

- Exercise increases the efficiency of the cardiovascular system and increases strength, flexibility and stamina for encountering future stressors.

- Many people experience short-term psychological benefits. **For example**, exercise can promote relaxation, thereby providing relief from stress symptoms.

- Strenuous physical activity can produce chemical changes in the body that can improve psychological health. **For example**, the brain releases mood-enhancing beta-endorphins during exercise (which relieve pain and increase a sense of wellbeing and relaxation).

- Exercise can also provide an opportunity for distraction or 'time out' from a stressor. **For example**, it can divert a person's attention away from a stressor and the negative emotional states associated with stress.

- People who exercise with others can experience long-term psychosocial benefits from the social interaction and potential social support the interactions can provide.

## Approach and avoidant coping strategies

**Approach coping strategies** involve efforts to confront a stressor and deal directly with it and its effects.

- Activity is focused towards the stressor, its causes and a solution that will address the underlying problem, issue or concern and minimise or eliminate its impact.

- Include strategies that involve engagement with the stressor. **For example**, seeking advice from an expert, accepting responsibility, venting to a friend etc.

## Benefits

- More adaptive and effective than avoidance strategies.
- People who rely more on approach strategies to cope with a stressor tend to experience fewer psychological symptoms and are more able to function effectively.

## Limitations

- Initially or in the short term, may increase stress levels whilst the individual is directly engaged with the stressor and its causes.
- May require a lot of the individual's energy and focus to deal with the stressor, thereby neglecting other aspects of their lives.

**Avoidant coping strategies** involve efforts that evade a stressor and deal indirectly with it and its effects.

- Activity is focused away from the stressor and there is no attempt to actively confront the stressor and its causes.
- Include strategies that involve behavioural or emotional disengagement. **For example**, denial, distancing, procrastination, fantasy or wishful thinking, escape, substance abuse, oversleeping etc.

## Benefits

- Selectively avoiding to deal with unchangeable aspects of a stressor by 'switching off' may be considered an adaptive strategy.
- It allows for the conservation of energy to focus on other stressors that can be changed.
- Disengagement, might be appropriate in a situation where nothing can be done.
- Can be more effective in coping with stress in the short term.
- Ignoring a stressor for a couple of days while focusing on other things can provide 'time out' from a stressor while minimising potential stress from another source.

## Limitations

- Tend to be maladaptive.
- Excessive reliance on avoidance strategies tends to be associated with a number of negative consequences, **e.g.** increased vulnerability to mental health problems and stress-related physical problems.
- Long-term use of avoidance strategies can also contribute to other problems. **E.g.** Substance use.
- Tend to only be helpful in the short term and their long term use can prevent people from responding to stressors in constructive ways.
- Delaying actually dealing with a stressor can also have negative consequences & might be detrimental when action is needed.



## CHAPTER 4: NEURAL BASIS OF LEARNING AND MEMORY

### NEURAL PLASTICITY AND CHANGES TO CONNECTIONS BETWEEN NEURONS

#### Neural plasticity

**Neural plasticity** is the ability of the brain's neural structure or function to be changed by experience throughout the lifespan. This property of the brain provides the physiological basis of learning and memory.

**For example**, learning language as a child.

#### Changes to connections between neurons

**Synaptic plasticity** refers to the ability of the synapse to change over time. It is also the biological basis of learning and memory.

**For example**, change may occur through growth or formation of new synaptic connections that strengthen the synapse or change may occur through disuse of synaptic connections that weaken or eliminate the synapse.

**Hebb's rule** is an explanation of changes to synaptic connections between neurons during learning; often summarised as 'neurons that fire together, wire together'.

According to Hebb, when neurotransmitter is repeatedly sent across the synaptic gap, presynaptic and postsynaptic neurons are repeatedly activated at the same time. When a presynaptic and a postsynaptic neuron are active at the same time, this changes the structure or chemistry of the synapse, strengthening the connection between these two neurons at the synapse. When the synaptic connection is strengthened, this makes them more likely to fire together again and to transmit their signals more forcibly and efficiently in the future. Conversely, not firing together – for example, through disuse, weakens the connections between neurons and also makes them less likely to fire together at the same time in the future.

#### Long-term potentiation and long-term depression

**Long-term potentiation (LTP)** refers to the long-lasting strengthening of synaptic connections, resulting in enhanced or more effective synaptic transmission.

LTP strengthens synaptic connections in a way that enables postsynaptic neurons to be more easily activated. The postsynaptic neurons become more and more responsive to the presynaptic neurons as a consequence of repeated stimulation by neurotransmitters. The more that the connection is

activated, the more the connection is strengthened. The more the connection is strengthened, the more the relevant neural pathway is strengthened, increasing the efficiency in transferring information along the pathway and decreasing the likelihood that what has been learned will be forgotten.

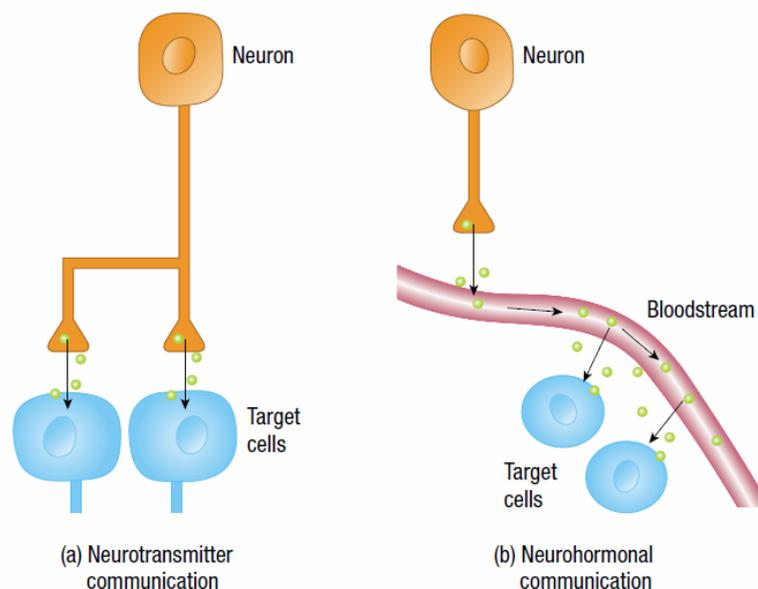
**Long-term depression (LTD)** is the opposite of LTP; that is, a long-lasting decrease in the strength of synaptic transmission.

Basically, a postsynaptic neuron becomes less responsive to the neurotransmitter released by a presynaptic neuron and the effect is to weaken the synaptic connection and therefore weaken or even silence communication at the synapse. The process occurs as if the rule 'use it or lose it' is being followed.

## ROLE OF NEUROTRANSMITTERS AND NEUROHORMONES

**Neurohormones** are chemical messengers that are manufactured by neurons and released from axon terminals into capillaries.

Unlike neurotransmitters, they are not released into the synaptic gap. Instead, they are released into capillaries (tiny blood vessels) where they are absorbed into the bloodstream and carried to target neurons or cells.



### Role of glutamate in synaptic plasticity

**Glutamate** is the main excitatory neurotransmitter throughout the brain and enhances information transmission by making postsynaptic neurons more likely to fire. It promotes the growth and strengthening of synaptic connections between neurons within a neural pathway that subsequently represents the memory of what has been learned.

Specific types of glutamate receptors have to be present on the dendrites of postsynaptic neurons for glutamate to have these effects. Two of these receptors are commonly called **AMPA** and **NMDA** and glutamate has to have an effect on both of them. Generally, AMPA prepares the postsynaptic neuron to accept glutamate then clears out so that NMDA can accept the glutamate. Glutamate will then excite the postsynaptic neuron and convey its message.

## Role of adrenaline in the consolidation of emotionally arousing experiences

### Consolidation

**Consolidation** is the biological process of making a newly formed memory stable and enduring after learning. Time is required after learning takes place to enable the new information to consolidate ('set') as a durable long-term memory.

**For example**, writing your name in wet concrete. Once the concrete has set (the information has consolidated in long-term memory), your name (the information) is relatively permanently ingrained. But while it is setting (the process of consolidation), it can be interfered with (altered) or erased (completely lost).

The **hippocampus** is a structure located deep within the brain that has a crucial role in the consolidation of most of our memories. Whenever a memory is retrieved, it is open to further consolidation and has to be 're-stabilised' through the process called **reconsolidation**.

### Role of adrenaline

**Adrenaline** is a hormone produced within the adrenal gland that is secreted during stress and may also affect memory consolidation of emotionally arousing experiences. In particular, adrenaline can enhance the consolidation of long-term memories of emotionally arousing experiences.

The **amygdala** is a structure located deep within the brain that has a crucial role in processing emotions. When released during heightened emotional arousal, adrenaline induces the release of noradrenaline in the amygdala.

## CHAPTER 5: MODELS TO EXPLAIN LEARNING

**Learning** is a relatively permanent change in behaviour due to experience.

**Conditioning** is the process of learning associations between a stimulus in the environment (one event) and a behavioural response (another event).

**For example**, associating a smile with friendly behaviour.

### CLASSICAL CONDITIONING

In relation to learning, a **stimulus** is any object or event that elicits (produces) a response from an organism.

A **response** is a reaction by an organism to a stimulus.

**Classical conditioning** refers to a type of learning that occurs through the repeated association of two (or more) different stimuli.

## Classical conditioning as a three-phase process

The **neutral stimulus (NS)** is any stimulus that does not normally produce a predictable response. **For example**, dogs do not normally salivate in response to the ringing of a bell.

The **unconditioned stimulus (UCS)** is any stimulus that consistently produces a particular, naturally occurring, automatic response. In Pavlov's experiments, the UCS was the food.

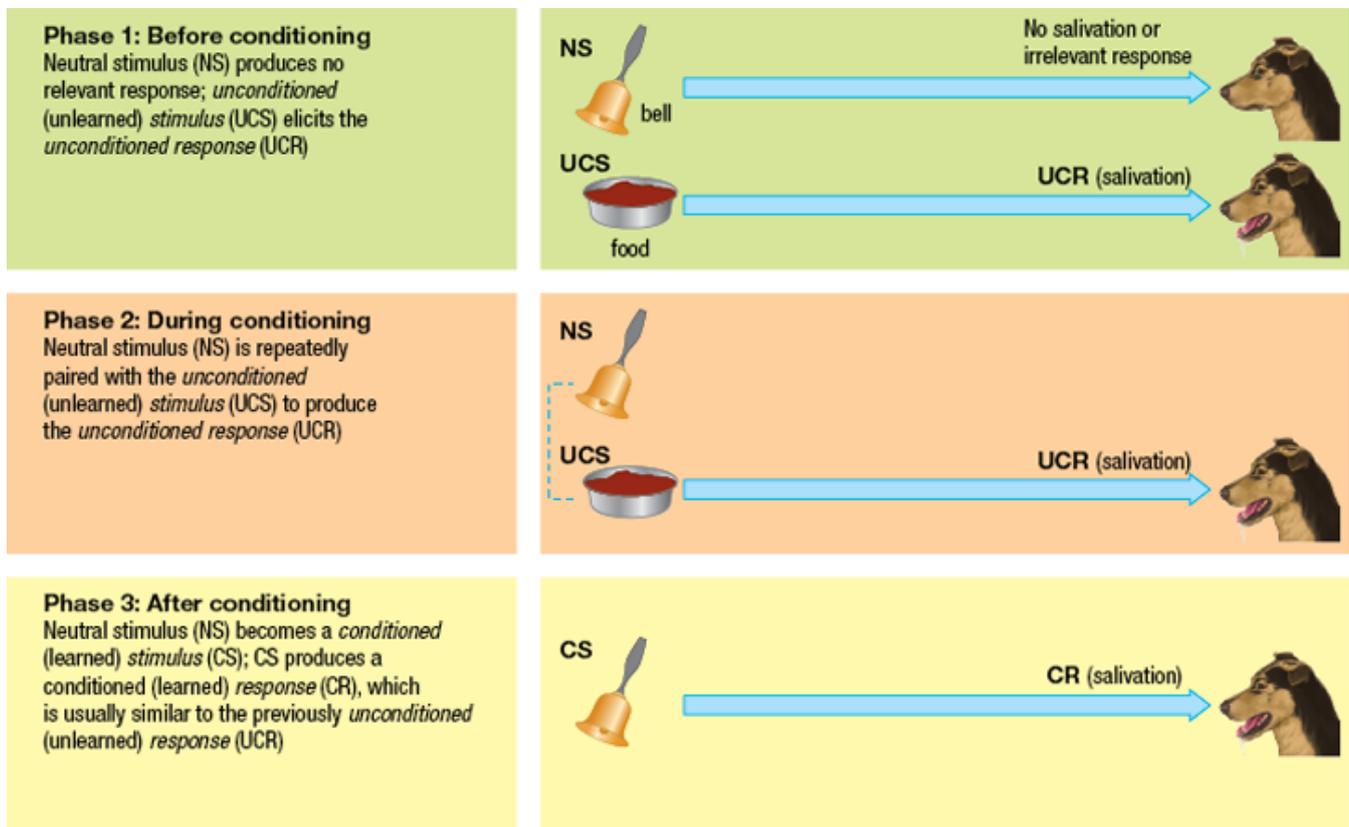
The **unconditioned response (UCR)** is the response that occurs automatically when the UCS is presented. In Pavlov's experiments, the UCR was the salivation by the dogs to the presence of food.

The **conditioned stimulus (CS)** is the stimulus that is 'neutral' at the start of the conditioning process but eventually triggers a very similar response to that caused by the UCS. In Pavlov's experiments, the CS was the ringing of the bell.

The **conditioned response (CR)** is the learned response that is produced by the conditioned stimulus. In Pavlov's experiments, the CR was the salivation by the dogs in response to the ringing of a bell.

A **trial** is each paired presentation of the NS with the UCS.

**Acquisition** is used to describe the overall process during which an organism learns to associate two events – the NS and the UCS – until the NS alone has become a CS that produces the CR.



## Stimulus generalisation

**Stimulus generalisation** is the tendency for another stimulus that is similar to the original CS to produce a response that is similar, but not necessarily identical, to the CR.

**For example**, if stimulus generalisation to the sound of a bell occurred with one of Pavlov's dogs, the dog might also salivate in response to the ringing of a front doorbell.

## Stimulus discrimination

**Stimulus discrimination** occurs when a person or animal responds to the CS only, but not to any other stimulus that is similar to the CS.

**For example**, stimulus discrimination would be observed when a dog salivated only in response to the sound of the 'experimental' bell, and not in response to any other similar sound such as a front doorbell.

## Extinction

**Extinction** is the gradual decrease in the strength or rate of a CR that occurs when the UCS is no longer presented.

**For example**, Pavlov's dogs eventually ceased salivating (CR) in response to the bell (CS) presented alone after a number of trials in which the food (UCS) did not follow the sound of the bell.

## Spontaneous recovery

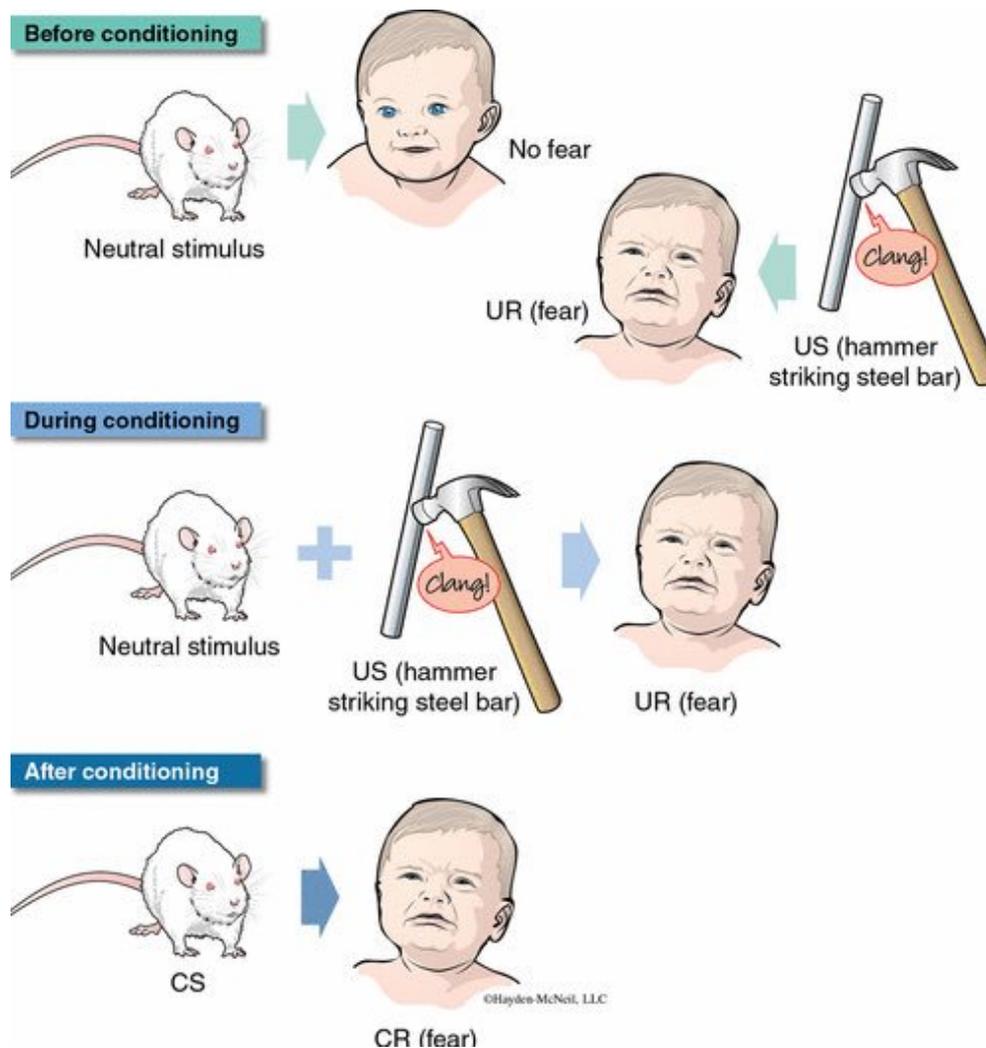
**Spontaneous recovery** is the reappearance of a CR when the CS is presented, following a rest period (i.e. when no CS is presented) after the CR appears to have been extinguished.

**For example**, spontaneous recovery would occur if one of Pavlov's dogs started salivating again to the sound of a bell after extinction is intentionally achieved as part of the experimental research.

## The 'Little Albert' experiment

A **conditioned emotional response** is an emotional reaction in response to a specific stimulus acquired through classical conditioning.

[Little Albert experiment chart](#)



## CLASS CLASSICAL CONDITIONING PRAC

**Aim-** To investigate the effect of classical conditioning through the use of repeated association of two stimuli (the chips and a bell).

**Hypothesis-** It is hypothesised that students will salivate only to the ring of the bell just after the process of conditioning has taken place.

**Discussion-** All **three phases** of classical conditioning were present in the experiment. During the first phase '**before conditioning**' the **neutral stimulus (NS)** (bell) produces no response in the participants, the **unconditioned stimulus (UCS)** (chips) caused the participants to **salivate**, which is an **unconditioned response (UCR)**. The second phase '**during conditioning**' then commenced, the **neutral stimulus (NS)** is paired and repeatedly associated with the **unconditioned stimulus (UCS)** which causes an **unconditioned response (UCR)** of **salivation** in the participant. The final phase '**after conditioning**' then takes place, in which, the **neutral stimulus (NS)** becomes a **conditioned stimulus (CS)** and the **unconditioned response (UCR)** converts into a **conditioned response (CR)**. Now through the sound of the bell (CS) participants salivated (CR). However, shortly after, the process of **extinction** took place and students no longer salivated to the sound of the bell.

# OPERANT CONDITIONING

**Operant conditioning** is a type of learning whereby the consequences of behaviour determine the likelihood that it will be performed again in the future.

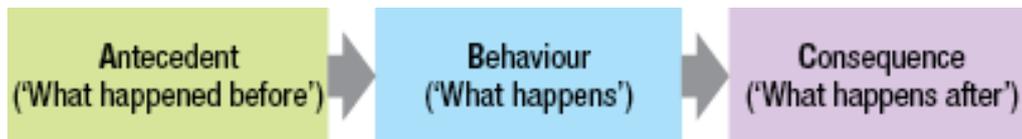
An **operant** is any response (or set of responses) that acts ('operates') on the environment to produce some kind of consequence.

Unlike the classical conditioning process which involves **involuntary**, reflexive responses that are automatically elicited by a stimulus, operant conditioning involves **voluntary** responses.

## Operant conditioning as a three-phase model

The **three-phase model of operant conditioning** has three parts that occur in a specific sequence:

1. The **antecedent** (A), a stimulus that occurs before the behaviour.
2. The **behaviour** (B) that occurs due to the antecedent.
3. The **consequence** (C) to the behaviour.



The **antecedent** is the stimulus (object or event) that precedes a specific behaviour, signals the probable consequence for the behaviour and therefore influences the occurrence of the behaviour.

**For example**, your mobile phone ring tone when you are expecting a call from a friend is the antecedent stimulus.

**Behaviour** is the voluntary action that occurs in the presence of the antecedent stimulus.

**For example**, tapping 'Accept' on your mobile's screen.

The **consequence** is the environmental event that occurs immediately after the behaviour and has an effect on the occurrence of the behaviour.

**For example**, being able to have a conversation with your friend.

## Reinforcers

**Reinforcement** is said to occur when a stimulus strengthens or increases the frequency or likelihood of a response that it follows.

A **reinforcer** is any stimulus that strengthens or increases the frequency or likelihood of a response that it follows.

## Positive reinforcer

A **positive reinforcer** is a stimulus that strengthens or increases the frequency or likelihood of a desired response by providing a satisfying consequence.

**Positive reinforcement** involves giving or applying a positive reinforcer after the desired response has been made, which strengthens the likelihood of the behaviour occurring again.

## Negative reinforcer

A **negative reinforcer** is any unpleasant or aversive stimulus that, when removed or avoided, strengthens or increases the frequency or likelihood of a desired response.

**For example**, a Skinner box has a grid on the floor through which a mild electrical current can be passed continuously. The removal of the shock (negative reinforcer) is referred to as negative reinforcement.

**Negative reinforcement** involves the removal or avoidance of an unpleasant stimulus. It has the effect of increasing the likelihood of a response being repeated, thereby strengthening the response. Thus, the likelihood of the lever-pressing response will increase because the negative reinforcer (the shock) is removed as a consequence of this lever-pressing behaviour.

- Positive (+) reinforcer = adding something pleasant
- Negative (-) reinforcer = subtracting something unpleasant

## Punishment

**Punishment** is the delivery of an unpleasant consequence following a response, or the removal of a pleasant consequence following a response.

**Positive punishment** involves the presentation (or introduction) of a stimulus, thereby decreasing (or weakening) the likelihood of a response occurring again.

**For example**, being given extra chores at home for doing something wrong.

**Negative punishment** involves the removal or loss of a stimulus and thereby decreasing (or weakening) the likelihood of a response occurring again.

**For example**, not being allowed to join basketball training because you are late.

## Response cost

**Response cost** may be described as involving removal of any valued stimulus, whether or not it causes the behaviour.

**For example**, if you get a speeding fine, your money (a valued stimulus) is taken away from you.

## FACTORS INFLUENCING THE EFFECTIVENESS OF REINFORCEMENT AND PUNISHMENT

- Order of presentation
- Timing
- Appropriateness

### OPERANT CONDITIONING TABLE REPRESENTATION

	Strengthens Behaviour	Weakens Behaviour
Adding something	Positive reinforcement	Positive punishment
Taking away something	Negative reinforcement	Negative punishment

### SKINNER'S EXPERIMENTS WITH RATS

When a hungry rat was placed in the box, it scurried around it and randomly touched parts of the floor and walls. Eventually, the rat accidentally pressed a lever mounted on one wall. Immediately, a pellet of rat food dropped into the food dish and the rat ate it. The rat continued its random movements and eventually pressed the lever again. Another pellet dropped immediately and was eaten. With additional repetitions of lever-pressing followed by food, the rat's random movements began to disappear and were replaced by more consistent lever-pressing. Eventually, the rat was pressing the lever as fast as it could eat each pellet. The pellet was a reward for making the correct response. Skinner referred to different types of rewards as reinforcers.

### CLASS OPERANT CONDITIONING PRAC

**Aim-** To trial operant conditioning through the use of negative and positive consequences in response to specific behaviour.

**Antecedent-** Being told to look for an object in the room.

**Behaviour-** Looking for an object by walking around the room.

**Consequence-** The consequence was either a positive response or a negative response from the audience. If the participant walked closer to the object the audience would cheer. If the participant walked away from the object the audience would boo them.

**Discussion-** Operant conditioning was present as the participant would repeat an action if it had a positive response from the crowd and would not repeat an action that had a negative response from the spectators. The positive response from the audience is **positive reinforcement** and the negative response is **positive punishment**.

## Stimulus generalisation

**Stimulus generalisation** occurs when the correct response is made to another stimulus that is similar (but not necessarily identical) to the stimulus that was present when the conditioned response was reinforced.

**For example**, a pigeon trained to peck at a switch that was lit by a green light would generalise the original stimulus with lights of varying colours.

## Stimulus discrimination

**Stimulus discrimination** occurs when an organism makes the correct response to a stimulus and is reinforced, but does not respond to any other stimulus, even when stimuli are similar (but not identical).

**For example**, a pigeon in a Skinner box could be taught to discriminate between a red and a green light.

## Extinction

**Extinction** is the gradual decrease in the strength or rate of a conditioned (learned) response following consistent non-reinforcement of the response.

**For example**, when Skinner stopped reinforcing his rats or pigeons with food pellets.

## Spontaneous recovery

After the apparent extinction of a conditioned response, **spontaneous recovery** can occur and the organism will once again show the response in the absence of any reinforcement.

# **OBSERVATIONAL LEARNING**

**Observational learning** occurs when someone uses observation of a model's actions and the consequences of those actions to guide their future actions.

A **model** is who or what is being observed and may be live or symbolic.

Bandura's **social learning theory** emphasises the importance of the environment, or 'social context', in which learning occurs.

**Vicarious conditioning** is when an individual observes a model displaying behaviour that is either reinforced or punished and later behaves in the same way, in a modified way, or refrains from doing so as a result of the observation.

**Vicarious reinforcement** increases the likelihood of the observer behaving in a similar way to a model whose behaviour is reinforced.

**For example**, a student who see another student being allowed to leave a class early after correctly finishing all their work may be more inclined in another class to model the behaviour and respond in a similar way if they consider leaving class early a desirable outcome (a reinforcer).

**Vicarious punishment** occurs when the likelihood of an observer performing a particular behaviour decreases after having seen a model's behaviour being punished.

**For example**, a student may observe someone else in class receiving detention for calling out without permission. The observer is likely to refrain from that behaviour in the future if they view detention as an undesirable outcome (a punisher).

### Observational learning processes

#### - Attention

Learner pays attention in order to observe the modelled behaviour.

#### - Retention

Learner mentally represents and retains what has been observed.

#### - Reproduction

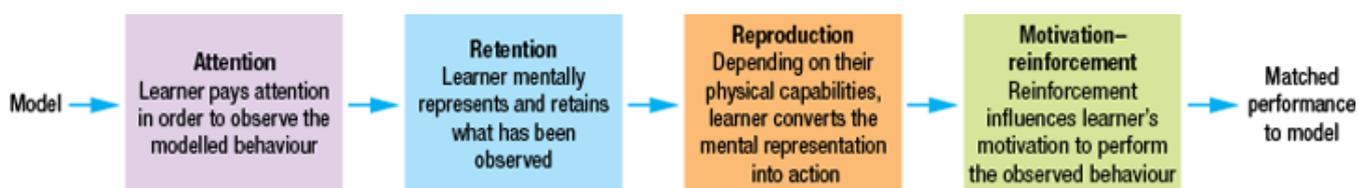
Depending on their physical capabilities, learner converts the mental representation into action.

#### - Motivation

The learner must want to reproduce what was observed.

#### - Reinforcement

Reinforcement influences learner's motivation to perform the observed behaviour.



## **BANDURA'S EXPERIMENTS WITH CHILDREN**

Bandura allocated children into 3 groups, each group watched one of three movies. The movies all displayed an adult model punching, hitting, kicking and verbally abusing a large inflated Bobo doll. The children were split into 3 conditions.

In the **first condition** children observed the **aggressive model** being **rewarded** with lollies, soft drink and praise from another adult.

In the **second condition** children observed the **aggressive model** being **punished** with a spanking and verbal criticisms such as 'Hey there, you big bully! Quit picking on that clown.'

In the **third condition** there were **no consequences** for the **aggressor's behaviour**.

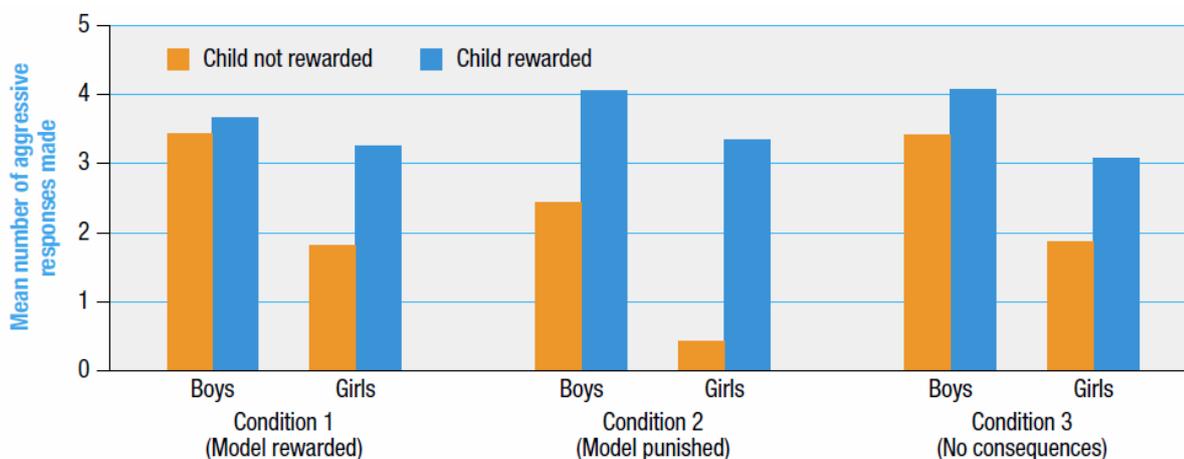
Children who watched the **aggressive model** either being **reinforced** or **experiencing no consequences** for their **aggressive behaviour imitated aggressive behaviour more than the children who watched the aggressive model being punished**.

When children were offered a **reward (positive reinforcer)** for **imitating the model's aggressive behaviour**, even children who had seen the **model punished tended to imitate the model's behaviour by behaving more aggressively**.

Although the **boys were more aggressive than the girls in all three conditions**, the **girls were nearly as aggressive as the boys if they were offered a reward**.

Importantly, the results also indicate that **observational learning can sometimes occur by simply viewing a model even if the model is neither reinforced nor punished**. Clearly the boys and girls had learned something from observing the model. This highlights an important **distinction between learning and performance (the actual production of a learned response)**. If someone **observes a model's behaviour and does not perform the actions they have observed, it does not mean that the behaviour was not learned**.

The results of Bandura's experiment indicate that probably all the **children learned the model's behaviour, regardless of whether they observed the model being reinforced or punished or experiencing no consequences for aggressive behaviour**. Some children simply did not perform what they had learned until they were offered an incentive (reward) to do so.



## CLASS OBSERVATIONAL LEARNING PRAC

**Aim-** To be able to recreate a balloon animal through the process of observational learning.

**Hypothesis-** It is hypothesised that year 11 and 12 students will be able to replicate the process of creating a balloon animal through the process of observational learning.

### Attention

Observing the model creating the balloon animal.

### Retention

Learner mentally represents and retains how the balloon has been transformed.

### Reproduction

The learner converts the mental representation into an action to imitate the actions of the model.

### Motivation

The learner wants to recreate the balloon animal.

### Reinforcement

The learner has a sense of fulfilment as they were able to recreate the balloon animal.

## COMPARING AND CONTRASTING BETWEEN CLASSICAL CONDITIONING AND OPERANT CONDITIONING

Classical conditioning	Similarities	Operant conditioning
<ul style="list-style-type: none"> <li>- The association of two stimuli, the NS and UCS, provides the basis of learning.</li> <li>- Extinction takes place over a period when the UCS is withdrawn or is no longer present and the CS is repeatedly presented alone.</li> <li>- Accounts for the acquisition of the response.</li> <li>-The behaviour of the organism does not have any environmental consequence.</li> <li>- The response is involuntary.</li> <li>- The learner is a passive participant and does not control the learning process.</li> <li>- Response relies on the UCS being presented first.</li> <li>- Association is between two stimuli.</li> <li>- The timing of the two stimuli must be close (ideally about half a second) and the sequencing is vital.</li> <li>- The response is often one involving the action of the autonomic nervous system, and the association of the two stimuli is often not conscious or deliberate.</li> </ul>	<ul style="list-style-type: none"> <li>- There is an acquisition process whereby a response is conditioned or learned.</li> <li>- Both types of conditioning are achieved as a result of the repeated association of events that follow each other closely in time.</li> <li>- Extinction of the learned response can occur.</li> <li>- Spontaneous recovery can occur.</li> <li>- Stimulus generalisation can occur.</li> <li>- Stimulus discrimination can occur.</li> </ul>	<ul style="list-style-type: none"> <li>- Behaviour is associated with consequences that follow it.</li> <li>- Extinction also occurs over time, but after reinforcement is no longer given.</li> <li>- Accounts for the perpetuation (maintenance) of the response.</li> <li>- The consequence of a response is a vital component of the learning process.</li> <li>- Involves voluntary responses that are initiated by the organism, as well as involuntary responses.</li> <li>- The learner is an active participant and does control the learning process.</li> <li>- The presentation of the reinforcer or punisher depends on the response occurring first.</li> <li>- Association is between the stimulus and the response.</li> <li>- While learning generally occurs faster when the reinforcement or punishment occurs soon after the response (behaviour), there can be a considerable time difference between them (especially in humans).</li> <li>- The response may involve the autonomic nervous system but often involves higher order brain processes because the response is conscious, intentional and often goal-directed.</li> </ul>

## **CLASS PRACTICALS OVERVIEW**

### **CLASSICAL CONDITIONING PRAC**

**NS** – The ringing of the bell.

**UCS** – Salt and vinegar chips.

**UCR** – Salivation to the salt and vinegar chips.

**CS** – The ringing of the bell.

**CR** – Salivation.

#### **Before conditioning**

The neutral stimulus (ringing of the bell) produces no response from the participants. The unconditioned stimulus (salt and vinegar chips) produces an unconditioned response (salivation).

#### **During conditioning**

The neutral stimulus (ringing of the bell) is repeatedly paired with the unconditioned stimulus (salt and vinegar chips) to produce the unconditioned response (salivation).

#### **After conditioning**

The neutral stimulus (ringing of the bell) becomes a conditioned stimulus. The conditioned stimulus produces a conditioned response (salivation) which is similar to the previously unconditioned response (salivation).

## **OPERANT CONDITIONING PRAC**

**Antecedent** – Being told to look for an inanimate object hidden in the room.

**Behaviour** – Looking and moving around the room to find object.

**Consequence** – The consequence was either a positive response or a negative response from the audience. If the participant walked closer to the object the audience would cheer. If the participant walked away from the object the audience would boo them.

Operant conditioning was present as the participant would repeat an action if it had a positive response from the audience and would not repeat an action that had a negative response from the audience. The positive response (cheering) from the audience is positive reinforcement as the participant's behaviour strengthens due to receiving a pleasant stimulus. The negative response (booing) is positive punishment as the participant's behaviour weakens due to receiving an unpleasant stimulus.

## **OBSERVATIONAL LEARNING PRAC**

**Attention** – The participants were actively observing the behaviour of the model (Miss Kerr) creating the balloon dog.

**Retention** – The participants created a mental representation and retained the information they observed of the balloon's transformations into the shape of a dog.

**Reproduction** – The participants were physically capable of replicating the actions of the model and created the balloon dog.

**Motivation** – The participants wanted to perform the behaviour of creating the balloon dog.

**Reinforcement** – As the participants were able to recreate the balloon dog, they felt a sense of fulfilment, strengthening their behaviour of recreating the balloon dog.

## **SIMILARITIES BETWEEN SKINNER'S EXPERIMENT AND OUR STUDY**

- Involved voluntary responses (rat pressing lever) and (participant moving around the room).
- The participant was active and was controlling their learning process.
- The participant's response was conscious, intentional and goal-directed.
- Both the rat and the participant explored their environment randomly (rat touching parts of the floor and walls, and the participant walking around the room randomly).

## CHAPTER 6: PROCESS OF MEMORY

### MEMORY

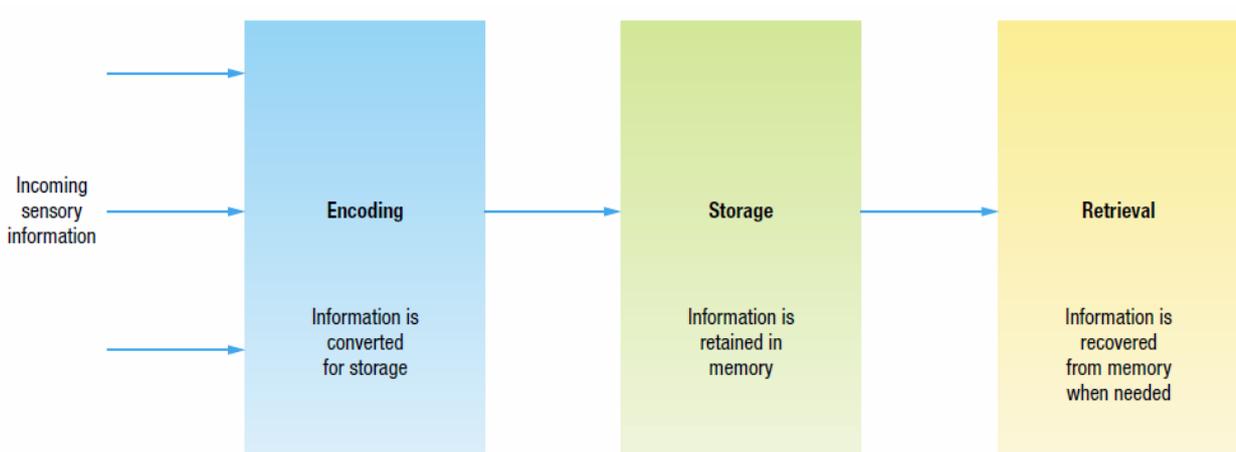
**Memory** refers to the processing, storage and retrieval of information acquired through learning.

#### The three fundamental processes of memory

**Encoding** is the conversion of information into a form that can be neurologically represented and stored in memory.

**Storage** is the retention of encoded information over time.

**Retrieval** is the recovery of stored information and bringing into conscious awareness for use.



## ATKINSON-SHIFFRIN MULTI-STORE MODEL OF MEMORY

### Atkinson-Shiffrin multi-store model

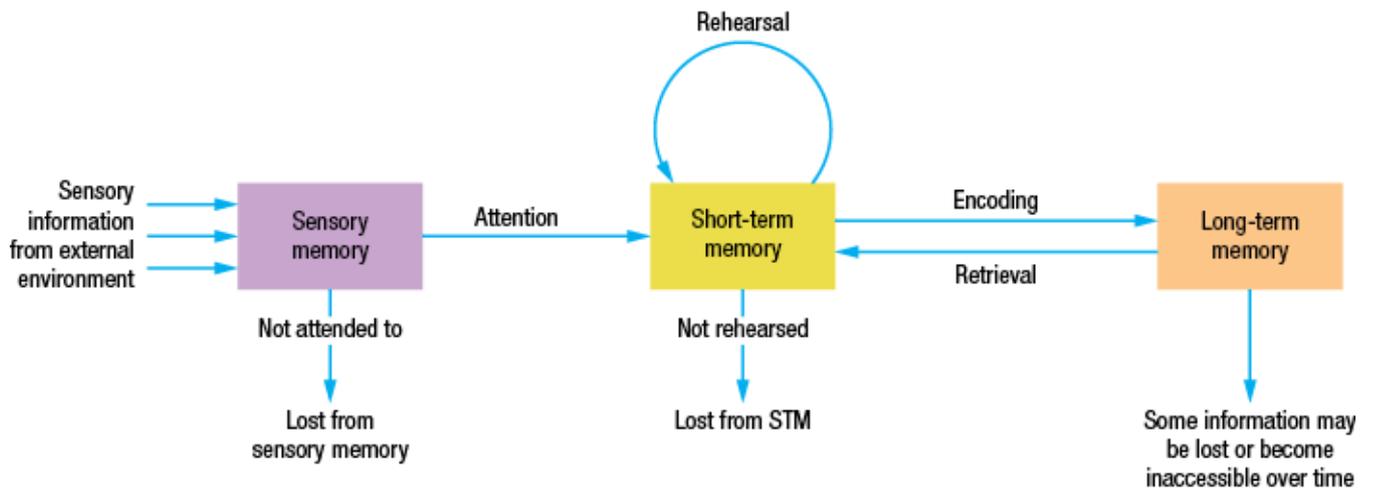
The **Atkinson-Shiffrin multi-store model** represents memory as consisting of three separate stores (components) called sensory memory, short-term memory and long-term memory. The Atkinson-Shiffrin multi-store model describes memory in terms of its structural features and control processes.

**Structural feature** in the Atkinson–Shiffrin multi-store model, is a permanent, built-in fixed feature of memory that does not vary from one situation to the other.

**For example**, storage capacity and storage duration.

**Control process** in the Atkinson–Shiffrin multi-store model, is an activity that is consciously performed to assist the memory process.

**For example**, attention and maintenance rehearsal are control processes.



### Key features of the three memory stores

Store	Function	Capacity	Duration
Sensory memory (SM)	<ul style="list-style-type: none"> <li>Receives sensory information from the environment</li> <li>Enables perceptual continuity for the world around us</li> </ul>	Vast, potentially unlimited	Momentary — about 0.2–4 seconds, occasionally up to 10 seconds
Short-term memory (STM)	<ul style="list-style-type: none"> <li>Receives information from SM and transfers information to and from LTM</li> <li>Maintains information in conscious awareness for immediate use</li> </ul>	$7 \pm 2$ pieces of information	<ul style="list-style-type: none"> <li>Temporary — 18–20 seconds, occasionally up to 30 seconds</li> <li>Longer if renewed (e.g. maintenance rehearsal; using for 'working memory')</li> </ul>
Long-term memory (LTM)	Information storage for re-access and use at a later time	Vast, potentially unlimited	<ul style="list-style-type: none"> <li>Potentially permanent</li> <li>Some information may be lost or inaccessible over time</li> <li>Indefinite</li> </ul>

## SENSORY MEMORY

**Sensory memory** is the entry point of memory in which the stimuli that bombard the senses are retained in their original sensory form for a very brief time.

- Sensory information remains in sensory memory just long enough for us to attend to and select the information to be transferred to short-term memory (STM) for processing. It is therefore a temporary storage system.

- However, when we direct our attention to information in sensory memory, this has the effect of transferring it to STM where we become consciously aware of it.

**For example**, if your attention is focused on reading this page, you will be unaware of many of the sounds around you.

- If the sensory information is not attended to and no further processing occurs, its impression fades and therefore cannot be transferred to STM or subsequently to long-term memory (LTM), and is permanently lost from experience.

**Sensory registers** are separate systems where it is believed incoming sensory information is stored for different periods.

There is probably a separate sensory register for each of the senses.

### Iconic memory

**Iconic memory** is visual sensory memory for incoming visual information that stores visual images in their original form for a third of a second.

**For example**, the numerous visual images you process while at a nightclub will be stored in your visual sensory register (iconic memory).

### Echoic memory

**Echoic memory** is auditory sensory memory for incoming auditory information that stores sounds in their original sensory form for about three or four seconds.

**For example**, in a nightclub, the sounds of music and voices of people will be stored in your auditory sensory register (echoic memory).

Echoic memory stores information for longer periods compared to iconic memory.

### Storage duration of iconic and echoic memories

iconic (visual) memory	about 0.2–0.4 of a second
echoic (auditory) memory	about 3–4 seconds

## **SHORT-TERM MEMORY (STM)**

**Short-term memory (STM)** is a memory system with limited storage capacity in which information is stored for a relatively short time, unless renewed in some way.

**For example**, if an individual is paying attention to this sentence, it has entered their short-term memory.

- Short-term memory stores information temporarily, but for a longer time than sensory memory (and less than long-term memory).

- In short-term memory, the information is no longer an exact replica of the sensory stimulus, but an encoded version.

- Many psychologists now prefer to use the term **working memory** instead of short-term memory to emphasise the active processing and use of information that occurs there.

**Working memory** is the active processing and use of information that enables us to actively 'work on' and manipulate information while we undertake our everyday tasks.

## Duration of short-term memory

Generally, most types of information can be retained fairly well in short-term memory for the first few seconds. After about 12 seconds, however, recall starts to decline and by about 18 seconds almost all of the information disappears entirely if it has not been renewed in some way. Short-term memory duration is sometimes described as 'up to 30 seconds'.

## Capacity of short-term memory

Compared to sensory memory and long-term memory, short-term memory has a very limited storage capacity. The amount of information it can hold at any one time is about seven 'bits of information'.

- When short-term memory is 'full', new items can only be added by pushing old items out.

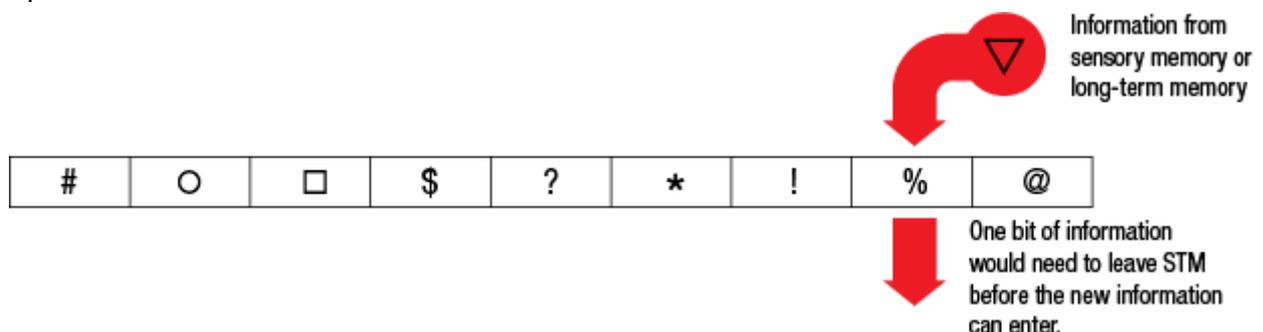
- Space in short-term memory is also filled when we think and when information is temporarily retrieved from long-term memory to be used or updated.

- Information stored in short-term memory is lost primarily through **decay** (not being used) and **displacement** (being pushed out) by new information. Decay of information in short-term memory occurs when information is not renewed (e.g. through repetition) and simply fades away with the passage of time.

**For example**, this occurs when you forget what you want to say in a conversation while you wait for another person to finish what they are saying. Your thoughts quickly fade from short-term memory because listening to what the speaker is saying prevents you from repeating the information and therefore maintaining in short-term memory the point you wanted to make.

- When you think, your 'working space' in short-term memory is used up. The limited capacity of short-term memory explains why it is difficult to think about problems involving more than  $7 \pm 2$  issues (or 'items' of information). We forget some aspects of the problem because they exceed the capacity of short-term memory.

- Fading or displacement can explain the experience of forgetting someone's name straight after they have been introduced to you. The new additional items of information introduced during the conversation may result in the capacity of short-term memory being exceeded and displacement of the person's name.



**Figure 6.12** When STM is 'full', new items can only enter though displacement — by pushing an old item out.

# LONG-TERM MEMORY

**Long-term memory (LTM)** is a memory store that holds a potentially unlimited amount of information for a very long time, possibly permanently. The two main long-term memory types are called explicit and implicit memory.

## Explicit memory

**Explicit memory** involves memory that occurs when information can be consciously or intentionally retrieved and stated. Explicit memories are also called **declarative memories**. Explicit memory has two sub-types that are called episodic memory and semantic memory.

### Episodic memory

**Episodic memory** is the long-term explicit memory of personally experienced events.

**For example**, your memory of your first day at school.

- These memories often include details of the time, place and our psychological and physiological state when the event occurred.

### Semantic memory

**Semantic memory** is the long-term explicit memory of facts and knowledge about the world. It includes our specialised knowledge of:

- Facts and knowledge of the kind learned in school
- Everyday facts and general knowledge
- The meaning of words
- Rules
- Areas of expertise

Unlike episodic memories, semantic memories are not 'tagged' with details of time and place.

## Implicit memory

**Implicit memory** involves memory that does not require conscious or intentional retrieval. Implicit memories are also referred to as **non-declarative memories**. The two sub-types of implicit memory are called procedural memory and classically conditioned memory.

**For example**, motor skills like brushing your teeth and riding a skateboard.

### Procedural memory

**Procedural memory** is the long-term implicit memory of motor skills and actions that have been learned previously.

**For example**, how to brush your teeth or how to use chop sticks.

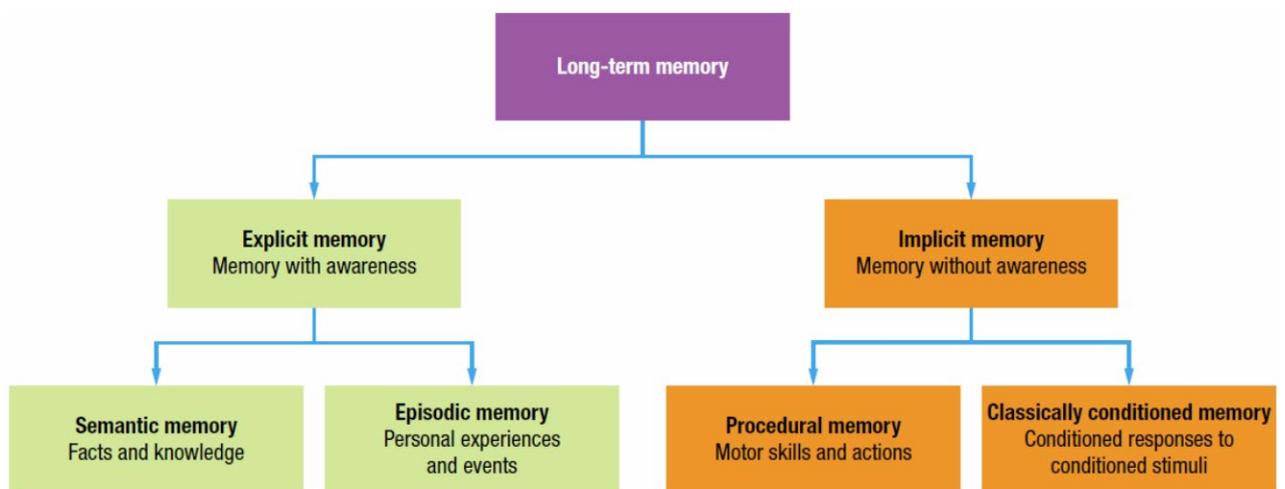
- It involves memories of 'how to do something'.

## Classically conditioned memory

Conditioned responses to conditioned stimuli acquired through classical conditioning are also considered to be a type of implicit memory, particularly those involving fear or anxiety.

**For example**, if you immediately experience fear or anxiety at the sight of a spider or when you think about having to go to the dentist because of past associations with anxiety or pain, implicit memory is involved, whether or not you have an explicit 'declarable' recollection of a relevant past event.

**Figure 6.22** Cooking a beef casserole can involve explicit and implicit long-term memories. Procedural memory is involved in knowing how to brown the meat. Remembering the recipe involves semantic memory. A memory of the time and place of a previous cooking disaster with beef casserole would involve episodic memory.



**FIGURE 6.16** Long-term memory types and sub-types

## BRAIN REGIONS INVOLVED IN THE STORAGE OF LONG-TERM MEMORIES

### Roles of the cerebral cortex

The **cerebral cortex** is the thin outer, wrinkly looking layer of neural tissue that covers the largest part of the brain (the cerebrum) and is involved in complex mental abilities, sensory processing and voluntary behaviours.

- Generally, long-term explicit semantic and episodic memories are widely distributed throughout the cortex. Their permanent storage tends to be in the areas where the relevant information was first processed.

## Roles of the hippocampus

The **hippocampus** is just above each ear, deep within the brain's medial ('middle') temporal lobe area, on the edge of and just under the surface of the cerebral cortex. It is also part of the brain's limbic system involved in emotion and various other functions, together with the amygdala and other structures. **The hippocampus has a crucial role in the consolidation of most of our memories.**

- Turns short-term memories into long-term memories.
- It is crucial in the consolidation of new semantic and episodic memories so that they are neurologically stable and long-lasting, but it is not directly involved in the formation of implicit procedural or classically conditioned memories.
- It is believed that it does not permanently store any memories itself. Instead, it transfers them to the cerebral cortex for long-term storage, most likely in the areas that initially processed the information.
- Through its interaction with the amygdala, the hippocampus also plays a role in the formation of emotional memories, particularly the explicit memory component of an emotional event.

The hippocampus is also important for **spatial memory**, which is an explicit memory for the physical location of objects in space.

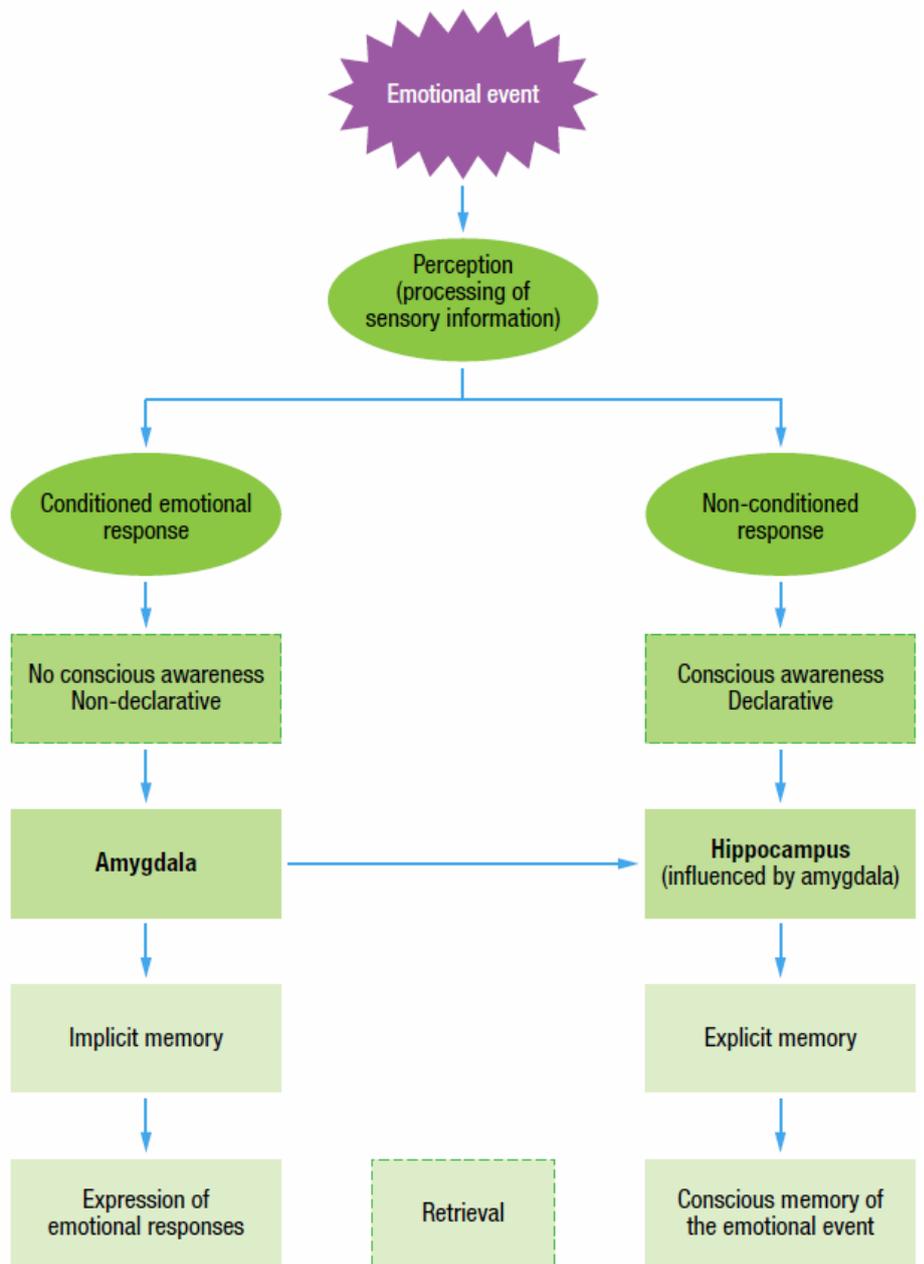
**Figure 6.28** The hippocampus is crucial in the consolidation of new semantic and episodic memories so that they are neurologically stable and long-lasting. This helps ensure pleasant holiday memories are stored relatively permanently.

## Roles of the amygdala

The **amygdala** is a small structure located just above and interconnected with the hippocampus in the medial temporal lobe that has a crucial role in processing emotions.

- Best known for its role in processing and regulating emotional reactions, particularly emotions such as fear and anger (including aggression) that may be experienced intensely and can motivate certain types of behaviour.
- Involved in the formation of a wide range of other emotional memories.
- People with damage to their amygdala are typically unable to acquire a conditioned fear response.
- It is believed that it does not permanently store emotional memories.

**Figure 6.33** The amygdala is crucial to the formation of implicit memories involving classically conditioned fear responses, and can also contribute to explicit memories by influencing the activity of the hippocampus.



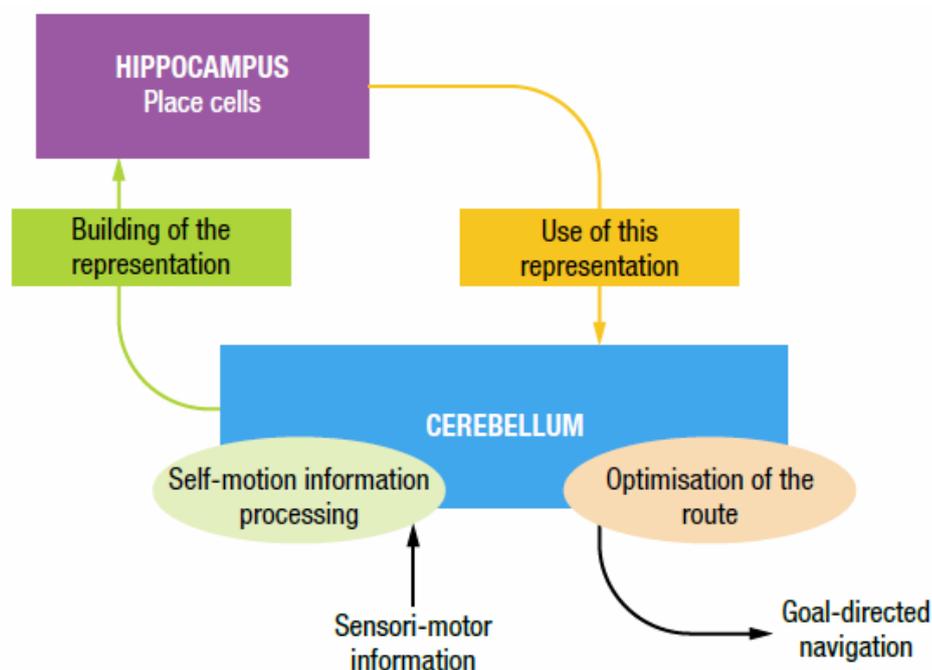
**FIGURE 6.33** The amygdala is crucial to the formation of implicit memories involving classically conditioned fear responses, and can also contribute to explicit memories by influencing the activity of the hippocampus.

## Roles of the cerebellum

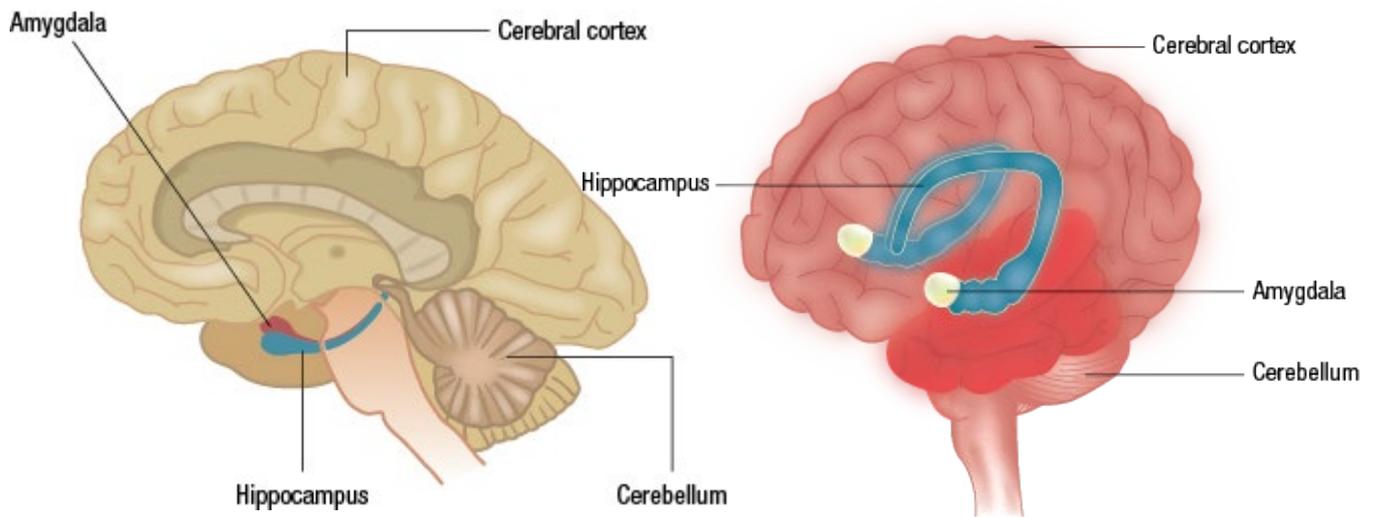
The **cerebellum** is the cauliflower-shaped structure located at the base of the brain and at the rear that looks like a mini brain.

- Coordinates fine muscle movements, regulates posture and balance, and contributes to various perceptual and cognitive processes.
- Best known for its involvement in activities requiring a skilled sequence of movements that require timing and are made with speed, ease and fluency. **For example**, playing the piano.
- Plays important roles in everyday voluntary, purposeful movements. **For example**, picking up a cup of coffee.
- Damage to the cerebellum makes it difficult to time and coordinate muscle control for everyday activities. **For example**, talking and walking.

**Figure 6.35** The cerebellum may contribute to spatial navigation at two levels, first in processing self-motion information to build spatial representation in the hippocampus at the level of place cells, and second in using this spatial representation to perform an optimal route toward a goal.



**FIGURE 6.35** The cerebellum may contribute to spatial navigation at two levels, first in processing self-motion information to build spatial representation in the hippocampus at the level of place cells, and second in using this spatial representation to perform an optimal route toward a goal.



## CHAPTER 7: RELIABILITY OF MEMORY

### Methods to retrieve information from memory or demonstrate the existence of information in memory

A **retrieval method** is any means used to retrieve information from memory.

Three types of retrieval methods are called recall, recognition and relearning.

#### Recall

**Recall** involves reproducing information stored in memory.

**Three types of recall are free recall, serial recall and cued recall.**

- **Free recall** involves reproducing as much information as possible in no particular order without the use of any specific cue.

**For example**, you may attend a training course for a new job and afterwards remember a few important points without recalling the order in which they were presented.

- **Serial recall** involves reproducing information in the order in which it was learned.

**For example**, if you are telling a friend about an overseas holiday and recall the names of the cities in the order in which you visited them, then you would be using serial recall.

- **Cued recall** involves the use of specific prompts ('cues') to aid retrieval and therefore reproduction of the required information.

**For example**, trying to remember the names of the last three prime ministers when provided with their initials.

## Recognition

**Recognition** involves identifying ('recognising') the original, learnt information.

**For example**, we might be called upon to identify the perpetrator of a crime from a Crime Stoppers photograph shown on TV.

## Relearning

**Relearning** involves learning information again that has been previously learned (and was therefore stored in LTM).

**For example**, you may believe you have forgotten some or all of the material, yet with even a small amount of reviewing you remember the information relatively quickly.

Relearning is also called the method of savings and is calculated using the formula:

Relearning is also called the **method of savings**, or simply **savings**, because it can be used to measure the amount of information 'saved' from previous learning.

**For example**, suppose you were a participant in an experiment and it took you ten trials (presentations) to learn a list of 12 nonsense syllables. If in a subsequent experiment, perhaps six months later, it took you five trials to relearn the same list, then the savings would be 50% because it took you half the number of trials to relearn the information.

The savings are calculated using the formula:

$$\text{Savings} = \frac{(\text{no. of trials for original learning}) - (\text{no. of trials for relearning})}{(\text{no. of trials for original learning})} \times \frac{100}{1}$$

A savings score can also be calculated on the basis of the *time* taken to relearn information. In this case, the formula would be:

$$\frac{(\text{time for original learning}) - (\text{time for relearning})}{(\text{time for original learning})} \times \frac{100}{1}$$

**TABLE 7.1** Comparison of retrieval methods

Method	Description	Example
<b>Recall</b>		
<i>Free recall</i>	Reproducing information in no particular order	Name the last three prime ministers of Australia.
<i>Serial recall</i>	Reproducing information in the order in which it was learned	Name the last three prime ministers of Australia in order from the most recent to the least recent.
<i>Cued recall</i>	Using a cue to assist the retrieval of information	Name the last three prime ministers of Australia. Their initials are MT, TA, KR.
<b>Recognition</b>	Identifying correct information from among a list of alternatives	Identify the last three prime ministers of Australia from the following list: Chifley, Gillard, Hawke, Abbot, Whitlam, Turnbull, Rudd, Howard, Keating, Menzies.
<b>Relearning (method of savings)</b>	Determining the amount of information saved when learning information again that has been previously learned	Time how long it takes to learn the last seven prime ministers of Australia. Time yourself two weeks later on the same task to test the amount of time saved in learning the information a second time compared with the first time.

## Sensitivity of recall, recognition and relearning as measures of retention

- Recall tends to be the least sensitive measure of retention.
- Relearning tends to be the most sensitive measure of retention.
- Recognition tends to be less sensitive than relearning but more sensitive than recall.

1. Relearning
2. Recognition
3. Recall

## Reconstruction

**Reconstruction** involves combining stored information with other available information to form what is believed to be a more coherent, complete or accurate memory.

**For example**, what we retrieve is not always a perfect reproduction of what happened at the time of encoding. We reconstruct our memories during retrieval. During reconstruction, if the memory has gaps or is not clear, we tend to add information that helps ensure the retrieved memory is complete and 'makes sense'.

**Reconstructive memory** is most evident when we retrieve an episodic memory of a specific event for which we can't recall or are uncertain about some of the details.

## Fallibility of memory reconstruction

**Reconstruction** of memories provides evidence for the fallibility of memory. This has been demonstrated by numerous research studies conducted by American psychologist Elizabeth Loftus and various colleagues on eye-witness testimony.

**Eye-witness testimony** is any firsthand account given by an individual of an event they have seen. Loftus has found that eye-witness testimony is not always accurate because eye-witnesses reconstruct their memories and their reconstructed memories can be manipulated by leading questions that contain misleading information.

Loftus's research makes it clear that leading questions can be used to manipulate memory reconstruction and therefore information that is reported by eye-witnesses.

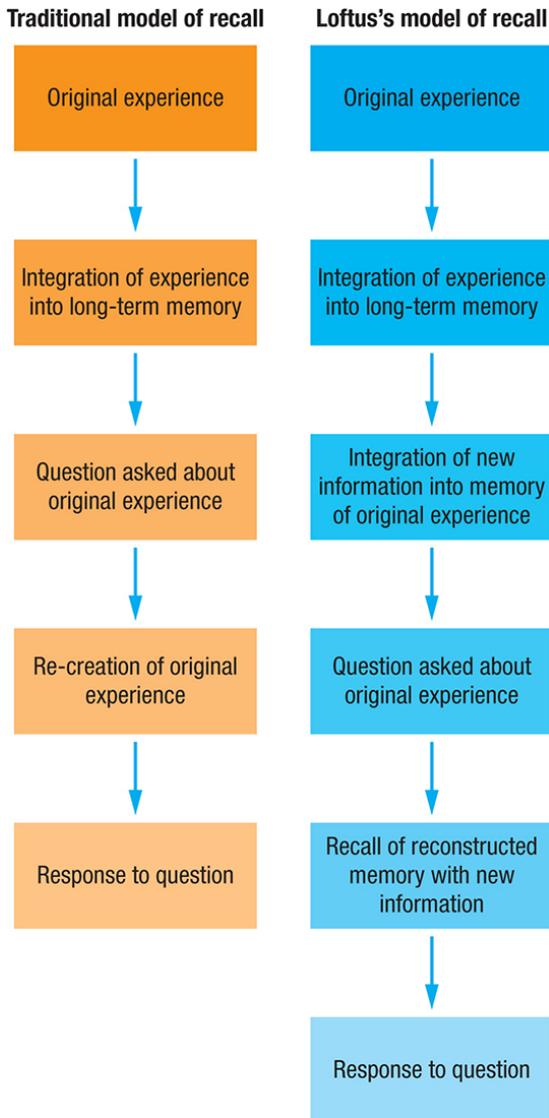
A **leading question** has content or is phrased in such a way as to suggest what answer is desired or to lead to the desired answer.

**For example**, suppose that you witness a car accident and are later asked, 'How fast was the car going when it ran the stop sign?'

According to Loftus (1975), this is a leading question because it contains a *presupposition* — information that should or must be true in order for the question to make sense. The question presupposes, or 'assumes', that there was a stop sign. But what if there was no stop sign? You might answer the question anyway because it was a question about how fast the car was going and not a question about the presence of a stop sign or whether the car ran a stop sign. Loftus proposes, however, that because of the way the question was worded, you might add the new false information about the stop sign to your memory of the event. Then you will be more likely to recall it as a part of your reconstructed memory when answering a question about it, such as 'Did you see the stop sign?' at a later time.

## RESEARCH BY LOFTUS

Read pages 309-311 for description of Loftus' experiments.



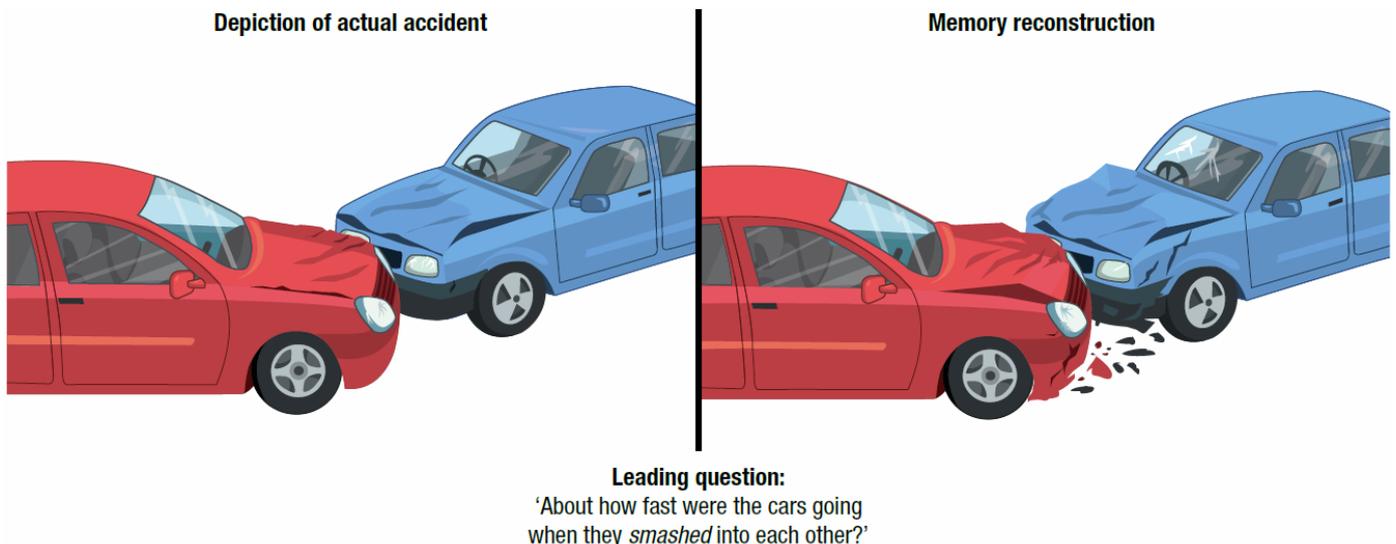
**TABLE 7.2** Speed estimates for each verb used

Verb	Mean estimate of speed (mph)
Smashed	40.5
Collided	39.3
Bumped	38.1
Hit	34.0
Contacted	31.8

**TABLE 7.3** Distribution of responses to the question 'Did you see any broken glass?'

Response	Verb condition		
	Smashed	Hit	Control
Yes	16	7	6
No	34	43	44

**FIGURE 7.8** A comparison of Loftus's model of recall from LTM with the traditional model. Loftus's model includes an extra step of integrating new information acquired after the original experience, which may be used in a reconstructed memory that does not accurately reflect the original experience.



**FIGURE 7.7** Loftus found that the wording of a question influenced the participants' memory reconstruction of the accident they had viewed. The more intense verbs brought about the highest speed estimates.

## EFFECTS OF BRAIN TRAUMA ON MEMORY

**Brain trauma** is any brain injury that impairs the normal functioning of the brain, either temporarily or permanently.

**For example**, a stroke, a drug use episode, a neurodegenerative disease.

A **neurodegenerative disease** is a disorder characterised by the progressive decline in the structure, activity and function of brain tissue.

**For example**, Alzheimer's disease.

**Amnesia** refers to loss of memory that is inconsistent with ordinary forgetting. Memory loss may be either partial or complete, temporary or permanent.

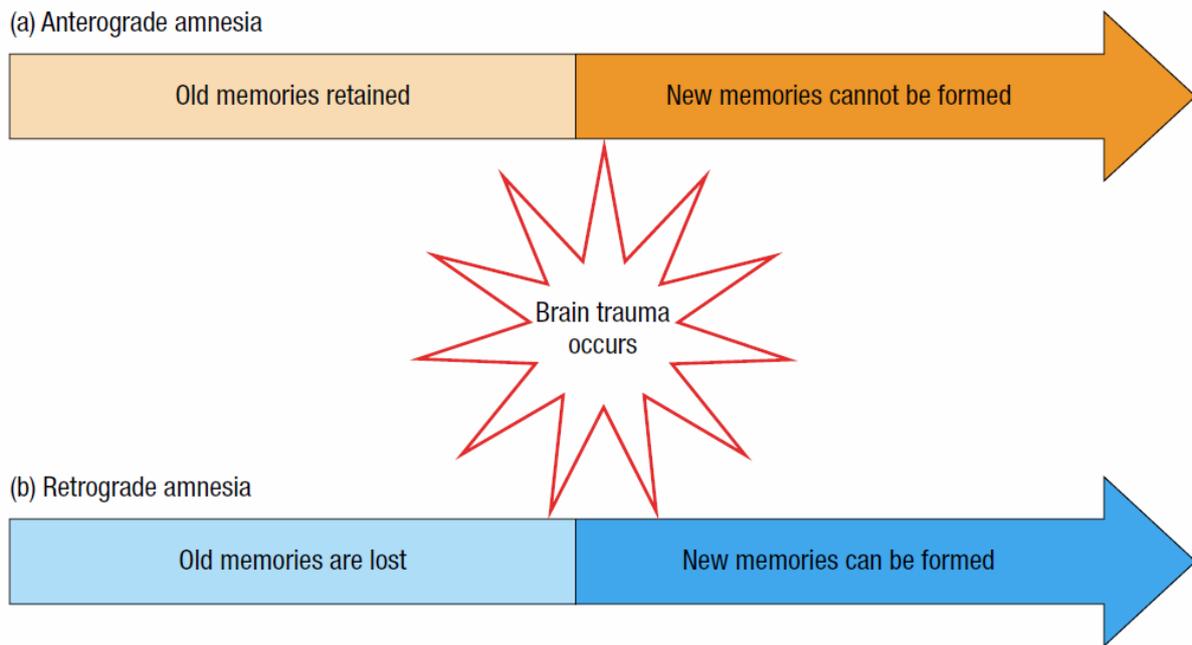
### Anterograde amnesia

**Anterograde amnesia** is loss of memory only for information or events occurring after the trauma that causes the amnesia.

- People with anterograde amnesia lose the ability to form or store new long-term memories.
- Anterograde amnesia is often found to be associated with damage to the medial temporal lobe area, particularly the hippocampus and connections linking the medial temporal lobe with the frontal lobes.
- A common cause among younger people is a traumatic brain injury caused by a blow to the head or by the head being forced to move rapidly forward or backward, usually with some loss of consciousness. When the head is struck hard, the brain slams against the inside of the skull. As a result of this blow or rapid movement, brain tissue may tear, twist or bleed.

## Retrograde amnesia

**Retrograde amnesia** is the loss of memory only for events or information formed before the trauma that causes the amnesia.



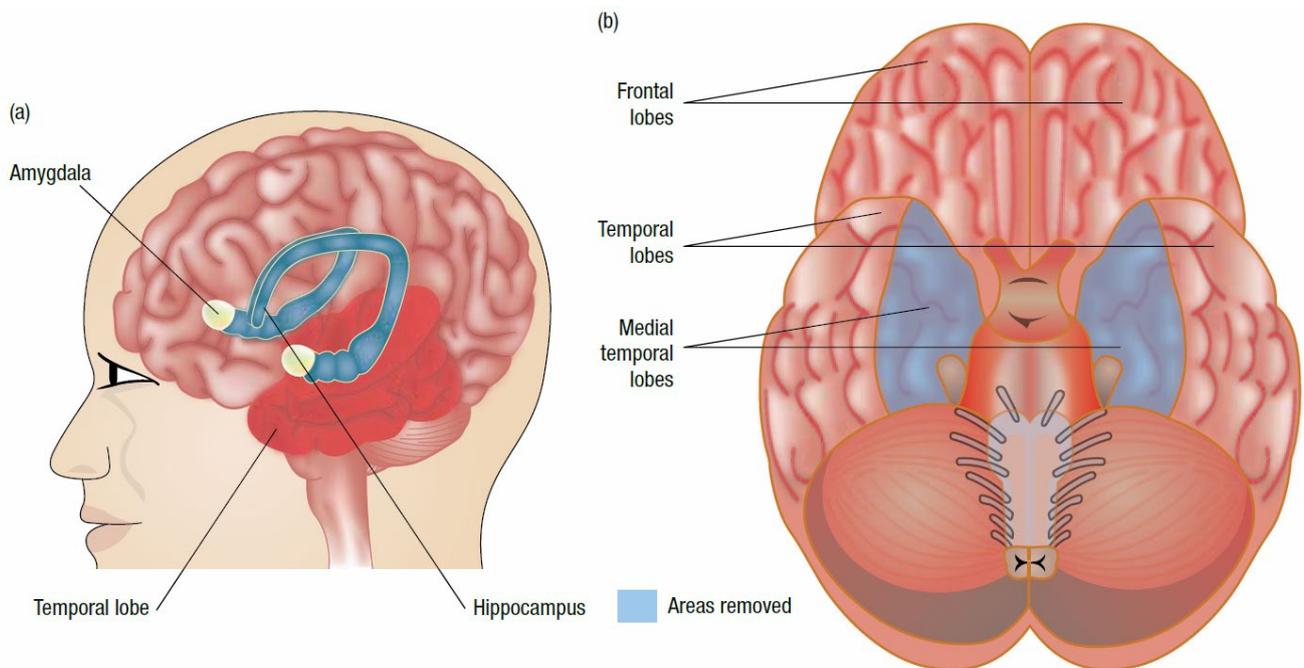
**FIGURE 7.12** (a) In anterograde amnesia, the person cannot form new memories that occur after the brain trauma (but not necessarily for all types of information). (b) By contrast, retrograde amnesia involves loss of some or all memories formed before the brain trauma occurred.

## **BRAIN SURGERY**

In 1953, when Molaison was 27 years old, he agreed to brain surgery to treat the severe epilepsy from which he had been suffering since the age of ten. At the time, doctors knew that, in many patients with epilepsy, seizures started in either the right or left hemisphere, usually in the medial temporal lobe (Scoville & Milner, 1957). Because Molaison's seizures were so severe, and because their precise origin could not be determined, his neurosurgeon decided to remove the medial temporal lobe from each hemisphere.

Molaison could not remember things that happened in the period leading up to his operation. This memory loss was virtually 'total' for about 2 years pre-surgery and 'partial' back to about 10 years pre-surgery. Overall, in relation to episodic memories, he could not remember any event that happened at a specific time and place but he had retained the gist of personal experiences. He could describe in a general way his life up until his operation. He could talk about experiences, but could not report specific details.

More significantly, Molaison had anterograde amnesia and was therefore incapable of forming new episodic or semantic memories.

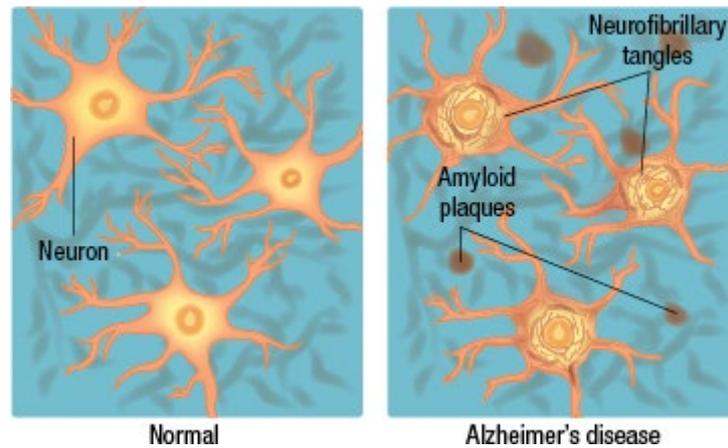


**FIGURE 7.14** (a) Location of the hippocampus and amygdala in the medial temporal lobe area. (b) Molaison had the hippocampus, amygdala and surrounding cortex in the medial temporal lobe area of each hemisphere surgically removed to treat his epileptic seizures. As a result, he lost certain past episodic memories and was incapable of forming new long-term explicit memories — both episodic and semantic memories.

[Pages from textbook concerning brain surgery:](#)

- The hippocampus, spatial learning and spatial memory- **Pages 318-320**
- Amygdala- **Pages 320 and 321**
- Cerebral cortex- **Pages 322 and 323**
- Cerebellum- **Pages 323 and 324**

## ALZHEIMER'S DISEASE



**Alzheimer's disease** is a type of dementia characterised by gradual widespread degeneration of brain neurons, progressively causing memory decline, deterioration of cognitive and social skills and personality changes. As brain cells die the brain shrinks. The outer part of the brain is usually the area affected first by the disease. Short-term memory loss is therefore one of the first symptoms of Alzheimer's disease. As the disease progresses to deeper parts of the brain, long-term memory is increasingly impaired. Explicit memories are primarily affected. Implicit memories tend to remain intact. The disease also affects other brain functions and consequently, many other aspects of behaviour are also disturbed. The area of the brain that appears most affected is the medial temporal lobe, particularly the hippocampus.

The *plaques* are fragments of the protein called beta amyloid that the body produces normally. In a healthy brain, these are broken down and eliminated from the brain naturally. In a brain with Alzheimer's disease, the fragments accumulate over time to form clumps of hard, insoluble plaques outside and around the neurons, thereby impairing synapses and inhibiting communication between neurons.

Within the neurons, another protein called *tau* also accumulates in an insoluble form. Gradually, the tau deposits form another type of abnormal structure called a *neurofibrillary tangle*. These tangles look like twisted fibres and inhibit transport of essential substances throughout the neuron. This failure of the transport system is believed to eventually kill the neurons.

## FACTORS INFLUENCING ABILITY AND INABILITY TO REMEMBER

**Forgetting** is the inability to access or recover information previously stored in memory.

### Context and state dependent cues

**Retrieval cue** is any stimulus that assists the process of locating and recovering information stored in memory.

#### Context dependent cues

**Context dependent cues** are prompts for memory retrieval based on environmental factors in the specific situation in which the required memory was originally formed.

**For example**, the context dependency of certain memories helps explain why an eye-witness may recall apparently forgotten information about a crime when they return to the crime scene. When they return to the scene (the context where the memory was originally formed), the environmental cues act as additional retrieval cues that assist the recall of additional information.

#### State dependent cues

**State dependent cues** are prompts for memory retrieval based on an individual's internal physiological and/or psychological state at the time the required memory was formed.

**For example**, if you learn information when you are happy, sad, intoxicated, sober, calm or aroused, that information is more likely to be retrieved when you are in the same 'state'.

### Maintenance and elaborative rehearsal

**Rehearsal** is the process of consciously manipulating information to keep it in short-term memory, to transfer it to long-term memory or to aid storage and retrieval.

#### Maintenance rehearsal

**Maintenance rehearsal** is repetition of information over and over again so that it can be retained in short-term memory.

**For example**, memorising the definition of 'memory' for the end-of-year exam by repeating the definition aloud.

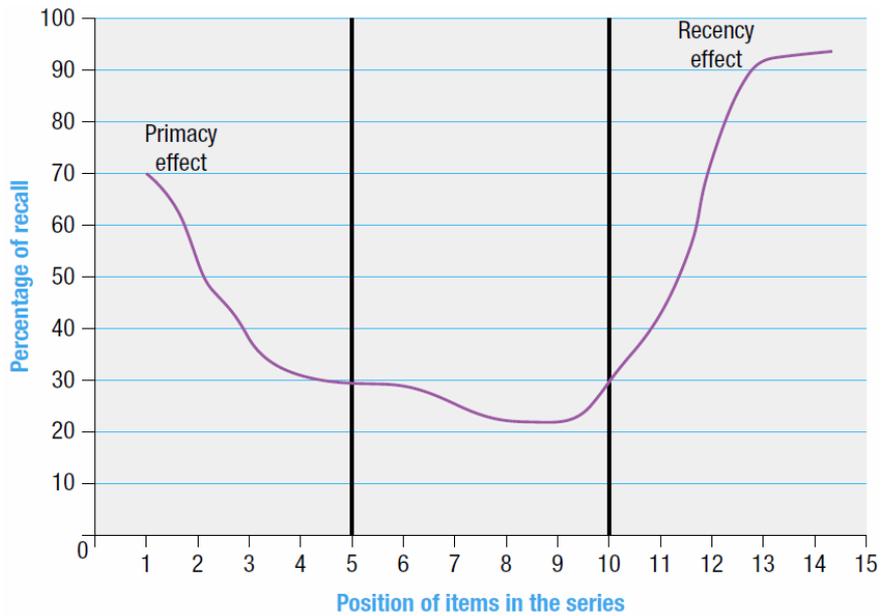
#### Elaborative rehearsal

**Elaborative rehearsal** is the process of linking new information in a meaningful way with information already stored in memory or with other new information to aid its storage and retrieval from long-term memory.

**For example**, your ability to recall the definition of 'memory' will be enhanced if you link it to learning and think about the nature of its relationship to learning, biologically and psychologically.

**Elaborative rehearsal** is a more active and effortful process than maintenance rehearsal. It is also more effective than maintenance rehearsal for remembering new information because it helps to ensure that information is encoded well. Elaborative rehearsal involves a deeper level of information-processing that enhances encoding and consolidation for long-term storage.

## Serial position effect



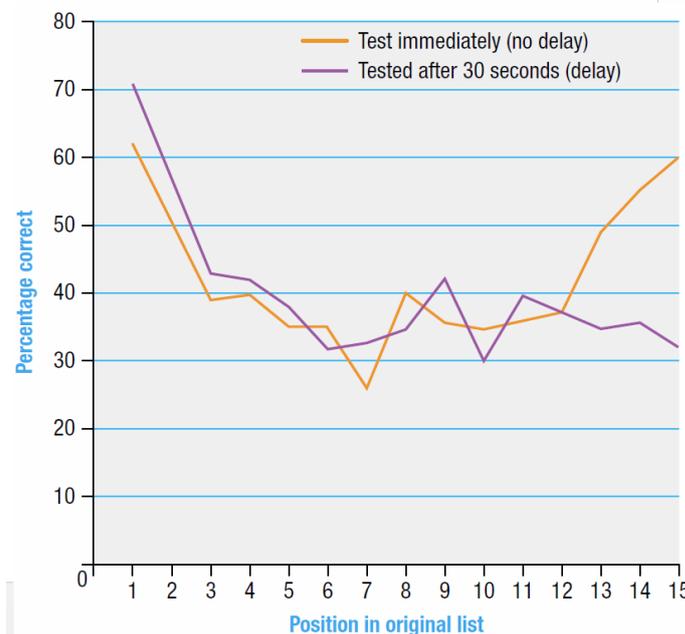
**FIGURE 7.32** The serial position effect shows that free recall is better for items presented at the end and the beginning of a list than for items in the middle of the list. Items from the end of the list are *most* likely to be recalled, and those from the middle of the list are *least* likely to be recalled.

**Serial position effect** is a research finding that free recall is better for items at the end and beginning of a list than for items in the middle of the list.

The **primacy effect** is the serial position effect of superior recall for items at the beginning of a list.

The **recency effect** is the serial position effect of superior recall for items at the end of a list.

The serial position effect is clearly evident when testing recall immediately after learning a list of items (i.e. with no time delay). However, when recall is delayed for 30 seconds, participants tend to forget the latter items and no recency effect is evident.



## MINIMISING FORGETTING

**Mnemonics** are techniques that can be used to improve or enhance memory. They can be as basic as an acronym or complicated strategies that themselves take considerable time to learn.

**Mnemonic techniques use information that is already stored in LTM.** The devices do not simplify information; they actually make it more elaborate. More information is stored, not less. However, it is believed that the additional information tends to make the material easier to locate and retrieve because it has enhanced organisation in LTM. Mnemonic devices tend to organise new information into a cohesive whole, so that retrieval of part of the information generally assists retrieval of the rest of it. These facts suggest that the ease or difficulty with which we learn new information depends not on how much we must learn, but on how well it fits with what we already know. Generally, the better it fits, the easier it is to retrieve.

### Mnemonics

#### Acronyms

When using acronyms, organisation of information is important. **Acronyms** are pronounceable words formed from the first letters of a sequence of words. The acronym doesn't have to be a real word. An acronym is often a pronounceable abbreviation. The letters of the abbreviation act as a retrieval cue for recall of more complex material. Acronyms are formed using a type of chunking procedure.

**For example**, ANZAC, is an abbreviation of 'Australian and New Zealand Army Corps'.

#### Rhymes

A **rhyme** is a phrase or string of words (such as a jingle), often with an emphasis on similar sounding key words.

**For example**, the rhyme 'i before e, except after c' assists memory for the correct spelling of words containing ie and ei.

These types of rhymes organise information by associating the information with a particular rhythm (sound) and with rhyming words. If we make an error in using a rhyme mnemonic, the rhythm is broken or the rhyme is ruined or both. Consequently, we immediately know an error in retrieval has occurred.

#### Acrostics

**Acrostics** involve making verbal associations for items to be remembered by constructing phrases or sentences using the first letters of the information to be remembered.

**For example**, using the phrase 'My Very Excited Monster Just Sat Upon Neptune' to recall the order of the planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune). Acrostics can also be useful when you have to remember information in sequential order.

## Narrative chaining

**Narrative chaining** involves linking otherwise unrelated items to one another ('chaining') to form a meaningful sequence or story ('narrative').

**For example**, consider all the following words that have no apparent relationship:

**Bird, costume, letterbox, head, river, nurse, theatre, wax, eyelid, fireplace**

Research studies have found that you will be far more likely to remember all of them if you linked them in a story such as the following:

A man dressed in a **bird costume** and wearing a **letterbox** on his **head** was seen leaping into the **river**. A **nurse** ran out of a nearby **theatre** and applied **wax** to his **eyelid**, but her efforts were in vain. He died and was tossed into the **fireplace**.