PSYCHOLOGICAL PROCESSES - 1

Complementary Course of BA Philosophy/Sociology

I Semester

(CUCBCSS - 2014 Admission onwards)

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

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Semester I

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Module 1:
Introduction to Psychology

Psychology is derived from Greek words *psyche* and *logos* which means study of mind or soul. It is a science that deals with behaviour and mental processes. Hence, psychology is defined as the scientific study of behaviour and mental processes. It focuses on both biological and social dimensions. The physiological psychologists or psychobiologists focus on *relationships* between behaviour and mental functioning. As for the social psychologists, they focus on group and social influences on individuals.

Psychologists are interested in every aspect of human thought and behaviour. The different fields of psychology includes developmental psychology, physiological psychology, experimental psychology, personality psychology, clinical psychology, counselling psychology, social psychology, industrial psychology, organizational psychology, etc. In these fields, they study different areas like development, physiological bases of behaviour, learning, perception, consciousness, memory, thought, language, motivation, emotion, intelligence, personality, adjustment, abnormal behaviour, social influences and social behaviours. Psychology is often applied in education, industry, health, clinical, consumer affairs, engineering and many other areas.

Given the wide array of interests, psychologists in various fields are drawn together by their common interests in a number of fundamental issues or questions about behaviour that cut across their areas of specialisation. These enduring issues include the ones related to 'person-situation', 'heredity-environment', 'stability-change', 'diversity' and 'mind-body'.

The 'person-situation' issue focus on to what extent behaviour is caused by the influence of processes occurring inside a person and external environment or situation. For decades, psychologists have been debating the degree of influence that heredity (genetics) and environment (experiences) have on behaviour. Psychologists are also interested in knowing to what extent do people stay relatively unchanged (stability) throughout their lives and how do people change? Another enduring issue is the one related to diversity, which inquires to what extent every person is in certain respects like all other people, like some other people and like no other person. Finally, many psychologists are fascinated by the 'mind-body' relationship ie., relationship between what we experience (such as thoughts and feelings) and the biological processes (such as activity in the nervous system).

Psychology as Science

Psychology is the science of behaviour and mental processes. Science provides logical guidelines for evaluating evidence and well reasoned techniques for verifying principles. Hence, psychologists rely on the scientific method when searching out answers to psychological questions. Consequently, they follow the scientific method which is essentially an approach to knowledge that relies on systematically collecting data through observation, generating a theory to explain the data, producing testable hypotheses based on the theory and testing those hypotheses empirically to reach valid

generalisable conclusions. Thus like all scientists, psychologists use the scientific method to describe, understand, predict and eventually to achieve some measure of control over what they study.

Since psychologists see themselves as scientists, the terms psychologist and behavioural scientists may be used to denote them. The broader label social scientist refers to all who study society or behaviour, and may include psychologists, sociologists, anthropologists, historians and others.

Psychology and Other Social Sciences

Psychology is not alone in applying the scientific method to the study of behaviour. The behavioural sciences like psychology, sociology, anthropology, political science, economics and history are very closely related. However, the questions and hypotheses that guide the research in each field differ, and consequently different methods of research are adopted.

A Brief History of Modern Scientific Psychology

Psychology has a long past but a short history. Human beings or homosapiens appeared on earth about 100,000 years ago and probably ever since they have been trying to understand themselves. Going back to the time of Greek philosophers like Plato and Aristotle, who have wondered about human behaviour and mental process. Aristotle (384-322 B.C) is sometimes called the Father of psychology. But speculation about psychological matters did not begin with the Greek thinker. Hundreds of years before Aristotle, the earliest philosopher on record were dealing with these topics. But not until the late 1800s, did great thinkers like Aristotle began to apply the scientific method to questions that had puzzled philosophers for centuries. Only then did psychology come in to being as a formal scientific discipline separate from philosophy.

The brief history of psychology will be discussed at a much later point in history ie., in the last part of the 19^{th} century when the field called psychology emerged. Charles Darwin (1809-1882) who was not a psychologist yet was considered to be responsible for the idea that human behaviour and thinking might be a subject for scientific inquiry. In the 'Origin of Species' (1859) and 'The Descent of Man' (1871), Darwin marshalled evidence that like other forms of life on earth, human beings *evolved* through a process of natural selection. If human beings are a product of evolution, may be wee too are subject to laws of nature. And therefore can be studied, analysed and understood scientifically.

Psychologists were just beginning to use scientific methods to study the brain, nerves and sense organs. Most important was the philosopher and physicist Gustav Fechner (1801-1887) who had shown how scientific methods could be applied to the study of mental processes. Early in 1850s Fechner became interested in the relationship between physical stimulation and sensation. He was fascinated by the sensitivity of human senses. Fechner devised the necessary techniques to find precise answers to questions like – how bright must a star be, to be seen? How loud must a noise be, to be heard? How heavy must a touch be, to be felt? When Fechner's major work, 'Elements of Psychophysics' was published in 1860, it showed how experimental and mathematical procedures could be used to study the human mind.

About twenty years later, a German psychologist Wilhelm Wundt, founded a discipline that he eventually called psychology.

The Major Movements in Modern Psychology

Structuralism: Wilhelm Wundt and Edward Bradford Titchener

Wilhelm Wundt (1832-1920) was originally trained as a physician, taught physiology for seven years at the University of Heidelberg in Germany. Early in his career he showed interest in mental processes. During this time, the field of psychology had no domain of its own and its subject matter belonged to philosophy. Wundt's ambition was to establish an independent identity for psychology. With this goal he left Heidelberg to accept chairpersonship of the philosophy department at the University of Leipzig in Germany. Four years later, in 1979, Wundt founded the first experimental psychology laboratory in the world, thus conferring on psychology a full fledged scientific status. His goal was to develop techniques for uncovering the natural laws of human mind. He believed that psychologists should investigate the elementary process of human consciousness, their combinations and relationships much as chemists study the fundamental elements of matter. Wundt felt that it was also important to study the central mental operations such as attention, intentions and goals.

Inorder to study the elementary process, Wundt and his followers devised a method called 'analytic or objective introspection', a formal type of self observation. They trained themselves in the art of objective introspection, recording in minute detail, their thoughts, feelings, heart beat and respiration rates for example, when listening to a metronome. From this they analysed many kinds of sensation patterns in to their component parts. The most important product of Leipzig was its students who carried the new science to Universities around the world. Among them was Edward Bradford Titchener, British by birth, who eventually published the summary of the basic 'sensation qualities' that had been discovered.

In 1892, Titchener, migrated to the United States and took charge of a new experimental laboratory at Cornell University. He considered psychology as the science of consciousness. He broke consciousness down in to three basic elements: physical sensations (what we see), feelings (such as liking or disliking bananas) and images (memories of other bananas). Even the most complex thoughts and feelings can be reduced to these simple elements. Titchener saw psychology's role as identifying these elements and showing how they can be combined and integrated. Because it stresses the basic units of experience and the combinations in which they occur, this school of psychology is called structuralism. The stucturalists held the following beliefs:

1. Psychologists should study human consciousness particularly sensory experiences.
2. They should use analytic introspective laboratory studies.
3. They should analyse the mental processes in to elements, discover their combinations and connections and locate related structures in the nervous system.

Limitations

1. Emphasised one method of study, ie., formal analytic introspection, which automatically excluded the experiences of children and animals that could not be properly trained.
2. Considered complex phenomena such as thinking, language, morality and abnormality in appropriate for introspective studies.
3. Structuralists were unwilling to address themselves to practical issues.

Functionalism: William James

William James (1842-1910) was the first American born psychologist. He taught philosophy and psychology at Harvard University for thirty five years. William james did not identify with any movement. His special 'system' of psychology evolved from keen observation of himself and others.

James opposed structuralism because he saw it as artificial, narrow and essentially inaccurate. He held that Wundt's 'atoms of experience' – pure sensation without associations, simply do not exist in real life experiences. According to James, our minds are constantly weaving associations, revising experience, starting, stopping, jumping back and forth in time. perception, emotion and images cannot be separated. He argued, consciousness flows in a continuous stream. If we could not recognise a banana, we would have to figure out what it was each time we saw a banana. Mental associations allow benefiting from previous experience.

William James suggested that when we repeat something, our nervous systems are changed so that each repetition is easier than last. With these insights, James arrived at a functionalist theory of mental behaviour. In early 1900s, several psychologists at the University of Chicago (including John Dewey) were strongly influenced by James views.

Functionalist theory goes beyond were sensation and perception to explore how an organism learns to function in its environment. The functionalists held the following beliefs:

1. Psychologists should study the functioning of mental processes and many other topics, including the behaviour of children and simple animals, abnormality and individual differences.
2. Psychologists should use informal introspection (self-observation and self report) and objective methods (those relatively free of bias) such as experimentation.
3. Psychological knowledge should be applied to practical matters such as education, law and business.

Behavourism: John B. Watson

John Watson (1878-1958) completed his doctorate in the field of animal psychology at the University of Chicago. In ' Psychology as Behaviourist Views It' (1913), Watson contented that you cannot define consciousness any more than you can define soul. And if you cannot locate or measure something, it cannot be the object of scientific study. Challenging structuralists, functionalists and psychodynamic theories, Watson argued that the whole idea of mental processes or consciousness could not be tested and reproduced by all trained observers, because they depended on each person's idiosyncratic impressions.

Watson's view of psychology, known as behaviourism, was based on well known experiments conducted by the Russian psychologist Ivan Pavlov. Pavlov concluded that all behaviour is learned response to some stimulus in the environment called conditioning.

Many young American psychologists were attracted to the behaviouris movement. In some form or another it dominated American psychology for bout thirty years. The early behaviourists had the belief that:

1. Psychologists should study environmental events (stimuli) and observable behaviour (responses).
2. Experience has a more important influence on behaviour, abilities and traits than heredity.
3. Introspection should be abandoned and objective methods should be used like experimentation, observation and testing.
4. Psychologists should aim at the description, explanation, prediction and control of behaviour.
5. The behaviour of lesser animals should be investigated along with human behaviour because, simple organisms are easier to study and understand than complex ones.

Psychoanalytic Psychology: Sigmund Frued

Sigmund Frued (1856-1939), the Vienese physician specialised in treating problems of the nervous system, particularly neurotic disorders. Frued noticed that many of his patients' nervous ailments appeared to be psychological rather than physiological in origin. Frued's clinical discoveries led him to develop a comprehensive theory called the psychoanalytic theory. Frued held that human beings are motivated by unconscious instincts and urges that are not available to the rational, conscious part of our mind. To uncover the unconscious, he developed a technique, called psychoanalysis, in which the patient lies on a couch, recounts dreams, and says whatever comes to mind which is termed as free association. The psychoanalyst sorts through half remembered scenes, broken trains of thoughts and the like and attempts to reconstruct the past experiences that shape the patient's present behaviour.

Frued held that personality develops in a series of critical stages during the first few years of life. If we successfully resolve the conflicts that we encounter at each of these stages, we can avoid psychological problems in later life. But if we become 'fixated' at any one of these stages, we may carry related feelings of anxiety or exaggerated fears with us in to adulthood. Frued maintained that many unconscious desires and conflicts have their roots in sexual repression. The view that unconscious conflicts within the individual influence much human thought and action is known as psychoanalytic psychology.

The psychoanalytic psychologists held the following beliefs:

1. Psychologists should study the laws and determinants of personality (normal and abnormal) and devise treatment methods for personality disorders.
2. The important aspects of personality like unconscious motives, memories, fears, conflicts and frustration are to be brought to consciousness for treatment of personality disorders.

3. Personality is formed during early childhood. Exploring memories of the first five years of life is essential for treatment.
4. Personality is most suitably studied in the context of a long term intimate relationship between patient and therapist.

Psychoanalytic theory as expanded and revised by Frued's colleagues and successors, laid the foundation for the study of personality and psychological disorders and remains influential today.

Gestalt Psychology

While behaviourism was becoming popular in America, Gestalt psychology (gestalt is the German word for whole or pattern or structure) was growing in Germany. As the name suggests, the gestalt psychologists believed that experiences carried with them a quality of wholeness or structure. Just like behaviourism, gestalt psychology arose as a protest against structuralism, particularly the practice of reducing complex experiences to simple elements. Gestalt psychology is that school of psychology that studies how people perceive and experience objects as whole patterns.

The gestalt movement had a number of psychologists like Max Wertheimer, Wolfgang Kohler and Kurt Koffka. Gestalt psychology paved the way for the modern study of perception.

The Views of Modern Psychology

Psychology as a science is continuing to grow in dimensions. Although contemporary psychologists rarely follow specific movements, they disagree on some fundamental philosophical issues and hence approach psychology in different ways. Many behavioural scientists identify themselves to some degree with one of the four major points of view like, psychoanalytic, neo-behaviouristic, cognitive and humanistic. Some follow a combination of these views known as eclectic approach.

1. Psychoanalytic View

The psychoanalytic view holds that behaviour results from psychological dynamics that interact within the individual and which is often outside conscious awareness

2. The Neo-behaviouristic View

The behaviouristic approaches have become broader and flexible today. Modern behaviourists still investigate stimuli, observable responses and learning. They also study complicated phenomena that cannot be directly observed like stress, attribution, motivation and personality. This new type of behaviourism is sometimes called neo-behaviourism, where 'neo' means new. The major characteristic of Neo-behaviouristic position is its insistence on asking precise, well delineated questions, using objective methods and careful research.

3. The Cognitive View

In the early 1960s cognitive psychologists began to rebel against the old bhaviouristic model. They insisted that psychologists had to come to understand what was going on inside the human mind, particularly the operations of the mind.

Cognitive psychologists hold the following beliefs:

1. Behaviourist scientists should study the mental processes like thought, memory, perception, attention, problem solving, language, etc.
2. Psychologists should aim at acquiring precise knowledge of how these processes operate and how they are applied in daily life.
3. Informal introspection should be used particularly to develop hypotheses, whereas, objective methods are preferred to confirm these hypotheses.
   Thus, cognitive psychology combines various aspects of functionalism, gestalt psychology and behaviourism.

4. The Humanistic view

Humanistically oriented psychologists have the aim of humanising psychology. Abraham Maslow (1908-1970) is an important psychologist in the humanistic movement. Most of the humanistically oriented psychologists share the following beliefs:

1. Psychologists should help people understand themselves and develop to their fullest potential enriching human lives.
2. Behavioural scientists should study living human beings as a whole.
3. Significant human problems should be the subject of investigations.
4. Behavioural scientists should focus on subjective awareness.

Methods in Psychology

Psychology as a scientific study of human behaviour and mental processes, it involves collecting data systematically and objectively. To accomplish this, a variety of research methods are used by researchers. Each method has its own advantages and limitations. The following section gives a brief description about the methods in psychology.

1. Naturalistic Observation

Psychologists and researchers use naturalistic observation to study human behaviour in natural settings. It is essentially a way of perceiving behaviour as it is. This method helps to infer mental processes of others through the observation of their external behaviour. Since there is minimal interference from the researcher, the behaviour observed is more likely to be accurate, spontaneous and varied than behaviour studied in a laboratory.

Advantages

1. It is a natural and flexible procedure, and hence economical.
2. It is reliable and more accurate.
3. It is verifiable by other researchers.
4. Very useful in developmental psychologies.
5. Very useful for clinical psychologists to gather data required for understanding abnormal behaviour.

Limitations

1. Can be used for observing overt behaviours only.
2. It is very difficult to apply in adults as they can easily manipulate or hide their behaviour.

3. Subjectivity of interpretations on the part of the observer will affect the results.
4. The success of the method depends on the ability to establish cause and effect in a proper manner.
5. The behaviour being observed is dependent on time, place and individual or groups involved.

2. Case studies

Researchers conducting a case study investigate the behaviour of one person or a few persons in depth. The concept of clinical method is included in the concept of clinical psychology which is the art and technology of dealing with the adjustment problems of individuals for achieving optimum social adjustment and welfare. It is a method used for studying the behavioural problems of maladjusted or deviant personalities which is often considered as a case. Case study is characterised by detailed and realistic description of a case. Data pertaining to the past and present are collected and analysed to locate causes of maladjustment or deviation inorder to find remedies to it.

The clinical set up or environment is associated with health care and treatment of individuals who undergo treatment of physical and mental disorders. This method can yield a great deal of detailed, descriptive information useful for forming hypotheses.

Advantages

1. It can be used for studying specific behaviour of an individual or a group.
2. It studies the problems indepth, and hence it is intensive yielding better results.
3. It is an efficient and useful method.
4. It helps in finding out the problems and its related causes, and suggests remedies to it.

Limitations

1. The success of this method depends on the efficiency of the researcher.
2. The area covered or the scope of the problem is often limited.
3. It focuses only on individual cases.
4. The findings of case studies cannot be generalised.

3. Surveys

Under this method data pertaining to a particular phenomenon are gathered and studied to reach at generalisable results. For this, the phenomena under study is thoroughly analysed in to relevant aspects. Questions are formed and pooled so that the maximum relevant data relating to the phenomenon can be generated for studying. Survey research generates large amount of data quickly and inexpensively by asking a set of questions from a large number of people. The data thus gathered are analysed by using techniques that are appropriate for the study.

Advantages

1. Data pertaining to phenomenon can be studied on a fairly large sample or population.
2. Data can be collected from large number of people using questionnaires.

3. Fairly large detailing of data can be done by including more questions in the questionnaires.
4. Large amount of data can be collected quickly that is economical.
5. The results can be generalised.

Limitations

1. The quality of questions determines the accuracy of data collected. Hence, if the questions are not prepared carefully, it may show wrong results.
2. If the sample is not a representative of population, then it may affect the results and will give a wrong picture when generalised to the population.
3. The analysis of large amount of data is often a tedious work.
4. The response of respondents is very crucial, if they wrongly represent their responses, it may affect the study.

4. Correlational Research

Correlational research is used to investigate the relation, correlation, between two or more variables. Correlational research is useful for clarifying relationships between pre-existing variables that cannot be examined by other means.

5. Experimental Research

In the experimental method one variable (independent variable) is systematically manipulated and the effects on another variable (dependent variable) are studied, usually using both an experimental group of subjects (participants) and a control group for comparison purposes. By holding all other variables constant, the researcher can draw conclusions about cause and effect. Often a neutral person is used to record data and results, so that experimenter bias does not exist.

Advantages

1. It is scientific method of inquiry.
2. It follows an objective method of research.
3. It helps in establishing the cause and effect relationship.
4. It helps to identify the problems for remediation.

Disadvantages

1. It is conducted under controlled situations.
2. Specific situation demands specific experiments to understand the problem under study.
3. Specialised knowledge is required to conduct experiments.
4. The skill and efficiency of the researcher is very important in conducting experimental research.
5. The researcher must have the ability to design appropriate experiments for conducting research.

Structure and Function of Neuron

The basic biological processes are at the root of our thoughts, feelings and actions. The body possesses two systems for coordinating and integrating behaviour. They are the nervous system and the endocrine system.

Neurons: The Messengers

The billions of neurons or the nerve cells underlie all the activity of the nervous system form a communication network that coordinates all the systems of the body and enables them to function. See *Figure: 1* for the structure of neuron. Neurons usually receive messages from other neurons through short fibres called dendrites that pick up messages and carry them to the neuron's cell body. The axon carries outgoing messages from the cell. A group of axons bundled together makes up a nerve. Some axons are covered with a myelin sheath, made up of glial cells. The myelin sheath increases neuron efficiency and provides insulation.

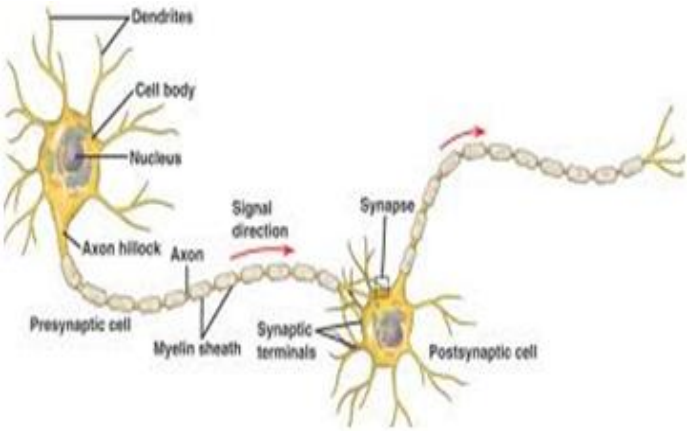


Figure 1: Structure of Neuron

The Neural Impulse

Neurons that carry messages from the sense organs to the brain or spinal cord are called sensory (afferent) neurons. Neurons that carry messages from the brain or spinal cord to the muscles and glands are called motor (efferent) neurons. Interneurons (association neurons) carry messages from one neuron to another.

When the neuron is at rest, or at its resting potential, a slightly higher concentration of negative ions exists inside the membrane surrounding the cell body than outside, so there is a negative electrical charge inside relative to outside. At rest, a neuron is in a state of polarization. When an incoming message is strong enough, the electrical charge is changed, an action potential (neural impulse) is generated, and the neuron is depolarised. Incoming messages cause graded potential, which when combined may exceed the minimum threshold of excitation and make the neuron fire. After firing, the neuron goes through the absolute refractory period, when it will not fire again, and then enters the relative refractory period, when firing will only occur if the incoming message is much stronger than usual. However, according to the all-or-none law, the impulse sent by a neuron does not vary in strength.

The Synapse

Neurotransmitter molecules released by synaptic vesicles, cross the tiny synaptic space (or cleft) between the axon terminal (or synaptic knob) of the sending neuron and the dendrite of the receiving neuron, where they latch on to a receptor site, much the way a key fits in to a lock. This is how they pass on their excitatory or inhibitory messages.

Experience and Neurons

The brain has plasticity, ie., it can be physically and chemically altered by experience. In a pioneering study of the influence of the environment on the brain, researchers found that rats that had been raised in a stimulating environment had more synaptic connections than rats that had been raised in cages that offered them no opportunities to explore or to manipulate objects.

The Central Nervous System

The billions of neurons in the brain are connected to neurons throughout the body by trillions of synapses. The nervous system is organised in to two parts: the central nervous system, which consists of the brain and the spinal cord, and the peripheral nervous system, which connects the central nervous system to the rest of the body. See *Figure: 2* for central and peripheral nervous systems.

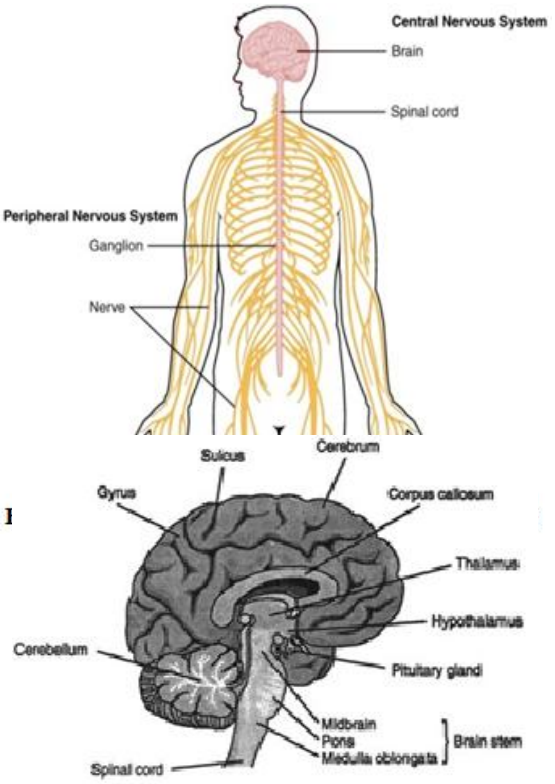


Figure 3: Structure of Brain

The Brain

The brain contains more than 90% of the body's neurons. Physically, the brain has three more, or less distinct areas: the hindbrain, the midbrain and the forebrain. The hind brain is found in even the most primitive vertebrates. It is made up of the cerebellum, the pons, and the medulla. The medulla is a narrow structure nearest the spinal cord; it is the point at which many of the nerves from the left part of the body cross to the right side of the brain and vice versa. The medulla controls such functions as breathing, heart beat rate and blood pressure. The pons that are located just above the medulla, connects the top of the brain to the cerebellum. Chemicals produced in the pons help to maintain our sleep-wake cycle. The cerebellum is divided in to two hemispheres and handles certain reflexes, especially those that have to do with balance. It also coordinates the body's actions. See *Figure:3* for the structure of brain.

The midbrain lies between the hindbrain and forebrain and is crucial for hearing and sight. The forebrain is supported by the brain stem and buds out above it, drooping somewhat to fit inside the skull. It consists of the thalamus, the hypothalamus and the cerebral cortex. The thalamus relays and translates incoming messages from the sense receptors- except those for smell. The hypothalamus governs motivation and emotion and appears to play a role in coordinating the responses of the nervous system in times of stress.

The cerebral hemispheres located above the thalamus take up most of the room inside the skull. The outer covering of the cerebral hemispheres is known as the

cerebral cortex. The cerebral hemispheres are what most of the people think of when they think of the brain. They are the most recently evolved portion of the brain, and they regulate the most complex behaviour. Each cerebral hemisphere is divided in to four lobes, delineated by deep fissures on the surface of the brain. The occipital lobe of the cortex, located at the back of the head, receives and processes visual information. The temporal lobe, located roughly behind the temples, is important to the sense of smell; it also helps us perform complex visual tasks, such as recognising faces. The parietal lobe, which sits on top of the parietal and occipital lobe, receives sensory information, in the sensory projection areas, from all over the body and figures in spatial abilities. The ability to comprehend languages is concentrated in two areas in the parietal and temporal lobes. The frontal lobe is the part of cerebral cortex responsible for voluntary movement and attention as well as goal directed behaviour. The brain starts response messages in the motor projection areas, from which they proceed to the muscles and glands. The frontal lobe may also be linked to emotional temperament.

The four lobes are both physically and functionally distinct. Each lobe contains areas for specific motor sensory function as well as association areas. The association areas- areas that are free to process all kinds of information – make up most of the cerebral cortex and enable the brain to produce behaviours requiring the coordination of many brain areas.

Hemispheric Specialisation

The two hemispheres of the cerebral cortex are linked by the corpus collosum, through which they communicate and coordinate. Nevertheless, they appear to have some separate functions. The right hemisphere of the cortex excels at nonverbal and spatial tasks, whereas the left hemisphere is usually more dominant in verbal tasks such as speaking and writing. The right hemisphere controls the left side of the body, and the left hemisphere controls the right side.

The Reticular Formation

The reticular formation is a network of neurons running through the hind brain, mid brain and forebrain that serves to arouse the higher parts of the brain.

The Limbic System

The limbic system encompasses structures that are critical for forming memories and experiencing pleasure, as well as for various motivational and emotional activities.

The Spinal Cord

The spinal cord is a complex cable of nerves that connects the brain to most of the rest of the body. It is made up of bundles of long nerve fibers and has two basic functions like to permit some reflex movements and to carry messages to and from the brain.

Tools for Studying the Nervous System

In recent decades science has developed increasingly sophisticated techniques for investigating the brain and nervous system. Among the most important tools are microelectrode techniques; macroelectrode techniques (ERP); Structural imaging

(CAT scanning and MRI); functional imaging (EEG imaging, MEG, MSI) and tools such as PET scanning that use radioactive energy to map brain activity. Scientists often combine these techniques to study brain activity in unprecedental detail.

The Peripheral Nervous system

The second major division of the nervous system is the peripheral nervous system. It carries messages to and from the central nervous system. It comprises of two parts: the somatic and autonomic nervous systems.

The Somatic Nervous System

The somatic nervous system is composed of the sensory (afferent) neurons that carry messages to and from the central nervous system and the motor (efferent) neurons that carry messages from the central nervous system to the skeletal muscles of the body.

The Autonomic Nervous System

The autonomic nervous system carries messages between the central nervous system and the internal organs. It is broken in to two parts: the sympathetic and parasympathetic divisions. The first acts primarily to arouse the body; the second, to relax and restore the body to normal levels of arousal.

The Endocrine System

The endocrine system is made up of endocrine glands that produce hormones, chemical substances released in to the blood stream to guide such processes as metabolism, growth and sexual development. Hormones are also involved in regulating emotional life.

The Thyroid Gland

The thyroid gland secretes thyroxin, a hormone that can reduce concentration and lead to irritability when the thyroid is overactive, and cause drowsiness and a sluggish metabolism when the thyroid is under active.

The Parathyroid Glands

Within the thyroid are four tiny pea shaped organs called the parathyroids that secrete parathormone to control and balance the levels of calcium and phosphate in the blood and tissue fluids. This, in turn, affects the excitability of the nervous system.

The Pineal Gland

The pineal gland is a pea sized gland that apparently responds to exposure to light and regulates activity levels over the course of the day.

The Pancreas

The pancreas lies in a curve between the stomach and the small intestine and controls the level of sugar in the body by secreting insulin and glucagon.

The Pituitary Gland

This gland produces the largest number of different hormones and therefore has the widest range of effects on the body's functions. The posterior pituitary is controlled by the nervous system. It produces two hormones: vasopressin, which causes blood pressure to rise and regulates the amount of water in the body's cells and

oxytocin, which causes the uterus to contract during the child birth and lactation to begin. The anterior pituitary, often called as the master gland responds to chemical messages from the bloodstream to produce numerous hormones that trigger the action of other endocrine glands.

The Gonads

These reproductive glands – the testes in males and the ovaries in females, and, to lesser extent, the adrenal glands- secrete androgens (including testosterone) and estrogens.

The Adrenal Glands

The two adrenal glands are located above the kidneys. Each has two parts: an outer covering, the adrenal cortex and an inner core, the adrenal medulla. Both influence the body's response to stress. For example, in response to a stressful situation, the pituitary gland may release beta endorphin and ACTH, which in turn prompt the adrenal cortex to release hormones. Meanwhile, the autonomic nervous system stimulates the adrenal medulla to secrete hormones such as epinephrine in to the blood stream.

Neurotransmitters and Behaviour

The neurotransmitters in our bodies are continually in flux. They are constantly being manufactured, secreted, broken down and recaptured. Drugs, direct electrical stimulation of the brain, disease and environment, events may raise or lower the amounts of these transmitter substances in specific brain pathways and produce dramatic effects on behaviour.

Module 2
Attention and Perception

Attention is the cognitive process of selectively concentrating on one aspect of the environment while ignoring other things. It is closely related to the immediate experience of the individual; it is a state of current awareness. Within the vast field of potential experiences, an individual focuses upon—or attends to—some limited subset of the whole. This subset constitutes the subjective field of awareness. A person cannot consciously experience all the events and information available at any one time. Likewise, it is impossible to initiate, simultaneously, an unlimited number of different actions. The question becomes one of how an appropriate subset of inputs, intermediate processes, and outputs are selected to command attention and engage available resources.

Attention, then, may be understood as a condition of selective awareness which governs the extent and quality of one's interactions with one's environment. It is not necessarily held under voluntary control. In other words attention is the first step in the observation. It is focusing the consciousness on a stimulus. It is a process of preferentially responding to a stimulus or a range of stimuli. Sometimes attention shifts to matters unrelated to the external environment, a phenomenon referred to as mind-wandering or "spontaneous thought".

Attention is one of the most intensely studied topics within psychology and cognitive neuroscience. Of the many cognitive processes associated with the human mind (decision-making, memory, emotion, etc), attention is considered the most concrete because it is tied so closely to perception. As such it is a gateway to the rest of cognition.

Definition

Attention has been commonly referred to as a "general, or universal, characteristic of consciousness".

"Everyone knows what attention is. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatterbrained state." (Principles of Psychology, 1890)

---- William James

"Attention is a state of sensory clearness with a margin and a focus. Attention is the aspect of consciousness that relates to the amount of effort exerted in focusing on certain aspects of an experience, so that they become relatively vivid".

----Titchener

Attention and the Processing of Information

This can be explained using the concept of *filtering.* Since we cannot process all the information in our sensory channels, we filter or partially blackout some inputs. It is hard to pay attention to more than one set of inputs at a time. This is called as serial processing, that is attending one set of inputs and then another. Whether you process the conversation serially, or listen to only one of them, you are filtering out

the unattended conversation. In the filter model of attention, inputs in the margin shift to the focus, when various attending getting features of the environment are present in the filtered input.

Clinical model of attention

Many times clinical models differ from investigation models. One of the most used models for the evaluation of attention in patients with very different neurologic pathologies is the model of Sohlberg and Mateer (1989). This hierarchic model is based in the recovering of attention processes of brain damage patients after coma. Five different kinds of activities are described in the model; connecting with the activities that patient could do as their recovering process advanced.

1. ***Focused attention*:** This is the ability to respond discretely to specific visual, auditory or tactile stimuli.
2. ***Sustained attention*:** This refers to the ability to maintain a consistent behavioural response during continuous and repetitive activity.
3. ***Selective attention*:** This level of attention refers to the capacity to maintain a behavioural or cognitive set in the face of distracting or competing stimuli. Therefore it incorporates the notion of "freedom from distractibility".
4. ***Alternating attention*:** it refers to the capacity for mental flexibility that allows individuals to shift their focus of attention and move between tasks having different cognitive requirements.
5. ***Divided attention*:** This is the highest level of attention and it refers to the ability to respond simultaneously to multiple tasks or multiple task demands.

This model has shown to be very useful to evaluate attention in very different pathologies, correlates strongly with daily difficulties and it is especially helpful to design stimulation programs such as the APT (Attention Process Training); a rehabilitation program for neurologic patients.

Overt and Covert Attention

Attention may be differentiated according to its status as 'overt' versus 'covert'. Overt attention is the act of directing sense organs towards a stimulus source. Covert attention is the act of mentally focusing on particular stimuli. Covert attention is thought to be a neural process that enhances the signal from a particular part of the sensory panorama.

There are studies that suggest the mechanisms of overt and covert attention may not be as separate as previously believed. Though humans and primates can look in one direction but attend in another, there may be an underlying neural circuitry that links shifts in covert attention to plans to shift gaze. For example, if individuals attend to the right hand corner field of view, we want to move eyes in that direction, and have to actively suppress the eye movement that linked to this shift in attention.

The current view is that visual covert attention is a mechanism for quickly scanning the field of view for interesting locations. This shift in covert attention is linked to eye movement circuitry that sets up a slower saccade to that location.

Forms of Attention: Voluntary, Non voluntary, Involuntary and Habitual Attention

1. Voluntary Attention

Sometimes an individual will divert his attention towards a particular activity or situation deliberately. Active, or voluntary, attention is precisely what the name implies, attention as the result of definitely self-initiated activity. In its clearest and most unambiguous form it always involves mental strain and effort.

It is not diverted spontaneously, but after some struggle. For example, while sitting in a class, the students divert their attention towards the lecture even if it is not interesting, because they have to pass the examination.

2. Non Voluntary Attention

It requires no extended reflection upon everyday experience to reveal to us the fact that in the course of every twenty-four hours we attend in an effortless way to a great many things to which we have no explicit purpose to direct our thought, to which we cannot, therefore, be said to attend voluntarily in the full sense of the word; but to which we certainly are not attending *against* our will and in *spite* of ourselves. Such cases constitute what is meant by non-voluntary, or spontaneous, attention.

3. Involuntary Attention

At times the attention is diverted towards some other activity without the conscious effort, may be against the will of the individual.

This is known as involuntary attention. For example, though the student is listening to a lecture with all interest, some loud sound outside the classroom may draw his attention towards it.

4. Habitual Attention

In some situations, reaction to a stimulus or attending to a stimulus becomes a habit. So the individual will automatically divert his attention towards that stimulus.

For example, a musician's attention will automatically be diverted towards the sound of music even if he is busily engaged in talking to somebody.

Factors Affecting Attention

Attention is a selective activity which often depends upon the preference of our mind. Apart from this, there are other factors in the objects as well as in the individual which can influence attention. These factors are divided into two: Objective factors and Subjective factors.

1. Objective Factors

These factors relate to particular aspects of objects which are inherent in the objects one perceives.

1. ***Movement:*** A moving object draws our attention more easily than a stationary object.
2. ***Intensity:*** More intense light, sound or smell draws our attention more easily than less intense one.
3. ***Novelty:*** New kinds of objects draw our attention quickly.

4. ***Size:*** A bigger or a smaller object draws the attention of people very easily than average level size of any object.
5. ***Change:*** A change in our environment draws our attention quickly.
6. ***Repetition:*** When a stimulus is presented repeatedly our attention is diverted.
7. ***Clarity:*** An object or sound which can be experienced clearly draws our attention than the stimuli which are not clear.
8. ***Colours:*** Colourful objects draw our attention more easily than black or white objects.
9. ***Contrast:*** An object that is strikingly different from its background draws our attention.

2. Subjective Factors:

These factors refer to factors related to the individual. There are several subjective factors which determine our attention. They are:

1. ***Interest:*** Objects of our interest draw our attention immediately.
2. ***Motives:*** Motives are powerful forces which make us to divert our attention.
3. ***Mental set:*** Mind set or readiness of mind is very important in attending to any stimulus.
4. ***Emotional state:*** Attention is disturbed during emotional state. It also affects our perception.
5. ***Habits:*** Our attention is diverted automatically towards the things to which we are habituated.

Major Conditions of Attention

There are four conditions of attention which refer to the duration and degree of attention. They are as follows: (1) Fluctuation of Attention (2) Distraction of Attention (3) Division of Attention (4) Span of Attention/Apprehension.

1. Fluctuation of Attention

It appears for us that our attention can be concentrated on a particular act for more time. But careful observation clearly shows that we cannot concentrate on a single act or stimulus for more than few seconds.

When we are seeing an object or listening to a sound, after few seconds, the attention will be shifted towards other stimulus or other area of the stimulus for a fraction of time and returns to the original stimulus. This process is called fluctuation. Here we will be unable to notice this short shrift.

2. Distraction of Attention

When our attention is concentrated on a particular act or stimulus, some other more powerful stimulus may draw our attention and holds it to remain there for more time.

It may or may not return to the earlier stimulus. For example, while reading a book, our concentration will be on the book. Meanwhile if we listen to an attractive music sound, our attention may be shifted towards that under such circumstances, physically we may be reading the book, but we may not follow the contents. Students

are much affected by distraction. Hence, they should learn to have concentration of mind on studies.

3. Division of Attention

Attending to more than one act at a time is known as division of attention. In such situations, we will divide our attention towards more than one act. For example, a tailor will be stitching the cloths and also speaking to his customers.

A nurse will be observing the pulse of a patient and also changes on his face. We ride a scooter while speaking to our friends. In such activities the attention is not divided, but it is possible to perform more than one act because, either our attention is shifted from one act to another rapidly, or our attention is concentrated on only one act and the remaining activities are carried on automatically.

Such activities do not need our attention, because these are almost mechanical. But in some technical jobs, attention has to be divided to perform more than one act at a time. However, under such circumstances, the quality and quantity of the task is affected. This can be proved experimentally by using a "Division of attention board".

4. Span of Attention/Apprehension

Span refers to the number of letters or digits or sounds that an individual can grasp within a given period of time. Using an instrument called 'Tachistoscope', it is experimentally proved that an individual can grasp 4-5 digits or letters easily within a fraction of time.

It is also proved that span will be more for meaningful material like words, than digits or non-sense syllables. It may be observed that digits on number plates of automobile vehicles are restricted to four only.

Role of Attention in Perception

During every waking moment enormous numbers of stimuli compete for our attention. Ordinarily, people and other animals select a small trickle of impressions to attend to. The stimuli that lie in the periphery (boundary) of our attention form a background. This selective openness to a small portion of impinging sensory phenomena is called attention.

Currently there is disagreement regarding the nature of attention. Some psychologists see attention as a type of *filter* that screens out information at different points in the perceptual process. Others believe that people simply *focus* on what they wish to perceive by actively engaging themselves with the experience without directly shutting out competing events.

Psychologists are interested in identifying the points in the perceptual process where attention operates. Studies suggest that attention is active at several times like, initially when receiving input from a sense organ and later on when sorting and interpreting sensory data, deciding whether to respond to them and preparing to act. According to Daniel Kahneman an Israeli psychologist, the capacity of attention depends on the resources demanded by the task that are being attempted. Needs, interests and values have been shown to be important influences on attention.

Normally people pay particular attention to events that are novel, unexpected, intense or changing. This perceptual style has important survival value. It helps us to

respond to sudden dangers, locate and manipulate objects in space and move about without collisions. If we attended to everything at once, important survival related cues could easily be lost amidst the clutter.

Perception

The inputs from our senses are elaborately transformed so that we perceive a meaningful and orderly world. Perception is defined as the process of organising and interpreting incoming sensory data (sensations) to develop an awareness of surroundings and self. Perception involves interpretation, whereas sensation does not.

Nature of Perception

Perception is an active complicated operation. The distinct nature of perception is described below.

Perception is not a mirror of reality

People sometimes assume that perception provides a perfectly accurate reflection of reality. Perception is not a mirror. Firstly, our human senses do not respond to many aspects of our surroundings. Secondly, people sometimes perceive stimuli which are not present. Direct electrical stimulation of the brain can cause a person to see vision or hear voices. Thirdly, human perceptions depend on expectations, motives and past experiences.

Perception is a multifaceted cognitive capacity

Perception involves numerous cognitive activities. Early in the perceptual process people decide what to attend to. Consciousness also influences perception. Memory enters in to the perceptual process at several points. Information processing takes place during perception too. Language influences our cognitions, moulding perception indirectly.

While all cognitive processes are highly interconnected, we are beginning with perception because it may be considered as the point where cognition and reality meet and the most basic activity out of which all other all others emerge. Information must be taken in to our minds before anything else can be done with it.

The Psychological Basis of Perception

The complex perceptual process depends on both the sensory systems and the brain. The sensory system detects information, convert (or transduce) it in to nerve impulses, process some of it, and send most of it to the brain via nerve fibers. The brain plays the major role in processing sensory data. perception depends on four operations like detection, transduction (the conversion of energy from one form to another), transmission and information processing.

Detection, Transduction and Transmission

The senses detect, transducer and transmit sensory information. Each sense has a detection element called a receptor. A receptor is a single cell or a group of cells that is particularly responsive to a specific type of energy. Certain cells in the ears are especially designed for registering sound, or vibrations in the air, a form of mechanical energy. Cells in the eyes are very sensitive to light, a form of electromagnetic energy. Pressure or vibrations may stimulate the eye too.

Receptors behave like transducers. The pickup cartridge on a record player is a transducer that you are probably familiar with. The cartridge converts (transduces) the mechanical vibrations of the needle riding in the record groove in to electrical signals. After the signals have been amplified, the speaker (another transducer) transforms this electrical energy back in to mechanical vibrations that we can hear. Receptors in our senses convert incoming energy in to the electrochemical signals that the nervous system uses for communication. If the incoming energy is sufficiently intense, it will trigger nerve impulses that transmit coded information about various features of the stimulus along specific nerve fibres to particular brain regions.

The Organisation of Visual Perception

The data that our senses supply are continually being organised. Ordinarily the process is so rapid and automatic that we are completely unaware of it. People use several processing strategies o interpret visual information about objects. It includes constancy, figure-ground and grouping.

1. Constancy

Constancy means that objects viewed from different angles at various distances or under diverse conditions of illumination are still perceived and retain the same shape, size and colour. Constancy gives a great deal of stability to our perceptual worlds. In ways that are not fully understood, people use knowledge derived from past experience without making any effort or having any awareness of the process, to compliment the images that the retina picks up.

2. Figure-ground

Whenever we look around, we tend to see objects (or figures) against a background (or ground). The same object may be seen as figure or ground depending on how you direct your attention. The stimuli that seem figure like appear to own the boundary or contour that is common to figure and ground and to be in front of the ground. Figures are seen as vivid and definitely shaped, as well.



Figure 4: Reversals in perception of figure and ground should occur simultaneously

As long as our senses and brain are operating normally, the same stimulus cannot be seen as both figure and ground at the same time. Notice how *Figure: 4* fluctuates. Sometimes we see two faces on a vague white background. At another time we see a vase on the featureless background. The reversals occur spontaneously and are hard to control. Still although we alternate between the two interpretations, only one dominates at any single time.

The figure- ground principle appears to be basic to all object perception. Something cannot be seen as an object until it has been separated from its background. This particular rule appears to be largely inborn.

3. Grouping

The following principles are among those that govern the way we group elements of incoming visual information. See *Figure: 5* for visual elements illustrating the principles of grouping.



Figure 5: Visual elements with same shape and colour appear to belong together

1. *Similarity:* visual elements with similar colour, shape or texture are seen as belonging together. We tend to group elements that move in a similar direction too.
2. *Proximity:* visual elements near one another are seen as belonging together.
3. *Symmetry:* visual elements that form regular, simple, well-balanced shapes are seen as belonging together.
4. *Continuity:* visual elements that permit lines, curves or movements tend to continue in the direction already established as to be grouped together.
5. *Closure:* incomplete objects are usually filled in and seen as complete, a tendency known as closure.

4. Perceiving Depth and Distance

Like a movie screen retina registers images in two dimensions: left-right and up-down. Yet people and animals perceive a three dimensional world. This is because; we use physiological, motion-related and pictorial cues to see depth and distance.

1. Physiological Cues

Several common physiological depth cues depend on the operation of both eyes, so they are *binocular depth cues*. Because our eyes are located in different positions, each retina records a slightly different visual image. This phenomenon is known as *binocular disparity*.

Convergence provides another binocular physiological depth cue. As our eyes fixate on a nearby object, they turn in toward one another. The resulting kinaesthetic feedback from the eye muscles gives us some idea about how distant the object is. Convergence cues are primarily useful for distances less than about 30 feet.

Even without two eyes, people and other animals still perceive distance. They use *monocular depth cues*, those that require the operation of only one eye. We will describe physiological, motion-related and pictorial monocular depth cues. First consider, *accommodation*, a physiological monocular depth cue. As you look at visual objects in any field, the lens system of the eye automatically focuses the incoming light rays on to the retina. During this process, known as accommodation, the eye muscles make the lens bulge to focus nearby objects or flatten to focus distant ones. In each case, the brain receives different kinaesthetic sensations from the eye muscles. These sensations provide information about distance. Because only minimal changes in accommodation occur beyond a few feet, this monocular depth cue is mainly effective for estimating short distances.

2. Motion-related Cues

Some cues about depth come from the perceiver's own actions. Whenever we move, for example, retina images of the visual field change. Objects that are close to

us appear to sweep by with great speed than distant ones. This important monocular dept cue is known as *motion parallax*. Motion parallax is vivid when driving. Fences, posts and poles beside the road seem to fly by at high speed, while those far away drift past slowly. The relative motion of objects provides reliable information about their distances.

3. Pictorial Cues

A two dimensional retinal image of an actual scene contains a great deal of information about distance. People rely on such picture related, or pictorial cues continually, usually without being aware of doing so. There are six categories of monocular depth cues. They are discussed below:

1. *Familiar Size*: whenever we see a familiar object, we roughly gauge its distance by noting the size of our retinal image. When the image is relatively large, we assume that the object is near, and when it is relatively small, we infer that the object is distant.
2. *Linear Perspective*: it is special case of familiar size. In *Figure: 6*, if we measure the cabinets on the photograph, we would find those towards the center are smaller, closer and higher. Past experience tell us that the actual cabinets are not smaller, closer and higher. We have seen the apparent narrowing of parallel structures in viewing the sides of roads, rails, tracks, steams etc often enough to know their funnel shaped appearance signifies distance and not convergence. So every time we see what we believe to be parallel lines converge, we make an interpretation. We assume that the gradually changing retinal image means that the converging end of the structure is farthest away. This cue is called *linear perspective*.



Figure 6: A cue for linear perspective

3. *Light and Shadow*: when light from a specific source such as the sun strikes a three dimensional object, it illuminates the side(s) facing the light source and leaves the other side(s) in shadow. The pattern of light and shadow helps to define contours and gives information about solidity, depth, protrusions and indentations.
4. *Texture gradient*: objects in visual field show a gradual change in texture with distance. They appear clear, detailed, and coarse nearby and less distinct farther away.
5. *Aerial Perspective*: Haze usually present in the atmosphere, makes distant objects appear bluish as well as blurred and indistinct.
6. *Interposition*: whenever one object obstructs the view of another, the complete object is seen as closer than the obstructed one.

Colour Perception

There are two main reasons why colour vision is of value to us: *Detection:* colour vision helps us to distinguish between an object and its background.

Discrimination: colour vision makes it easier for us to make fine discriminations among objects (e.g., between ripe and unripe fruit).

In order to understand how we can discriminate about five million different colours, we need to start with the retina. There are two types of visual receptor cells in the retina: cones and rods. There are about six million cones, and they are mostly found in the fovea or central part of the retina. The cones are specialised for colour vision and for sharpness of vision. There are about 125 million rods, and they are concentrated in the outer regions of the retina. Rods are specialised for vision in dim light and for the detection of movement. Many of these differences stem from the fact that a retinal ganglion cell receives input from only a few cones but from hundreds of rods. As a result, only rods produce much activity in retinal ganglion cells in poor lighting conditions.

Theories of Colour Vision

There are two major theories that explain and guide research on colour vision: the *trichromatic* theory also known as the Young-Helmholtz theory, and the *opponent-process* theory. These two theories are complementary and explain processes that operate at different levels of the visual system.

1. Trichromatic Theory

Evidence for the trichromatic theory comes from colour matching and colour mixing studies. In 1802, Thomas Young proposed that all human vision occurred through the combination of sensitivity to red, green, and blue. This theory, modified by Hermann von Helmholtz in 1852, came to be known as the *Young-Helmholtz* or *trichromatic (three-color)* theory of colour vision. The basic idea was that the eye responded to three primary colours, and combining the three primary colours of additive colour mixing formed all the other colours.

Young and Helmholtz carried out experiments in which individuals adjusted the relative intensity of 1,2, or 3 light sources of different wavelengths so that the resulting mixture field matched an adjacent test field composed of a single wavelength. The finding that there are three types of colour-sensitive cone receptors in the retina supported the three-color theory. One set of receptors is sensitive to long wavelengths such as red, one to medium wavelengths such as green, and one is sensitive to short wavelengths such as blue.

Individuals with normal colour vision needed three different wavelengths (i.e., primaries) to match any other wavelength in the visible spectrum. This finding led to the hypothesis that normal colour vision is based on the activity of three types of receptors, each with different peak sensitivity. Consistent with the trichromatic theory, we now know that the overall balance of activity in S (short wavelength), M (medium wavelength), and L (long wavelength) cones determines our perception of colour.

So there is some truth to the three-color theory. However, other aspects of color vision cannot be accounted for by the trichromatic theory. For example, there is the phenomenon of *color afterimages*. If you stare at a red dot, then move your gaze to a white wall, you will see a green dot as an afterimage. If you stare at a green dot, you will see a red afterimage. The same thing happens with yellow and blue.

2. Opponent-Process Theory

Ewald Hering (1878) put forward an opponent-process theory that handles some findings that cannot be explained by the Young-Helmholtz theory. Hering's key assumption was that there are three types of opponent processes in the visual system. He suggested that colour vision occurred in three channels where "opposite" colours (called *complementary* colours) are in a form of competition. For example, red and green are complementary colours. When you stare at something red, your redness detectors are worn out or fatigued. Their opponents, the green receptors, gain the upper hand, and you see a green afterimage after staring at a red dot. One type of process produces perception of green when it responds in one way and of red when it responds in the opposite way. A second type of process produces perception of blue or yellow in the same fashion. The third type of process produces the perception of white at one extreme and of black at the other.

The modern form of this theory assumes there are three basic channels for vision. One channel is the *red/green* channel; another is the *yellow/blue* channel. A third channel, the *black/white* or *brightness/darkness* channel, may also provide information relevant to colour vision, but that is a complex issue being debated among researchers.

The yellow/blue channel may seem odd, because there are no yellow-sensitive cones in the retina. Yellow light stimulates a *combination* of long-wavelength (red-sensitive) and medium wavelength (green-sensitive) cones. If there is more activity in blue receptors (compared to red plus green receptors) the brain interprets this as blue. If there is more red plus green activity (as compared to blue) the brain interprets this as yellow. The result is a yellow/blue channel. Yellow and blue act as opponent processes just like red and green. If you stare at a blue image, you get a yellow afterimage; if you stare at a yellow dot, you get a blue afterimage.

Monochromat, Dichromat Or Trichromat

A person with no colour-sensitive pigments, therefore no colour vision, is called a *monochromat* (one-colour person). To such a person, the world looks like a black-and-white TV picture. Colours are shades of gray. A person with a defect in one channel-either the red/green or yellow/blue channel-is called a *dichromat*. Both colours in a channel are affected, so if the person cannot distinguish red that same person cannot distinguish green. A person who cannot see blue as a distinct colour will also not see yellow as a distinct colour. People with normal colour vision use

all three channels (black/ white, red/green, and yellow/blue) and are called *trichromats*.

Theoretical Approach to Perception

There are four major approaches toward a theory of perception. The Gestalt approach heavily stresses nativistic factors of perceptual organisation. The constructionist approach accords greater influence to the factors of learning and memory. The motor approach centres on the role of feedback from the perceivers motor exploration of his environment. Gibson's ecological approach emphasises the full environmental information inherent in the stimulus pattern.

1. The Gestalt Approach

A small group of experimental psychologists in Germany began to champion what was then a radical view: that we naturally, normally, immediately and directly perceive forms, figures and objects that have properties reflecting the whole stimulus pattern. The movement begun by these German psychologists became known as Gestalt psychology. (Gestalt is the German word for 'pattern' or 'whole'). Its intellectual pioneers were Max Wertheimer, Kurt Koffka and Wolfgang Kohler., all of whom later emigrated to the United States.

The Gestaltists believed in inherent or innate laws of brain organisation. This, they argued, accounted for the central phenomena of figure-ground differentiation, contrast, contour, closure, the principles of perceptual grouping, etc. They asserted that any pattern involving greater symmetry, closure, closely knit units and similar units would seem 'simpler' to the observer. The influence of the Gestalt approach on the field of perception has been immense. It has pervaded and covered all modern conceptions of perceptual organisation and functioning. At the same time many limitations has been expressed. It has been objected that the demonstrations of the 'laws' of organisation and the simplicity principle were too heavily based on lines and dots on flat paper, a kind of display that is pictorial and lacks all the rich detail of real objects in a real world. Perhaps under these circumstances, it is said, when the stimulus structure is weak and ambiguous, the gestalt principles do come in to play. But in the densely textured three dimensional solid world we normally move around in a different kind of perceptual process may occur.

A heavy criticism of the Gestalt approach is that, in its pre occupation with innate factors of organisation, it has not given appropriate emphasis to factors of prior experience. This leads us next to a brief look at the constructionist approach.

2. The Constructionist Approach

In the constructionist view of perception, central importance is assigned to the role of *memory*. It is suggested that we add remembered residuals of previous experiences to here-and-now stimulus-induced sensations and thus construct a percept. And, the constructionists argues, the processes of selecting, analysing and adding to

stimulus information from ones memory store are the bases of organised perceptions, rather than the Gestaltists' natural operation of innate laws of brain organisation.

The constructionists suggest that memory is highly significant in the perceptual process in that it provides a familiar context for perceiving; but this need not occur by literally adding details to perception.

3. The Motor Approach

Following the direction of Pavlov's early work, modern Russian perceptual research has concentrated on the role of motor behaviour in influencing and guiding perception. These investigators argue that there is a 'motor copy' that controls some of our perception of patterns. They believe that a copy of the movements made in exploring an object is one of the determiners of what will be seen.

Such movements seem to be, at least in part a learned tendency. In the early stages of the development of visual perception eye movements do not tend to follow the outlines of objects or to concentrate upon their more figural features. Eye movement tracing seems to have an adaptive function; procedures especially designed to induce children and adults to trace the contours of objects visually have been found to aid visual learning and relearning. It is certain that our eye movements are closely related to perception. Indeed, if we do not move our eyes at all, the effect is that the visual scene fades completely.

A motor approach to perception, and its emphasis on effect, may hold in a powerful way for eye movements, but that the approach may not be equally appropriate for all kinds of movement in the perceptual process.

4. Gibson's Ecological Approach

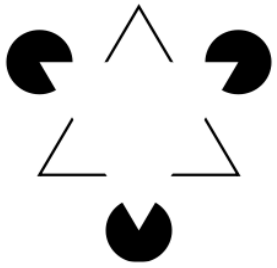
In 1950, American psychologist, J. J. Gibson proposed that perception relies very heavily on a kind of relation that he believed had been overlooked by previous generations of psychologists. According to him, the normal environment is composed of textured surfaces and that a visual system that can detect textures makes important use of gradients of texture in perceiving the world. He believes that texture forms the basis for our perception of surfaces, and he calls the perception of textured surfaces as normal or ecological perception. He thinks that the highly structured world, with its textured surfaces, supplies sufficiently rich and accurate information from which the observer can select. In Gibson's view, our perceptual selection skills get better and better with age.

Underlying Gibson's 'ecological' approach is the belief that in many respects all people see the world in similar ways, clearly and in whole. According to him people generally see the sizes and shapes and locations of objects quite accurately, and the mechanisms for seeing edges and surfaces operate similarly in most people.

Visual Illusions

Visual illusions stimulate us by challenging us to see things in a new way. Some optical illusions trick us because of the properties of light and the way our eyes work, and are addressed by biology and perhaps optics, while other illusions depend on a "higher" level of processing which is better addressed by psychology. Gregory, one of the most well-known researchers of optical illusions, addresses the difficulty in defining "illusion" in such a way that it includes everything that we think of as illusions, but excludes things like movies, which are illusions in the sense that they appear to depict motion while actually being composed of a series of static pictures.

How many triangles are present in the image below?



Answer: There are no triangles. In reality there are only 3 V shapes and 3 shapes that look like Pac-Men.

According to Gregory, many classic visual illusions can be explained by assuming that previous knowledge derived from the perception of three-dimensional objects is applied inappropriately to the perception of two-dimensional figures. For example, people typically see a given object as having a constant size by taking account of its apparent distance. *Size constancy* means that an object is perceived as having the same size whether it is looked at from a short or a long distance away. This constancy contrasts with the size of the retinal image, which becomes progressively smaller as an object recedes into the distance. Gregory's misapplied size-constancy theory argues that this kind of perceptual processing is applied wrongly to produce several illusions.

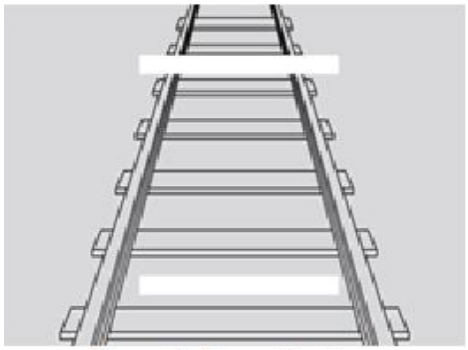


Figure 7: Ponzo illusion

The basic ideas in the theory can be understood with reference to the Ponzo illusion (see *Figure: 7*). The long lines in the Figure look like railway lines or the edges of a road receding into the distance. Thus, the top horizontal line can be seen as further away from us than the bottom horizontal line. Misapplied size-constancy theory can also explain the Müller- Lyer illusion; (see *Figure: 8*). The vertical lines in the two figures are the same length. However, the vertical line on the left looks longer than the one in the figure on the right. According to Gregory (1970), the Müller-Lyer figures can be thought of as simple perspective drawings of three-dimensional objects. The left figure looks like the inside corners of a room, whereas the right figure is like the outside corners of a building. Thus, the vertical line in the left figure is in some sense further away from us than its fins, whereas the vertical line in the right figure is closer to us than its fins. Because the size of the retinal image is the same for both vertical lines, the principle of size constancy tells us that the line that is further away (i.e., the one in the left figure) must be longer. This is precisely the Müller-Lyer illusion.

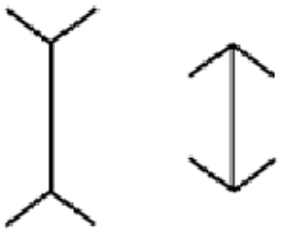


Figure 8: Müller- Lyer illusion

One of the most complete classification systems of visual illusion that can be found comes from Gregory (1997). He starts with defining a simple division between physical and cognitive illusions. He further divides physical illusions into two categories: those due to optics (disturbance of light between objects and the eyes), and those due to the disturbance of the sensory signals of the eye. He then divides cognitive illusions into those that are due to general knowledge (or "rules"), and those that are due to specific knowledge of objects.

	Physical		**Cognitive**	
Kinds	Optics	Signal	Rules	Objects
Ambiguity	Mist	Retinal rivalry	Figure-ground	Hollow face
Distortion	Mirage	Cafe wall	Muller-Lyer	Size -weight
Paradox	Mirror	Rotating spiral	Penrose triangle	Magritte mirror
Fiction	Rainbow	After-images	Kaniza triangle	Faces in the fire

From the above table, visual illusion is classified in to four classes based on appearance, which can be named quite naturally from errors of language like ambiguity, distortion, paradox and fiction. The causes of many illusionary phenomena have not yet been found to be explained satisfactorily. According to Gregory, based on the classification, we may suppose four principle causes for visual illusion; the first two lying broadly within physics and the last two in cognitive, as they are associated with knowledge.

The first (physical) is the result of optical disturbance intervening between the object and the retina; the second (physical) is due to disturbed physiological signals in the eyes or brain; the third (cognitive) is the application of misleading knowledge of objects; the fourth (cognitive) is the application of misleading general rules.

However, Gregory cautions that "although (physical and cognitive illusions) have extremely different kinds of causes, they can produce some surprisingly similar phenomena," so it may not be wise to put seemingly similar illusions in the same category without looking at the research. In addition, some illusions may have aspects that place them in two or more categories.

Extrasensory Perception (ESP)

The term Extra Sensory Perception (ESP) was coined by Sir Richard Burton and adopted by J. B. Rhine, a psychologist at Duke University. ESP is used to denote the ability of the psyche to receive information that are not gained through the physical senses; only mind can sense ESP. It includes psychic abilities like telepathy, clairaudience and clairvoyance and their trans temporal operations such as precognition or retrocognition. ESP is sometimes referred to as the sixth sense.

The study of ESP and other paranormal psychic phenomena is termed as parapsychology. Parapsychologists demand evidences for existence of ESP through

tests like the ganzfeld experiment; while the scientific community rejects ESP on the grounds that it lacks evidence base and theoretical base explanations.

Types of Extrasensory Perception

1. Clairvoyance: Clair means 'clear' and voyance means 'vision'. Hence, clairvoyance is the ability of an individual to gain information regarding an object, location or a person through means other than the known human senses. The person having this ability is called as a clairvoyant.
2. Clairaudience: Clair means 'clear' and audience means 'hearing'. Clairaudience is the ability of a person to acquire information by paranormal auditory means.
3. Clairsentience: Clair means 'clear' and sentience means 'feelings'. Hence the person possessing the ability can feel the vibrations of other people through paranormal perception.
4. Clairalience: (clear- smelling) is a form of extra sensory perception wherein a person access psychic knowledge through the physical sense of smell.
5. Claircognizance: (clear-knowing/knowledge) an ESP in which the individual acquires information by means of intrinsic knowledge.
6. Clairgustance: (clear- tasting) a form of ESP in which a person tastes a substance without actually tasting it.

Module 3
Learning

Learning is a relatively permanent change in a behavioural tendency and is the result of reinforced practice (Kimble & Garmezy, 1963). Learning is the modification of the behaviour through experience. It can also be understood as acquisition of new patterns of behaviour. It involves new ways of doing things and operates in an individual's attempt to adjust to his/her environment.

Definitions

1. Learning is the modification of behaviour through experience and training.

----- Gates

2. Learning is a process of progressive behaviour adaptation.

----- Skinner

3. Learning is the acquisition of habits, knowledge and attitudes.

---- Crow and Crow

Nature of Learning

Learning occupies a very important place in our life. Most of what we do or do not do is influenced by what we learn and how we learn it. Learning, therefore, provides a key to structure of our personality and behaviour. An individual starts learning immediately after his birth or in a strict sense even earlier in the womb of the mother. Experiences, direct or indirect are found to play a dominant role in moulding and shaping, the behaviour of the individual from the very beginning.

Gardner Murphy (1968) The term learning covers every modification in behaviour to meet environmental requirements.

Henry P. Smith (1962) Learning is the acquisition of new behaviour or the strengthening or weakening of old behaviour as the result of experience.

Hilgard (1958) Learning is the process by which an activity originates is changed through reaching to an encountered situation, provided that the characteristics of the changes in activity cannot be explained on the basis of native response, tendencies, maturation, or temporary states of the organism (eg: fatigue or drugs, etc.)

Kimble (1961)

Learning is a relatively permanent change in bahavioural potentially that occurs as a result of reinforced practice.

The above definition reveals the following facts:

1. Learning is a process and not a product.
2. It involves all those experiences and training of an individual (right from birth) which help him to produce changes in his behaviour.
3. Learning leads to changes in behaviour but this does not necessarily mean that these changes always bring about improvement or positive development. One has an equal chance to drift to the negative side of human personality.
4. Instead of change in existing behaviour or acquisition of new behaviour, learning may also result in discontinuance or abandonment of existing behaviour.

5. Learning prepares an individual for any adjustment and adaptation that may be necessary.
6. Learning is purposeful and goal-oriented. In case there is no purpose, there would definitely be hardly any learning.
7. It is very comprehensive process which covers nearly all fields – conative, cognitive and affective – human behaviour.
8. Learning is universal and continuous
9. Learning as a process is of different types and involves different methods.
10. Learning does not include changes in behaviour on account of maturation, fatigue, illness or drugs etc.

Outcomes of Learning

1. *Bringing desirable changes in behaviour:* Learning is the process of bringing changes in behaviour ie., in all three domains like cognitive, conative and affective.
2. *Attaining of proper growth and development:* Learning helps in reaching one's maximum in terms of growth and development.
3. *Attaining balanced development of personality:* Learning results to bringing all-round development in personality.
4. *Attaining proper adjustment:* Learning helps individuals to get adjusted themselves to the environment.
5. *Realizing of the goals of life:* Learning process helps an individual to realise his goals.

Theories of Learning

Connectionist or behaviourists theories belong to the school of behaviourism. They interpret learning in terms of connection or association between stimulus and response.

Cognitive theories, belong to the school of Gestalt psychology and cognitive psychology. In place of a purely mechanical or instrumental approach these theories emphasize the role of purpose, insight, understanding, reasoning, memory and other cognitive factors in the process of learning.

Trial and Error Theory of Learning

The famous psychologists Edward L. Thorndike (1874-19459) propounded the theory of trial and error learning based on the findings of his experiments on chickens, rats and cats.

In one of his experiments, he put a hungry cat in a puzzle box (See *Figure: 9*). There was only one door which could be opened by correctly manipulating a latch. A fish was placed outside the box. The situation is described by Thorndike himself as.

"It tries to squeeze through every opening; it claws and bites at the bars or wires.

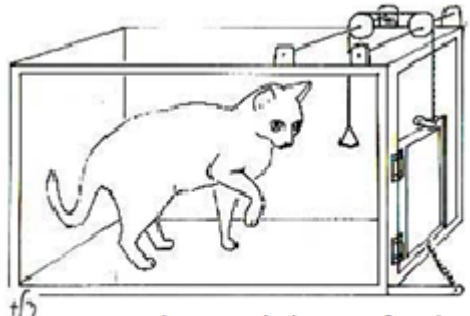


Figure 9: Cat in a puzzle box performing trial and error learning

If thrusts, its paws through any opening and claws at everything if reaches" In this way, it made a number of random movements and in one of the random movements, the latch was manipulated accidently. The cat came out and got its reward.

In another trial the process was repeated. The cat was kept hungry and placed in the same puzzle box. The fish and its smell again worked as a motive for it to get out of the box: it again made random movements and frantic efforts. But this time, it took less time to come out. In subsequent trials such incorrect responses, biting, clawing and dashing were gradually reduced and the cat took less time on each succeeding trial. In due course, it was in a position to manipulate the latch as soon it was put in the box. In this way, gradually, the cat learned the art of opening the door.

1. ***Drive:*** In the *present* experiment it was hunger and was intensified by the sight of the food.

2. ***Goal:*** To get at the food by getting out of the box.

3. ***Block:*** The cat was confined in the box with a closed with a closed door.

4. ***Random movements:*** The cat persistently tried to come out of the box without knowing how.

5. ***Chance success:*** As a result of this striving and random movements the cat, by chance, succeeded in opening the door.

6. ***Selection*** (of proper movement). Gradually, the cat recognised the correct way to manipulate the latch. It selected proper way of manipulating the latch out of its random movements.

7. ***Fixation:*** At last, the cat learned the proper way to open the door by eliminating all the incorrect responses and fixing only the right response. Now it was able to open the door without any error or in other words, learned the correct way of opening the door.

The major theoretical principles which form the basis of Thorndike's theory of learning are summarized as follows.

Learning involves trial and error or selection connection. Thorndike named the learning of his experimental cats as "trial and error learning". Through his experiments, he found out that learning is the stamping in of the correct responses and stamping out of the incorrect responses through a process of trial and error. In trying to find the correct solution, the cat made many false attempts. In the subsequent trials, it tried to avoid the wrong moves and to repeat the correct way of manipulating the latch. Thorndike termed this as learning by selecting and connecting as it provides an opportunity for the selection of the proper responses and to connect or associate them with adequate stimuli.

Learning is the result of the formation of connection. According to Thorndike, learning is the result of the formation of a connection in the nervous system between the stimuli and the responses. Thorndike (1931) writes *that* learning *is connecting. The mind is man's connection system.* According to him there is a definite association between senses, impression, impulse and action. This association is named a bond or connection. Since it is the strengthening or weakening of these bonds or connections,

which result in the making or breaking of habits. Thorndike's system is sometimes called “Bond psychology" or just "connectionism".

Learning is incremental and not insightful. Continuing to increasing the number of trials or practice will gradually improve our performance. Thorndike termed such improvement in performance as incremental and so concluded that learning is always terminated. Learning, according to Thorndike, needs several attempts and trials and then occurs in small systematic steps rather than in huge jumps.

Learning is direct, not mediated by ideas. Thorndike found that learning is a simple, semi-mechanical process of establishing a simple connection between sensory stimuli and the appropriate responses and does not involve mediation by any ideas, reasoning or thinking.

Thorndike's Laws of Learning

1. The law of readiness

When any conduction unit is ready to conduct, for it to do so is satisfying. When any conduction unit is not in readiness to conduct, for it to conduct is annoying. When any conduction unit is in readiness to conduct, for it not to do so is annoying.

Readiness, according to Thorndike, is preparation for action. It is essential for learning. If the child is ready to learn, he learns more quickly, effectively and with greater satisfaction than if he is not ready to learn.

2. The law of effect.

When a modifiable connection between stimulus and response is made and is accompanied or followed by a satisfying state of affairs, that connection’s strength increased. When made and accompanied or followed by an annoying state of affairs, its strength is decreased. In other words, learning can be said to have taken place properly when it results in satisfaction and the learner derives pleasure from it. Therefore, the satisfaction and dissatisfaction, pleasure or displeasure resulting from a learning experience decides the degree of its effectiveness.

This law emphasizes the role of rewards and punishment in the process of learning. Getting a reward as a result of some learning motivates and encourages the child to proceed with increased intensity and enthusiasm while punishment of any kind of discourages him and creates distaste for the learning.

Revised law of effect. Later researches of Thorndike made him to realise that his law of effect was not really correct (1930). He found that while a pleasant or satisfying situation resulted in the strengthening of the connection between stimulus and responses, an unpleasant or annoying situation did not necessarily decrease the strength of the connection. From this he concluded that while reinforcements in the form of reward or incentives increase the strength of the connection, unpleasant experiences in the form of pain or punishment do not necessarily weaken it. Thorndike's views a regarding the effectiveness of negative measure like punishment in the breaking of undesirable habits and behaviour modification revolutionized the task of rearing and education of children.

The law of use

When a modifiable connection is made between a situation and response that connection's strength is, other things being equal, increased.

The law of disuse

When modifiable connection is not made between a situation and response, during a length of time, that connection's strength is decreased.

The law of use refers to the strengthening of a connection with practice and the law of disuse to the weakening of connection or forgetting when the practice is discontinued. It can be said in short, that the law of exercise as a whole emphasizes the need for repetition.

Revised law of exercise. After 1930 Thorndike also revised the law of exercise. Further work and experiments on the law of exercise demonstrated that both the laws of use and disuse do not work as effectively as propounded by him earlier. He later held that use in the shape of mere repetition does not result in effective strengthening of the connection, not does the disuse or lack of practice result in the total weakening of the connection. Mechanical use or disuse, therefore, does not necessarily lead to effective learning or total forgetting. Thorndike may thus be said to have discarded the law of use and disuse after 1930.

Thorndike's idea of connectionism led to the enunciation f the following important laws.

Law of multiple response or varied reactions. This law implies that when an individual is confronted with new situation he responds in a variety of ways trying first one response and then another before arriving at the correct one.

Law of multiple responses or varied reactions. This law implies that when an individual is confronted with a new situation he responds in a variety of ways trying first one response and then another before arriving at the correct one.

Law of attitude. Learning is guided by a total attitude or 'set' of the organism. The learner performs the task properly if he has developed a healthy attitude towards the task.

Law of analogy. An individual responds to a new situation on the basis of the responses made by him in similar situation in the past. i.e., he makes responses by comparison or analogy.

The law of analogy propounded by Thorndike led to his famous "identical elements theory" of the transfer of learning or training which states that transfer from one situation or learning to another depends upon the extent and number of elements or components which are common to both situation.

4. Law of association shifting. This law states that "Any response may be elicited from the learner of which he is capable, in association with any situation to which he is sensitive. In other words, any response which is possible can be linked with any stimulus.

Theory of Classical Conditioning

A Russian psychologist named Ivan Pavlov (1849-1936) encountered an unforeseen problem the dogs in his experiment salivated not only upon actually eating but also when they saw the food, noticed the man who usually brought it, or even heard his footsteps. Pavlov began to study this phenomenon which he called 'conditioning'. Since the type of conditioning emphasized was a classical one – quite different from the conditioning emphasized by other psychologists at the later state-it has been renamed classical conditioning.

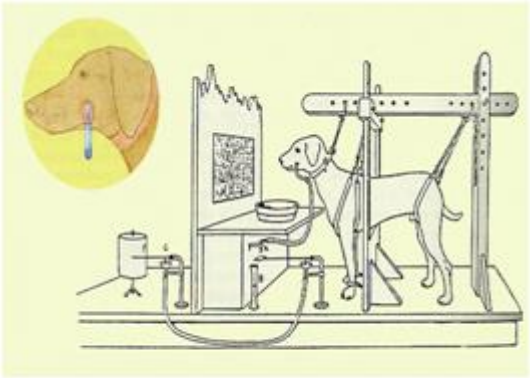


Figure 10: Classical conditioning experiment of Pavlov

In one of his experiments, Pavlov kept a dog hungry for a few days and then tied him to the experimental table which was fitted with certain mechanically controlled devices (See *Figure: 10*). Arrangement was made to give food to the dog through an automatic mechanism. He also arranged for a bell to ring every time food was presented to the dog. When the food was put before the dog and the bell was rung, there was automatic secretion of saliva from the mouth of the dog. The activity of presenting the food accompanied with the ringing of the bell was repeated several times and the amount of saliva secreted was measured.

After several trials the dog was given no food but the bell was rung. In this case also, the amount of saliva secreted was recorded and measured. It was found that even the absence of food (the natural stimulus), the ringing of the bell an artificial stimulus) caused the dog to secrete the saliva (natural response).

The above experiment thus brings to light four essential elements of the conditioning process. The first element is a natural stimulus, technically known as unconditioned stimulus (US) i.e, food. It results in a natural response called the unconditioned response (UR). This response constitutes the second element.

The third element is the artificial stimulus, i.e. the ringing of the bell which is technically known as a conditioned stimulus (CS). It is substituted for the natural stimulus (food). To begin with, the conditioned stimulus does not evoke the desired response. i.e., the conditioned response (CR). The fourth element is the chain of the conditioning process. However, as a result of conditioning, one learns to produce behaviour in the form of a conditioned response to conditioned stipules.

The theory of conditioning as advocated by Pavlov, thus considers learning as habit formation and is based on the principle of association and substitution. It is simply a S-R type of learning where in place of a natural stimulus like food, water, sexual contact etc., an artificial stimulus like the sound of the bell, sight of light of a definite colour etc., can evoke a natural response. When both artificial or natural stimulus (ringing of the bell) and the natural stimulus (food) are brought together several times, the dog becomes schooled or conditioned to respond to this situation. A perfect association occurs between the types of stimuli presented together. As a result,

after some time, the natural stimulus can be substituted or replaced by an artificial stimulus and this artificial stimulus is able to evoke the natural response.

Principles of Classical Conditioning

The theory of classical conditioning emphasized by Pavlov and Watson gave birth to a number of important concepts and principles in the field of learning such as:

1. Extinction. It was noted by Pavlov that if the conditioned stimulus (ringing of the bell) is presented alone a number of times without the food, the magnitude of the conditioned responses of salivation begins to decrease and so does the probability of it appearing at all. This process of gradual disappearance of the conditioned response or disconnection of the S.R. Association called extinction.

2. Spontaneous recovery. It was also discovered by Pavlov that after extinction. When conditioned responses are no longer evident, the behaviour often reappears spontaneously but at a reduced intensity. This phenomenon the reappearance of an apparently extinguished conditioned response (CR) after an interval in which the pairing of conditioned stimulus (CS) and unconditioned stimulus (US) has not been repeated is called spontaneous recovery.

3. Stimulus generalisation. Pavlov's dog provided conditioned response (Salivation) not at the sight of the food but to every stimulus like ringing of the bell, appearance of light, sound of the footsteps of the feeder etc., associated with its being fed. Responding to the stimuli in such genralized way was termed as stimulus generalization with reference to a particular stage of learning behaviour in which an individual once conditioned to respond to specific stimulus is made to respond in the same way in response to other stimuli of similar nature.

4. Stimulus discrimination. Stimulus discrimination is the opposite of stimulus generalization. Here, in sharp contrast to responding in a usual fashion, the subject learns to react differently in different situations. Conditioning through the mechanism of stimulus discrimination one learns to react only to a single specific stimulus discrimination one learns to react only to a single specific stimulus out of the multiplicity of stimuli and to distinguish and discriminate one from the others among a variety of stimuli present in our movement.

Operant Conditioning

Many behavioural scientists have advanced on understanding operant conditioning. Operant conditioning is a process of learning through which organisms learn to repeat behaviours that yield positive outcomes or permit them to avoid or escape from negative outcomes. The theory of operant conditioning was developed in 1930 by B. F. Skinner, an American psychologist. Skinner is known for his behaviouristic point of view.

For studying operant conditioning, he trained food deprived rat and pigeon to peck a key or press a bar. Each time the hungry animal/bird performed the appropriate action, a food pellet was released for the animal/bird. By manipulating conditions under which food was dispensed, Skinner observed how behaviour changed. Thus, the theory is based on certain actions called *operants* which an organism has to carry out. During operant conditioning the frequency of an action (operant) is modified. If a

given operant is repeatedly followed by a pleasant outcome, the act is likely to be performed more often under similar conditions. If a given operant is followed by an unpleasant consequence, the behaviour is likely to be repeated less frequently under similar conditions. Operant conditioning research has led to a sophisticated teaching technology which is often termed as *behaviour modification*.

In the theory Skinner makes a distinction between respondent behaviour and operant behaviour. According to Skinner, there are two types of responses called *elicited response* (respondent behaviour) and *emitted response* (operant behaviour). Respondents are responses elicited by specific stimuli. It constitutes specific stimulus-response connections (S-R connections) called 'reflexes'. Operants are responses that are emitted by the organism. Skinner considers an operant as a response that operates on the environment and changes it. Operant conditioning is the process whereby an operant behaviour is made more frequent by reinforcement.

Skinner's Experiment of Operant Conditioning

Skinner devised a special apparatus called Skinner-box to conduct experiments (See *Figure: 11*). It may contain a rat, a lever and a device for delivering a pellet of food. Every time the rat presses the lever, it gets a pellet of food. Gradually, the rat learns to press the lever to get the food, and the response by lever pressing is strengthened because it brings food.

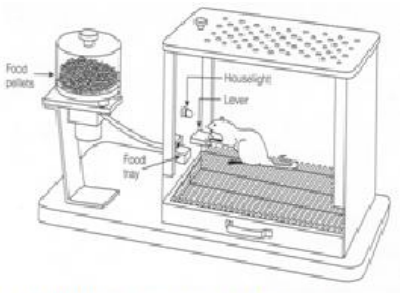


Figure 11: Experiment of operant conditioning- a rat in a Skinner box

In Skinner's experiment with pigeons, an apparatus called a pigeon box was used, in which the pigeon in the box had to peck on a lighted plastic key mounted on the wall. Each time the pigeon pecked on this lighted key, it was rewarded with grain (See *Figure: 12*).

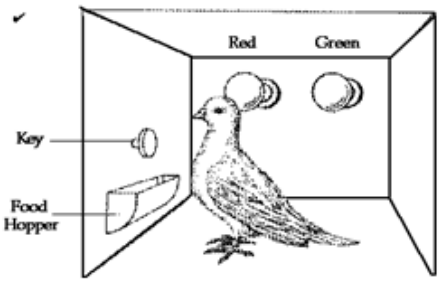


Figure 12: Pigeon in an operant conditioning chamber

Skinner gives great importance to operant behaviour, which is more concerned with responses (R), than with stimuli (S). He calls it R-type conditioning. He changed the usual S-R formula in to R-S. According to the R-S formula, when a desired response is emitted, a reinforcing stimulus is presented. Thus a desirable response is conditioned by constantly reinforcing it. The reinforcement must come after the response has been made, and not before it. If the response is not reinforced, it results in the extinction of the operant. The response emitted by the organism is instrumental in bringing about its reinforcement. Hence it is also called as instrumental conditioning.

Reinforcement

Any stimulus whose presentation or removal increases the chance of occurrence of a response is called a reinforcer. The application or removal of a stimulus to increase the strength of behaviour is called reinforcement. Reinforcement occurs during operant conditioning as during respondent conditioning. In both cases, reinforcement strengthens the likelihood of certain behaviour. There are differences

between the reinforcement of respondent and operant behaviour. While reinforcement precedes the strengthened act in respondent conditioning, reinforcement follows the strengthened act in operant conditioning. The nature of reinforcement procedure also differs. Respondents are reinforced by pairing initially neutral and unconditioned stimuli, whereas operants are reinforced by the consequences that follow the behaviour.

According to Skinner there are two types of reinforcement namely, positive and negative reinforcement.

a. ***Positive Reinforcement*** is a stimulus which when added to the situation, increases the likelihood of the preceding response (behaviour). In this type of reinforcement, a pleasant experience is given after the response occurs which increases the probability that the response (operant behaviour) will occur again.
b. ***Negative Reinforcement*** is a stimulus which when removed from the situation, increases the likelihood of the desirable behaviour. In negative reinforcement, an unpleasant experience is withdrawn from the situation and this increases the probability of the occurrence of the response (operant behaviour).

Negative Reinforcement	**Punishment**
An unpleasant stimulus is removed from the situation, which increases the occurrence of behaviour preceding it.	An unpleasant stimulus is added or a pleasant stimulus is removed from the situation, which decreases the occurrence of behaviour preceding it.
it is defined in terms of strengthening a response.	It is defined in terms of weakening a response.
The aversive stimulus precedes the avoidance response.	The aversive stimulus follows the undesirable response.
Negative reinforcement motivates behaviour.	Punishment decreases or suppresses behaviour.
Negative reinforcement can be used to establish a new desired behaviour.	Punishment cannot be used to establish a new desired behaviour.

The Schedules of Reinforcement

The term schedule of reinforcement refers to the timed plan according to which reinforcers follow the response. B. F. Skinner and C. B. Ferster's studied a quarter of a billion responses over 70,000 hours. They found that the way of scheduling reinforcement had an important influence on (1) how fast animals learned a response initially, (2) how frequently they performed the behaviour that had been learned, (3) how often they paused after reinforcements, and (4) how long they continued to make the response once reinforcement became unpredictable or was stopped. They also noticed that the animals showed a stable characteristic rate and pattern of behaviour on a given schedule. The important schedules of reinforcement are discussed below.

1. ***Continuous Reinforcement Schedule***: the reinforcement scheduled continuously follows every correct response. ie., to reinforce or reward every correct response of the organism immediately during learning.
2. ***Partial Schedules***: four basic partial schedules were studied extensively. Two (fixed ratio and variable ratio) schedules specify that the reinforcer should follow a particular *number of correct responses* and are known as *ratio schedules*. The other two (fixed interval and variable interval) schedules depend on the *passage of time.*

a. ***Fixed Ratio Reinforcement Schedule*:** in this, reinforcement occurs after a *definite and unvarying number* of correct responses. ie., the reinforcement is given after a fixed number of correct responses.
b. ***Variable Ratio Reinforcement Schedule***: in this, the reinforcer is presented following a *varying number* of correct responses.
c. ***Fixed Interval Reinforcement Schedule***: in this, the time period between reinforcers is *constant*. ie., the organism is rewarded after a fixed interval of time.
d. ***Variable Reinforcement Schedule***: in this, the duration of time between reinforcers varies randomly about a mean value. ie., reinforcement is given at varying intervals of time or after a varying number of responses.

Shaping

Through the appropriate use of a positive reinforcement strategy called shaping or the method of successive approximations, people and other animals can learn new operant responses. Initially, positive reinforcement is given for an act in the organism's current repertoire that only faintly resembles the desired behaviour(s). As this behaviour is strengthened, the trainer becomes more selective and reinforces only those behaviour that resemble the goal more closely. When this conduct is well established, the trainer becomes even more demanding, and the process continues until the goal is reached.

Cognitive Learning

Some psychologists suggest that the importance of mental activities such as attention, expectations, thinking and remembering as crucial to the process of learning. We learn how to find our way around a building or neighbourhood, we learn what to expect from a given situation, we learn abstract concepts, and we can even learn about situations that we have never experienced firsthand. These kinds of ***cognitive learning*** are impossible to observe and measure directly, but they can be *inferred* from behaviour. Much of the recent research in the area of learning concerns cognitive learning. The different forms of cognitive learning include: (1) latent learning; (2) Insight learning; and (3) observational learning.

1. Latent Learning and Cognitive Maps

Early experiments by Tolman and other psychologists demonstrated that learning takes place even before the subject reaches the goal and occurs whether or not the learner is reinforced. Tolman proposed the concept of ***latent learning***, which maintains that subjects store up knowledge even if this knowledge is not reflected in their current behaviour because it is not elicited by reinforcers. Later research

suggested that latent learning is stored as a mental image or ***cognitive map***. When the proper time comes, the learner calls up this map and puts it to use.

2. Insight and Learning Sets

One phenomenon that highlights the importance of cognitive processing in learning is ***insight***, in which learning seems to occur in a 'flash'. Through insight learning, human and some non human animals suddenly discover whole patterns of behaviour or solutions to problems. ***Learning sets*** refer to the increasing effectiveness at problem solving that comes about as more problems are solved.

3. Learning by Observing

Social Learning theory argues that we learn not just from firsthand experience, but also from watching others, or by hearing about something. Albert Bandura contends that ***observational*** (or ***vicarious***) ***learning*** accounts for many aspects of human learning. His highly influential theory of learning holds that although reinforcement is unrelated to learning itself, reinforcement may influence whether learned behaviour is actually displayed. Such observational learning stresses the importance of models in our lives. To imitate a model's behaviour, we must (1) pay attention to what the model does; (2) remember what the model did; and (3) convert what we learned from the model in to action. The extent to which we display behaviours that have been learned through observations can be affected by ***vicarious reinforcement*** and ***vicarious punishment***. Social cognitive theory emphasises that learning behaviour from observing others does not necessarily lead to performing that behaviour. We are more likely to imitate behaviours we have seen rewarded.

Cognitive Learning Theories

According to cognitive theories, learning is a process of developing understanding or insight in the learner. The important cognitive theories are discussed below:

1. Insight learning Theory

Insight is the sudden grasping of solution for a problematic situation, a flash of understanding which comes to tell us all of a sudden. It is the sudden awareness of relationships in a total situation.

The theory of learning by insight is the contribution of Gestalt psychologists. They consider learning as the development of insight which is concerned with perception.

Basic concepts of insight learning

1. Learning is purposive, exploratory and creative in which total situation is considered.
2. Learning situation is a problem situation and the learner can find solution as a whole.
3. Learner perceives the situation as a whole and takes proper decision in an intelligent way
4. The learner responds to the proper relationship rather than specific stimuli.
5. Learning occurs spontaneously and suddenly by the development of insight.

Kohler's Experiment

Experiment 1. It was an experiment conducted on a chimpanzee which was put in a cage and a banana was a hung from the roof of the cage (See *Figure: 13*). A box was placed inside the cage and the chimpanzee tried to reach the banana by jumping but could not succeed. Suddenly, he got an idea and used the box as jumping platform. In a second experiment, Kohler made this problem more difficult and two or more boxes were required to reach the banana. The animal solved the problem by putting two boxes one upon the other.



Figure 13: Chimpanzee in the Kohler's experiment

Experiment 2. The banana was placed outside the cage and two smaller sticks were placed inside the cage. One stick was hollow at one end so that the other may be fitted in to form a longer stick. The chimpanzee tried to reach the fruit with the sticks one after another but failed. It started examining the whole situation and suddenly an insight came when he joined the two sticks together and reached the banana (See *Figure: 14*).



Figure 14: Chimpanzee in Kohler's experiment

From the experiment Kohler concluded that the solutions to problems were found out not by trial and error mechanism but intelligently by using insight learning.

Steps in Insight Learning

(1) Identifying the problem (2) Understanding the problem (3) Incubation of Ideas (4) Trial of mode of response (5) Sustained attention, (6) Insight development (7) Steady repetition adaptive behaviour (8) Comprehension of ability.

Gestalt Laws of Learning

1. *Law of similarity:* In this the elements of a stimulus configuration will be group together perceptually if they are similar to each other. Stimuli of similar shape, size or colour tend to be grouped together.

2. *Law of proximity:* In this elements nearer to each other are perceived as part of the same configuration. It refers to tendency to perceive stimuli nearer to one other as belonging together.

3. *Law of closure:* In this we tend to close the open edges of a figure to make the stimulus configuration complete. Groupings are usually made in terms of enclosed or completed figures rather than open ones.

4. *Law of Continuity:* In this we link individual elements of a configuration so that they found continuous pattern that make sense to us.

2. Kurt Lewin's Field Theory

According to the theory proposed by Kurt Lewin, learning is a process of perceptual organisation or reorganisation of one's life space involving insight and emphasizes on behaviour and motivation in learning.

Field or life-space is a psychological representation of an individual's environment. It consists of everything that affects the behaviour of the individual at a particular time. It includes drives, motives, believes, objects and events. Life-space is surrounded by a non-psychological boundary called the foreign hull.

The person is represented as moving in his life-space (See *Figure: 15*). Psychologically a person is composed of two components - motor perceptual stratum and inner personal stratum. The life space also contains goals, the barriers that restrict person's movement towards the goal, and the path he must follow to reach the goal. A person in life-space is always under the influence of psychological factors called vectors. It controls the movement of a person towards a goal.

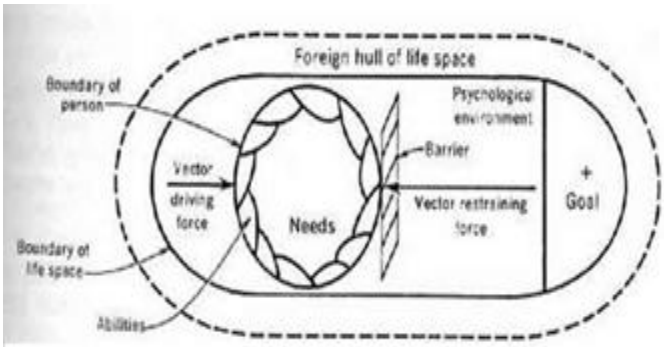


Figure 15: Life Space of an individual according to Lewin

According to Lewin, learning is a change in cognitive structure (change in the structure of life-space of the individual). The movement of the person is decided by the valance (attracting or repelling force) of the goal. When the person is attracted it is positive valence and when the person is repelled it is negative valance.

The valances create conflicts. There are three types of conflicts.

1. *Approach-Approach conflict:* It arises when person is caught in between two goals both having positive valances.

2. *Approach-Avoidance conflict:* It arises when the person is caught in between a positive and a negative goal.

3. *Avoidance-Avoidance conflict:* It arises when the person is caught in between two goals both having negative valances.

3. Bruner's theory of Learning by Discovery

According to Bruner, learning is an active social process in which learners construct new ideas or concepts based on their current knowledge. The learner selects the information, forms hypotheses and then integrates this new material in to their own existing knowledge and cognitive structure. The cognitive structure provides meaning and organisation to experiences and allows the individual to go beyond the information given. This process continues.

According to Bruner learning takes place in three stages namely, enactive, iconic and symbolic.

Enactive: in the enactive stage, children need to have concrete experiences like manipulating objects by themselves inorder to develop a better understanding.

Iconic: in this stage learners are able to identify materials represented in the form of pictures and icons (graphic representation).

Symbolic: in this stage learners are able to use their logic and higher thinking skills and symbolic systems like formulas and equations.

Discovery Learning: in the discovery learning propounded by Bruner, learners are inquirers of knowledge in which they have to acquire it in which it is generated. Under this method, the learner is presented with a problematic situation to which the learners seek alternative methods to solving the problem under consideration. This follow three steps like *activation, maintenance* and *direction*. Activation implies initiation of actions, maintenance implies sustaining the action initiated and direction implies movements or action directed towards the achievement of goals.

Piaget's Learning Theory

Piaget's approach to learning is the readiness approach, which in developmental psychology emphasises that every individual's learning capacity progresses with maturation. The individual's ability to learn is related to the stage of intellectual development attained. According to Piaget, there are four stages of development, and the thinking or cognition of an individual varies from stage to stage. Hence the capacity to learn also varies from stage to stage.

The four stages of development identified by Jean Piaget are given below.

1. *Sensori- motor stage:* (birth-2years). During this stage the child is able to differentiate from objects and recognises self as agent of action; hence begins to act intentionally. The child also achieves object permanence by which the child realises that things continue to exist even when they are no longer visible to the senses.
2. *Pre-operational stage: (2-7years).* During this stage the child learns to use language and begins to represent objects by images and words. The child still follows egocentric thinking and finds it difficult to identify with the view points of others. The child develops the capacity to classify objects according to one single characteristic.
3. *Concrete Operational stage: (7-11 years).* The child develops the capacity to think logically about the events and objects that appear around them. Another distinct feature is that the child develops the quality of conservation of numbers, weights, etc, and learns to classify objects according to several characteristics. The child also develops the capacity to arrange things in order according to a single dimension (example, height of objects).
4. *Formal operational stage: (12-15 years).* At this stage the child develops the capacity of logical and abstract thinking. The individual is able to test hypotheses and deal with problems that are not present in the environment (ideological problems). This stage reflects the advanced stage in the functioning of the cognitive system. The individual solves problems through mental manipulations of symbols by adopting a logical and systematic way.

According to Piaget, cognitive development takes place in three processes. They are assimilation, accommodation and equilibration. *Assimilation* is the process whereby the learner incorporates new information in such a way that it fits in to the existing cognitive structure. It is through assimilation the newly learned information are incorporated in to the existing cognitive structure. In *accommodation*, the

individual modifies the existing cognitive structure so as to accommodate the newly learned information in to it. *Equilibration* involves the individual's maintaining a balance between himself and the environment. That is, while encountering a new situation, the individual experiences a disequilibrium, which is overcome or equilibrated by proper assimilation of the new information and accommodation of the same to the existing cognitive structure.

Social Learning Theories

Social Constructivism Theory of Lev Vygotsky

Social learning theory was proposed by a Russian psychologist Lev Semyonovich Vygotsky (1896-1934). Vygotsky's theories greatly influenced modern constructivist thinking. He contended that humans, unlike animals who react only to the environment, have the capacity to alter the environment for their own purposes. According to this theory learning is a social process that takes place in a social settings in which the learner learns by interaction or communication through which knowledge is constructed. The social learning theory gives emphasis to the social and cultural context. Vygotsky's "sociocultural theory" suggests that social interaction leads to continuous changes in children's thought and behaviour.

Vygotsky also differentiated between a person's higher and lower mental functions. Lower or elementary functions are genetically inherited; they are our natural mental abilities. In contrast, our higher mental functions develop through social interaction, being socially or culturally mediated. Higher mental functions allow us to move from impulsive behaviour to instrumental action. Mediation occurs through the use of tools or signs of a culture. Language and symbolism are used initially to mediate contact with the social environment, then within ourselves. This cognitive development is a process in which language is a crucial tool for determining how a child will learn how to think because advanced modes of thought are transmitted to the child by means of words.

There are several core principles of development at the heart of Vygotsky's sociocultural theory. They are as follows:

(a) Children construct their knowledge, (b) Development cannot be separated from its social context, (c) Learning can lead development, and (d) Language plays a central role in mental development.

In addition, the sociocultural theory contains another widely recognized element called the Zone of Proximal Development (ZPD) (See *Figure: 16*). Vygotsky believed that any pedagogy creates learning processes that lead to development and thus this sequence results in "zones of proximal development." It's the concept that a child will accomplish a task that he or she cannot do alone, with help from a more skilled person. Vygotsky also described the ZPD as the difference

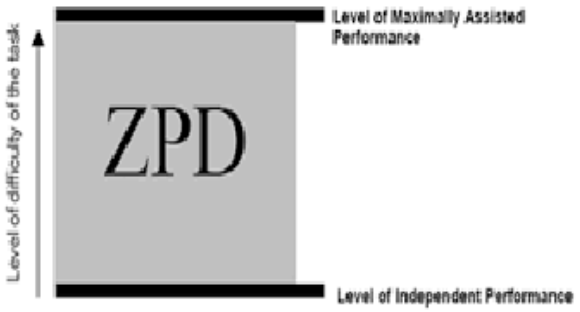


Figure 16: Zone of Proximal Development (ZPD)

between the actual development level as determined by individual problem solving and the level of potential development as determined through problem solving under adult guidance or collaboration with more knowledgeable peers.

In order for the ZPD to be such a success, it must contain two features. The first is called *subjectivity*. This term describes the process in which two individuals begin a task with different understanding but then eventually arrive at a shared understanding despite original differences in thought or thought process. The second feature is *scaffolding*, which refers to a change in the social support over the course of a teaching session. If scaffolding is successful, a child's mastery or level of performance can change, which means that it can increase a child's performance on a particular task.

Social Learning Theory of Albert Bandura

Social learning theory or social cognition theory was proposed by a Canadian psychologist called Albert Bandura. The theory explains the influences of social modeling, human cognition, and motivation on behaviour. The development of the theory was influenced by his early psychological research studies and by his early life experiences. In his theory, Bandura presents humans as adaptable and agentic (i.e., capable of effecting desired change) individuals who use direct and indirect learning sources to guide their present and future actions.

In social cognition theory, Bandura presents human behaviour as being largely a product of direct and indirect learning. Direct learning (also referred to as trial and error learning) is reinforced through the learner's receipt of rewards or punishments. Indirect learning (also called vicarious learning and observational learning) occurs when the learner alters his or her behaviour without receiving rewards or punishment. For Bandura, observational learning had important advantages over trial and error learning. Whereas trial and error learning is risky and time-consuming, observational learning saves the learner both time and risk by allowing him or her to learn from the successes and mistakes of others.

Central to Bandura's theory of social cognition is the term *triadic reciprocal causation*, which describes the simultaneous influences of thoughts, feelings, and the environment on human behaviour. According to Bandura, human behaviour result from interactions between individual *biological factors* (e.g., cognitive capabilities), *psychological factors* (e.g., emotional states) and the *environment*. These factors influence and are, in turn, influenced by one another; the interactions among these biological, psychological, and environmental factors produce variations in human behaviour. The results of reciprocal causation are that humans are at the same time producers of and products of their environment.

According to Bandura, human beings have a great capacity for symbolism (retain socially modelled information in the form of mental images or verbal descriptions that serve as symbols for future behaviour). Through social modeling, individuals can extend their learning by using symbols from the original modelled behaviour to guide future rules for action.

The modeling process includes four steps like (1) attention (2) retention (3) reproduction and (4) reinforcement.

1. ***Attention***: the learner pays attention to the distinct features of the modeled behaviour. The matters being attended by the observer is influenced by the characteristics of modeled behaviour and the learner's characteristics.
2. ***Retention***: the behaviour observed by the learner is stored in the memory in the form of mental images or verbal descriptions.
3. ***Reproduction***: this step involves the conversion of symbolic representations in to actions or behaviour by the learner. Here, while reproducing actions, the learner organises own behaviour according to the modeled behaviour.ie., the learner imitates the modeled behaviour.
4. ***Reinforcement***: positive reinforcement encourages imitation of modeled behaviour and negative reinforcement discourages the imitation there by discontinuation of modeled behaviour.

Module 4
Retention and Retrieval

Remembering

It is the ability of human mind to store what have been previously learned and to reproduce it after some time whenever required. According to Ryburn, memory is the power of a person to store experiences and to bring them in to the field of consciousness sometime after the experiences have occurred.

Factors related to Remembering

Remembering involves four factors like ***Learning, Retention, Recall*** and ***Recognition***. A person is said to have good memory when he/she has an ability to learn something easily, to retain it for long time, to recognise and recall it accurately with rapidity and lastly, to make proper use of his/her previous learning or experience.

Types of Memory

1. *Immediate memory*: in this memory, one can learn and remember things for a short time and then forget it.
2. *Permanent memory:* here retention of learning and experiences are of permanent nature.
3. *Rote memory:* here, things are learned without understanding their meaning.
4. *Logical memory:* materials are learned with insight, understanding and logical thinking in this memory.
5. *Associative memory:* here the individual associate newly learned things with so many related things existing in the memory and then establish multiple connections.

Information Processing

Information processing is a cognitive activity in which human nervous system receives an input of information through sense organs, transforms it, stores it and retrieves it when needed. According to information processing theory, human memorisation process involves three tasks like (1) encoding; (2) storage; and (3) retrieval.

1. ***Encoding:*** encoding is the process through which information is converted in to a form that can be entered in to memory.
2. ***Storage:*** storage is the process through which information is retained in memory over varying periods of time.
3. ***Retrieval:*** retrieval is the process through which the information stored in memory is located and accessed when it is needed.

Atkinson-Shiffrin Model of Information Processing

In 1968 Atkinson and Shiffrin proposed a model of human memory which speculates three distinct memory stores like sensory memory, short term memory and long term memory.

1. Sensory Memory

Sensory memory stores information that has just been perceived. This particularly refers to information that has not yet been attended to or has not yet reached the consciousness of the person and has not yet been stored in the short term memory. These images last only for a few milliseconds. There are two types of sensory memory. They are iconic and echoic.

a. ***Iconic memory*** is visual memory which holds an image that has been visually perceived.
b. ***Echoic memory*** is auditory memory that represents sounds that have just been perceived.

2. Short Term Memory (STM)

It is a memory system that holds limited amount of information for relatively short periods of time. STM is also called working memory (because of its interaction with long term memory) and relates to what we are thinking about at any given moment of time. In Fruedian terms, it is the conscious memory. It is created by our paying attention to an external stimulus, an internal thought or both. It will initially last somewhere around 15 to 20 seconds unless it is repeated (called as maintenance rehearsal) at which point it may be available for up to 20 minutes.

The STM contains new information and also information that has been received from long term memory. It lasts for a few seconds or a few minutes. Information in STM can be rehearsed or processed so that it enters Long Term Memory (LTM).

3. Long Term Memory (LTM)

The LTM retains large amounts of information over a long period of time. LTM is much more stable than STM. This may be due to the reason that a permanent structural change takes place in the brain, namely changes in synaptic strength. It is the final storing house for memorial information. The LTM generates rather than reproduces ie., it is affected by perception and interpretation of the individual who is remembering. The individual remembers the information stored in the LTM according to the schemata or scripts. It is influenced by understanding what has been perceived.

In Atkinson- Shiffrin model, memory starts with a sensory input from the environment. This input is held for a very brief time in a sensory register associated with the sensory channel. Information that is attended to and recognised in the sensory register may be passed on to STM, where it is held for around 20 to 30 seconds. Some of the information reaching the STM is processed by being rehearsed (a process of repeating the information that has entered STM) or linking it with other information already stored in memory. Information that is rehearsed may then be passed along to LTM; and the information not so processed is lost. In the LTM, the processed information are organised in to categories, where they may reside for days, months or for a lifetime.

Episodic and Semantic Memory

Episodic memory is the memory which depends on retrieving particular events or episodes experienced by a person through direct or indirect experiences. On experiencing events, it is stored in the memory in episodes organising it in terms of time, place and such characteristics of the events. While recalling such memories or

events, these traces of memories are reproduced in the way it has been sequenced and stored in the memory.

Semantic memory stores and retrieves relationships between events or association of ideas. It is based on general knowledge along with meaningful interpretation, generalised rules, formulae and principles. The semantic memory impressions are more or less permanent in nature.

Forgetting

Forgetting is the loss of the ability to recall or recognise something learned earlier. It is the inability of the individual to revive in consciousness the information earned without the help of the original stimulus.

Kinds of Forgetting

a. ***Passive or Natural Forgetting***: In this, there is no intention of forgetting on the part of the individual.
b. ***Active or Morbid Forgetting***: In this, the individual deliberately tries to forget something.

Causes of Forgetting

Some of the main causes of forgetting are discussed below:

1. *Inadequate impression:* lack of interest and poor motivation result in inadequate impression at the time of learning which in turn lead to forgetting.
2. *Laps of time:* the memory traces get weaker and weaker until it fades away totally.
3. *Interference of new learning:* forgetting may also cause due to interference of new learning which causes inhibiting effect of one learning experience on another. In proactive inhibition, previous learning interferes with the retention of new learning. In retroactive inhibition, new learning interferes with the retention of earlier learning.
4. *Repression:* the painful and unacceptable experiences are forced down to the unconscious layer of mind thus resulting in forgetting of such experiences. It is a kind of defence mechanism by which the individual safeguard themself from painful experiences.
5. *Emotional disturbances:* sudden rise of emotions like anxiety, fear, anger, etc in an excessive way will hinder or block the process of recall.
6. *Alteration of stimulus conditions:* alteration of stimulus conditions between the time of learning and time of recall may sometimes result in forgetting.
7. *Brain injury:* people suffering from brain injury may forget or are found to have very weak capacity to retain or recall the information stored in the memory.
8. *Low IQ*: people with low level of Intelligence Quotient often forget things easily and possess very poor capacity to retain things in memory and recall them when needed.

Ebbinghaus's Curve of Forgetting

One of the earliest systematic studies on forgetting was carried out by a German psychologist Herman Ebbinghaus in 1885. He conducted the study on himself

by considering himself as the subject. For studying the phenomenon of forgetting, Ebbinghaus memorised a list of non-sense syllables and tested himself at intervals varying from 20 minutes to a month find out how much he remembered. The findings of the study were given in terms of lapse of time and the percentage of materials forgotten which was as follows:

Time elapsed	***Materials forgotten (in %)***
20 minutes	47 %
One day	66%
Two days	72 %
Six days	75 %
31 days	79 %

These results were plotted on a graph to form a curve called the *curve of forgetting* (See *Figure: 17*).

From the findings of the study Ebbinghaus concluded the following:

a) The amount of learnt material forgotten depends upon the time elapsed after learning.
b) The rate of forgetting is very rapid at first and then gradually diminishes proportionately as the time interval lengthens.

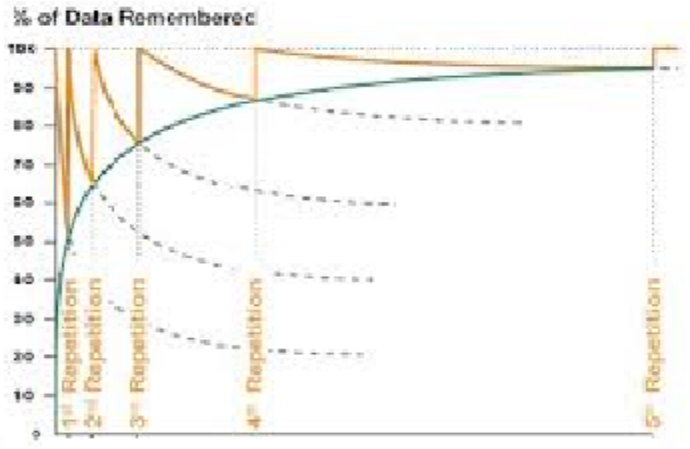


Figure 17: Ebbinghaus's Curve of Forgetting

Theories of Forgetting

The inability to recall, recognise or relearn at an improved rate is called forgetting. This condition can be due to a strong failure in which the trace was never satisfactorily created or consolidated initially, or it can also be due to a retrieval failure in which the trace is intact, but an appropriate cue for evoking it is lacking.

Several theories have been offered to explain how these failures occur. Some of the theories of forgetting like the decay theory, the interference theory, the repressive forgetting and the obliteration theory are discussed below.

1. The Decay Theory

According to the decay theory, the memory trace deteriorates unless it is used. This is due to the continuous metabolic action of the cells of the nervous system. Merely the lapse of time may be responsible for forgetting. This theory is one of the much popular theories of forgetting. Decay theorists stress the notion that there is a limited information processing system, and that decay of memory can be prevented through *rehearsals*. They point out that a person can process only so much information during a given period of time and that rehearsal prevents the decay process chiefly by keeping the material active in memory. When the individual stops

rehearsing, decay of memory begins quite independently of any interference. While this theory is still unproven, it is equally difficult to demonstrate that there is no deterioration of the memory trace with time.

Obliteration of the Trace

Another view of forgetting that postulates a storage failure focuses on sudden destruction of the new trace of memory, rather than slow deterioration through disuse. This is called the obliteration theory. The obliteration theory postulates that certain conditions occurring soon after the experience eradicate the memory trace before it becomes permanent.

2. The Interference Theory

Interference is a major factor that leads to forgetting. It is the phenomenon by which recall is hindered because of other information in memory which displaces orr blocks it. During this process, either the old experience hinders retention of the new or the new obliterates the old. Accordingly there are two types of interference called the *proactive inhibition* and *retroactive inhibition.*

i. Proactive Inhibition

Proactive inhibition occurs when the memory of the earlier learning interferes with recall of the material learned later. Here the old learning or experiences retained in our memory works forward to disrupt the memory of what we learn afterwards. For example, a child learns the spelling of the word QUEUE. He learns it and recalls it correctly. Later on he learns the spelling of another word QUEEN. Later afterwards, when he wants to write the word QUEEN, he writes it as QUEUEEN. Here the previously learned word QUEUE interfered with the retention of the word learned later QUEEN.

ii. Retroactive Inhibition

In retroactive inhibition, later learning interferes with the recall of earlier learning. Here, interference occurs with retention of information already present in memory by new information that is being entered in to the memory. In this type of inhibition, the current learning work backwards disrupting the retention of the previously learned material. For example, a child learns the spelling of the word RABBIT. He learns it and recalls it correctly. Then he learns another word HABIT. Later, when he wants to write the word RABBIT, he wrote it as RABIT. Here the learning of the word HABIT interfered with the retention of previously learned word RABBIT.

3. Repressive Forgetting

According to Sigmund Frued, this type of forgetting is caused by factors within the individual, such as hopes, anxieties and frustrations that makes a person want to forget. Frued called this exclusion of unwanted thoughts from awareness as *repression*, and such forgetting is now referred to as motivated or *repressive forgetting*. For Frued, repression is a key factor not only in memory but in the whole personality.

Strategies for Remembering or Memorising

There are several ways in which one can remember or memorise information. Some of them are discussed below.

1. ***Rote rehearsal***: if one wants to hold on to information for just a minute or two, the most effective way is to do it through rote rehearsal (also called as maintenance rehearsal). This is a method whereby the learner keeps on repeating information, silently or out loud, inorder to memorise it. Experiments have confirmed that repeating an item more often does not necessarily improve later recall. Hence rote learning is unlikely to be very effective over the long term.
2. ***Elaborative Rehearsal***: elaborative rehearsal is a method of relating new information to something that we already know. Elaborative rehearsal demands a deeper and more meaningful processing of new information than does simple rote repetition. This strategy would help to memorise and remember information learned for a fairly longer period of time.
3. ***Chunking***: chunking method is helpful in remembering especially the numbers. In this method the individual, instead of trying to remember all of them altogether, splits it in to chunks of say three or two or convenient form of chunking for easy memorisation.
4. ***Keyword method***: it makes use of imagery for remembering difficult and unfamiliar information. The word to be remembered or memorised is associated with a word similar to it, thus creating a mental image. By remembering the mental image formed, the individual can actually recall the original word.
5. ***Loci method***: Loci is a Latin word which means location or place. Loci method is an encoding technique which creates visual associations between already memorised places and new items or words that are to be memorised.