Directorate of Distance Education

UNIVERSITY OF JAMMU

JAMMU

SELF LEARNING MATERIAL

B. A. SEMESTER - II

Subject : PSYCHOLOGY **Unit : I - V**

Course No. : PY-201 **Lesson No. : 1 - 14**

Dr. Neelam Choudhary
Course Co-ordinator

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INTRODUCTION TO PSYCHOLOGY

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PSYCHOLOGY

COURSE NO.: PY-201 **Title : Introduction to Psychologyy-II**

Duration of Exam : 3 hrs **Max. Marks : 100**

Theory Exam. : 80

Internal. Assess.: 20

Objective : This course is designed to provide exposure to how behavior is controlled by biological processes

UNIT-I

The Nervous System : Central Nervous System (Structure and Functions) and Peripheral Nervous System Structure and Functions)

Endocrine System : Hormones and Behaviour

UNIT-II

Sensation : Nature of Sensation : Visual Sensation : Auditory Sensation : Auditory senssation, Cutaneous, Gustatory, and Olfactorym Sensation.

UNIT-III

Perception : Meaning , Gestalt Laws of Perceptual Organization.Depth Perception (Monocular and binocular cues) Illusion, Perceptual Constancy

UNIT-IV

Thinking : Concept Formation : Deductive and Inductive Reasoning Problem Solving -Steps in problem solvings.Heuristics and Algorithms.

UNIT-V

Psychophysics : Meaning and laws of psychophysics Methods : Limit, Average Error, Constant Stimuli Signal Detection Theory

Books Recommended :

Baron, R.A. (2003) Psychology 5/e Delhi Pearson Education

Carlson, N.R. (2005) *Foundation of Physiological Psychology,* 6th ed. Pearson Education : New Delhi

Ciccarelli. S.K. Meyer, G.E. (2208), *Psychology,* South Asian Edition.Pearson Education : New Delhi

D' Amato, M.R. (1970) : *Experimental Psychology Methedollogy, Psychophysics and Learning*, Delhi : Tata McGraw Hill

Hergenhan, B.R. (2001) *Introduction to History of Psychology,* New Delhi : Thomson Wadsworth

Sternborg, R.J. (2007) *Cognitive Psycology* (4th Edition) New Delhi : Thomson Wadsworth.

NOTE FOR QUESTION PAPER SETTING :

There would be **two long answer type questions,** set from each unit. Out of which one question will have to be attempted by the students, unitwise.

Similarly there would be **two short answer question type questions,** set from each unit. The student wi;; have to attempt **one short answer type question f**rom each unit. In all , students will have have to attempt f**ive long answer type questions** and f**ive short answer type questions** , out of five units

Long answer type questions would carry **Sixty marks (12 marks, each question 12x5 =60;** and short answer type questions would carry **twenty marks for five questions (4 marks, each question 4x5 = 20)** These questions would be set unitwise in question paper separately.

Internal Assesment (Total Marks : 20)

20 marks for theory paper in a subject reserved for internal assesment.

Contents

THE NERVOUS SYSTEM

B.A. SEM – II **Unit - I**
Course No. : PY-201 **Lesson : 1**

Structure

1.1.0 OBJECTIVES :

After going through this lesson the student should be able to :

— know the functions of nervous system in human body.

— know the divisions of nervous system.

— know the structure of neurons.

— enumerate classes of neurons.

— know different types of nerves in human body.

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1.1.1 INTRODUCTION :

The way we feel, think and act depends upon, the large extent on the nature of our nervous system D.G. Myers (1995) writes "every thing psychological is simultaneously biological." Therefore, in order to have a meaningful understanding of behaviour it is very essential to have an understanding of the nervous system or the biological basis of behaviour. The nervous system enables human beings to make a greater variety of responses and to some extent modify his environment.

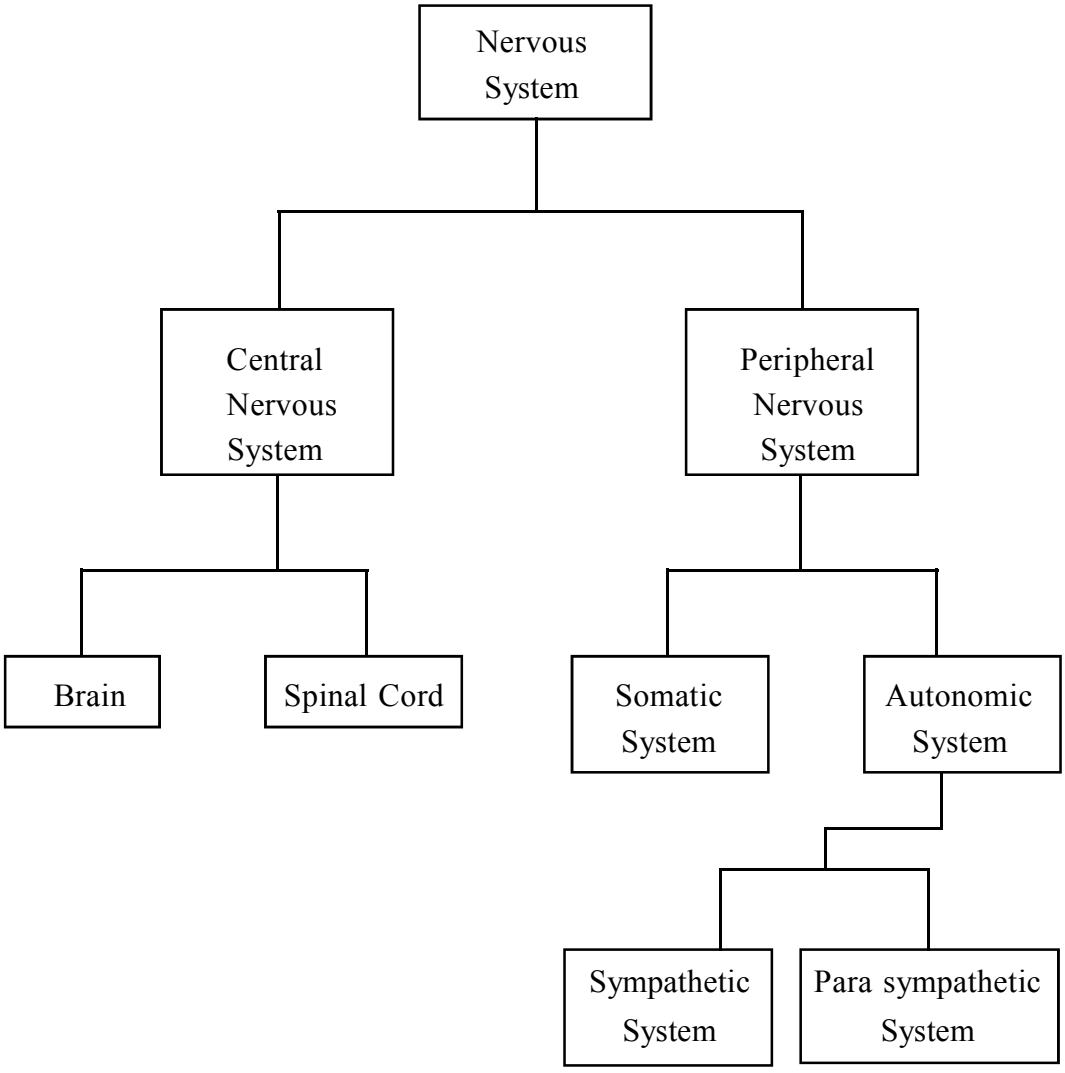
The nervous system is a complex system in human body. It conducts and controls human behaviour. Our whole body depends on this system. Nervous system regulates the various movements of our body. It controls the secretion of different glands. It also receives all types of sensations from the different organs. Nervous system receives stimulations of external world through the sensory organs and to transmit them to muscles and glands for making necessary movements or adjustments needed for the maintenance of the fullest possible amount of life within the individual. We think, learn, understand, remember, love, hate, fear, rejoice and will. Our organs are guided, directed and governed by the Nervous system.

The vertebrate nervous system is composed of two divisions based on the type of function :

(i) the central nervous system and

(ii) the peripheral nervous system.

The organization of nervous system is schematically presented below :



The central nervous system is divided into two parts, the brain and the spinal cord. The brain and the spinal cord together control all the bodily activity through the peripheral nervous system (Fig. 1)

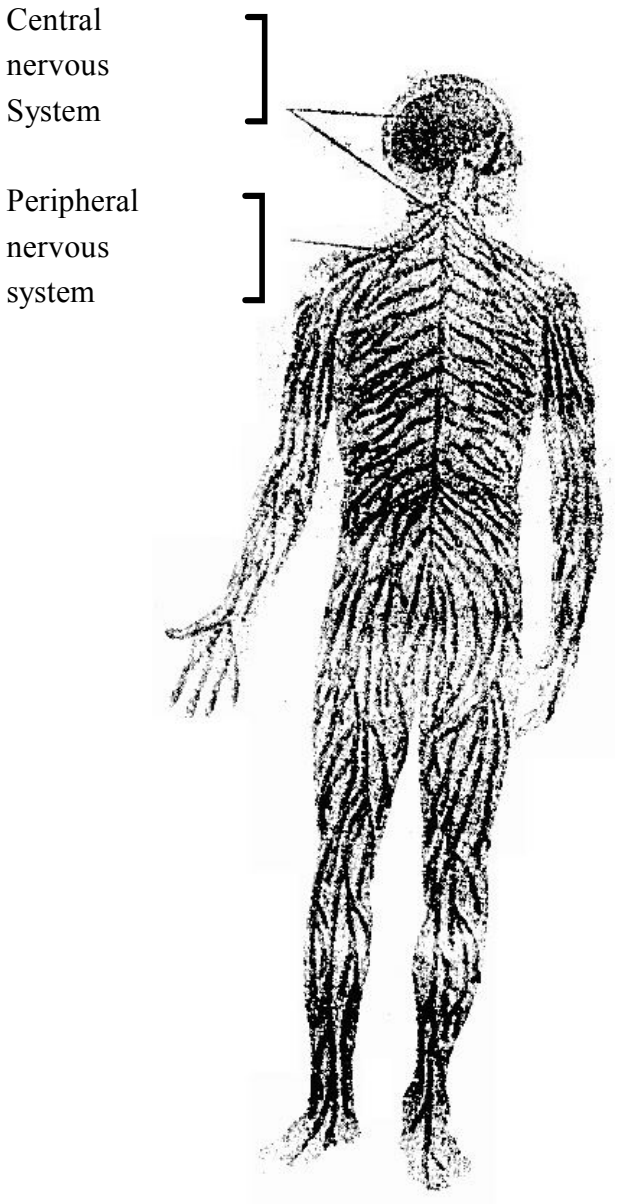


Figure 1

The central nervous system, consisting of the brain and spinal cord, and the peripheral nervous system

The peripheral nervous system is divided into four functional parts :

(i) the somatic sensory nerve fibres which carry the informations from the external receptors, the eyes, ear, nose, skin and tongue etc. to the central nervous system ;

(ii) the somatic motor fibres carry commands from the central nervous system to the skeletal muscles, those attached to bones instructing them to move the body ;

(iii) the visceral sensory fibres carry information regarding the internal state of body and viscera to the central system ;

(iv) the visceral motor fibres carry commands from the central system to the smooth muscles of blood vessels and internal organs to heart muscles and to glands. The visceral motor fibres are otherwise called autonomic nervous system. The autonomic nervous system plays a central role in a person's response to a situation.

CHECK YOUR PROGRESS EXERCISE NO. 1

Note : Use the space given below for your answer. Use separate sheet if required.

1. What are the functions of nervous system in human body ?

   _____

   _____

   _____

2. Draw a schematic presentation of nervous system.

   _____

   _____

   _____

1.1.2 NEURONS

Neurons or nerve cells are cells that are specialized for the reception, conduction and transmission of electro chemical signals. The neurons are the most active but smallest units of the whole nervous system. Neurons communicate by means

of chemicals called *neurotransmitters*. Each neuron transmits and co-ordinates messages in the form of neural impulses.

Every neuron is a single nerve cell with a cell body, dendrites and an axon (Figure 2). The cell body contains the core or nucleus of the cell. There are from a few to several hundred short fibres, or *dendrites,* which extend from cell body like roots. Each neuron has one *axon* that extends like a trunk from the cell body. Axons end in small bulb-shaped structures called *terminals*. Neurons carry messages in one direction only : from dendrites or cell body through axon to the axon terminal. The messages are then transmitted from the terminals to the dendrites or cell bodies of other neurons.

Classes of Neurons : Based on the number of processes emanating from their cell bodies, the neurons are classified as under :

Multipolar Neuron is a neuron with more than two processes extending from its cell body. Most neurons are multipolar.

Unipolar Neuron is a neuron with one process extending from its cell body.

Bipolar Neuron is a neuron with two processes extending from its cell body.

Inter Neurons are neurons with short axons or no axons at all and their function is to integrate the neural activity within a single brain structure, not to conduct signals from one structure to another.

SUPPORTIVE CELLS :

In the central nervous system, the neurons are provided with physical and functional support by *Glial Cells* and in the peripheral nervous system, they are provided with physical and functional support by *Satellite cells.*

SYNAPSE :

The junction of two neurons is called the synapse. The neurons interact only at synapses. The dendrites and axons of different neurons are separated by gaps. These minute gaps are called synapses. These help in controlling the rate of flow of electro chemical waves.

NERVES :

A nerve is a bundle of nerve fibres, enveloped in a covering of connective tissue. It is connected with a nerve cell and looks like a white silvery thread in the body. Nerves are of the following kinds :

(1) Sensory or Afferent nerves are those which carry sensations from the various parts of the body to the brain. They make us aware of the various sensations.

(2) Motor or Efferent nerves are those which carry orders of the brain to the muscles of the body. They cause contraction of muscles.

(3) Mixed nerves are those which contain both the sensory and motor nerve fibres. They carry impulses to and from the brain.

The parts of the body which have no nerves are the hair, nails, cartilage and epidermis of the skin.

CHECK YOUR PROGRESS EXERCISE NO. 2

Note : Use the space given below for your answer. Use separate sheet if required.

1. What are Neurons ?

   _____

   _____

   _____

2. What are the functions of Neurons ?

   _____

   _____

   _____

3. Draw a diagram depicting different parts of Neurons.

   _____

   _____

   _____

4. What is meant by

(a) Synapse_____

_____

_____

_____

(b) Afferent nerves_____

_____

_____

_____

1.1.3 LET US SUM UP

The nervous system is a complex system in human body. It conducts and controls human behaviour. The vertebrate nervous system is composed of central nervous system and the peripheral nervous system.

Neurons are the basic elements of the nervous system. They allow the transmission of messages that co-ordinate the complex activities of the human body. All neurons have a similar basic structure. They receive messages through the dendrites and transmit them through the axon to other neurons.

The specific site of transmission of messages from one neuron to another is called the synapse. Neuro transmitters are the specific chemicals that make the chemical connection at the synapse.

NERVOUS SYSTEM : DIVISIONS OF NERVOUS SYSTEM
(i) CNS
(ii) PNS

B.A. SEM – II **Unit - I**
Course No. : PY-201 **Lesson : 2**

Structure

1.2.0 OBJECTIVES :

After going through this lesson the student should be able to :

— know the various components of Central Nervous System.

— understand the functions of CNS and its components.

— know the components of peripheral nervous system.

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— understand the functions of somatic division and autonomic division of peripheral nervous system.

1.2.1 CENTRAL NERVOUS SYSTEM :

The Central Nervous System (CNS) is a very important structure of our response mechanism. It is the centre of all neural activety – it integrates all incoming information, thought processes, decision making and issues orders to the body. The CNS can be divided into two man parts :

(i) Spinal Cord

(ii) Brain

1.2.1.1 Spinal Cord :

The spinal cord is housed in a bony case of spinal column. It is soft structure like a rope and consists of collections of axons running from brain to the rest of the body through pathways in the peripheral nervous system. Spinal nerves branch out from the spinal cord between each pair of vertebrae in the spinal column. Two types of nerves join the spinal cord—

(i) Sensory or Afferent nerves and

(ii) Motor or Efferent nerves

These nerves carry the sensations from receptors to the spinal cord and motor nerves carry the information from the spinal cord to the muscles. Receiving of sensations and sending out of motor impulses are mediated by the gray matter on the inside of the spinal cord. 50 percent portion of the spinal cord is gray matter and the rest contains white matter. In the middle portion of the spinal cord are the cell bodies, where as conduction paths are found in the peripheral portion. As cending and descending tracts are found in its white matter. Associative neurons lie in the gray matter of the spinal cord.

1.2.1.2 Functions of Spinal Cord

Spinal cord is the centre of integration of Reflex action. In reflex action sensory nerve carries the sensation to the central nervous system and motor nerve bring

message from the central nervous system to the muscles and muscles do the activity. This action takes a very brief time.

Spinal cord connects the outer organs of the body with the brain. 31 pairs of spinal nerves join the spinal cord from the outer organs. Each pair has one sensory and one motor nerve. Thus the activities of outer organs of the body (below the head) like hands and feet are controlled by the spinal cord. Many learned activities like writing, typing, playing guitar, wearing clothes, walking, dancing etc. are controlled by the participation of spinal cord.

CHECK YOUR PROGRESS EXERCISE NO. 1

Note : Use the space given below for your answer. Use separate sheet if required.

1. CNS comprises of_____ and _____
2. Briefly explain the location and components of spinal cord :

   _____

   _____

   _____

3. What are the functions of spinal cord ?

   _____

   _____

   _____

1.2.1.3 Brain

Besides the spinal cord, the brain is the second principal part of the central nervous system. The brain is the large upper portion of the central nervous system.

Brain has very important functions in human behaviour. This part of the CNS is an important and higher centre for various connections in the body. Some nerves do not enter the spinal cord. These nerves enter the central nervous system through the brain. Some impulses travel between the spinal nerves and cerebral cortex. Conduction of these impulses also takes place through the brain. Thus there are many higher centres in the human brain which control and integrate various activities of the

body.

Brain is divided into three main parts. These parts are :—

(i) Hind brain

(ii) Mid brain and

(iii) Fore brain

CHECK YOUR PROGRESS EXERCISE NO. 2

Note : Use the space given below for your answer. Use separate sheet if required.

1. What are the function of brain ?

   _____

   _____

   _____

   _____

2. Brain is divided into _____ main parts, namely :

   (i)_____ (ii)_____ (iii)_____

1.2.2 PERIPHERAL NERVOUS SYSTEM

The Peripheral Nervous System is composed of all the neurons forming the nerve fibres that connect the central nervous system to the rest of the body. The nerves branch out from the spinal cord and brain to reach the extremities of the body. Made up of long axons and dendrites, the peripheral nervous system emcompasses all parts of the nervous system other than the brain and spinal cord. The Peripheral Nervous system is divided into the *Somatic Division* and the *Autonomic division* both of which connect the Central nervous system with the sense organs, muscles, glands and other organs. The Autonomic Nervous System is further divided into sympathetic and para sympathetic divisions. The Peripheral

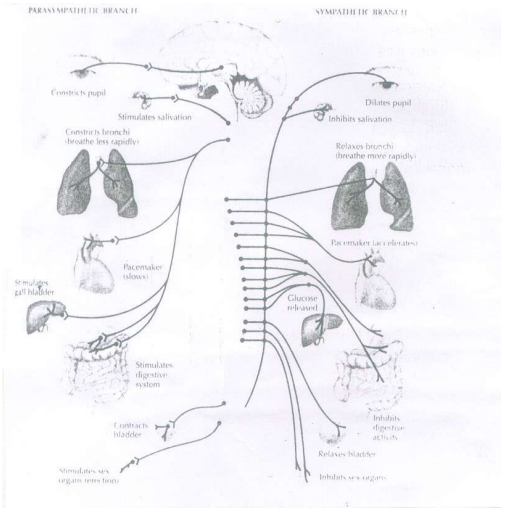
Nervous System provides the Central Nervous System with information from sensory receptors (eyes, ear, touch etc.) and relays back commands from the brain to body organs and muscles.

1.2.2.1 Somatic Nervous System : The first part of the Peripheral Nervous System, called the Somatic Nervous System, is under voluntary control and regulates the actions of the body's skeletal muscles. This division specializes in control of voluntary movements–such as the motion of eyes to read a sentence or the hand to turn page of a book and the communication of information to and from the sense organs.

1.2.2.2 Autonomic Nervous System (ANS) : the Autonomic Nervous System, meaning self regulating or independent, is the second part of the Peripheral Nervous System. It is concerned with the parts of the body that keep us alive the heart, blood vessels, glands, lungs and other organs that function involuntarily without our awareness. It works even when the individual is asleep. It sustains life process when individual is under anaesthesia and prolonged coma state.

Figure 1 ***Branches of the Autonomic Nervous system***

The Branches of the Autonomic Nervous System (ANS) The Parasympathetic branch of the ANS Generally acts to replenish stores of energy in the body. The sympathetic branch is most active during activities that expend energy. The two branches of the ANS frequently have antagonistic effects on the organs they service.



The Autonomic Nervous System (ANS) has two branches :

(a) Sympathetic and

(b) Parasympathetic

These branches have largely opposing effects. Many organs and glands are stimulated by both branches of the ANS (Fig. 1).

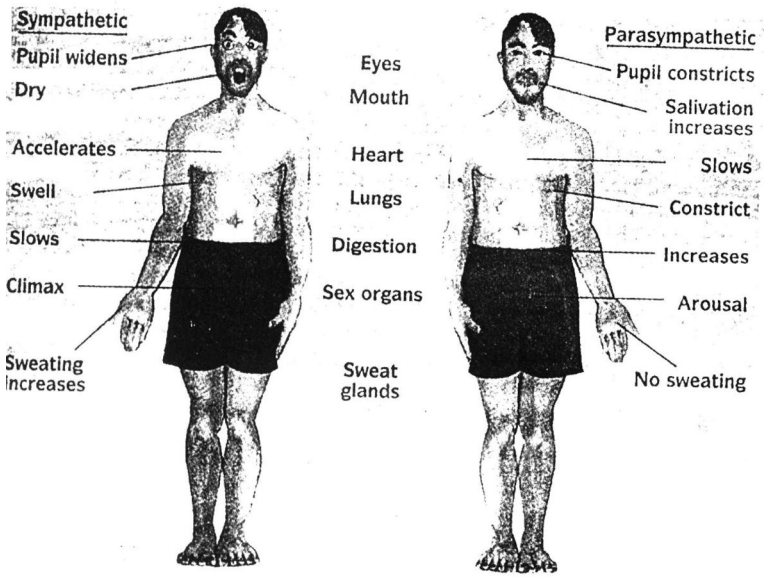


Figure 2 **The major functions of the autonomic nervous system.** The sympathetic division acts to prepare certain organs of the body for stressful emergency situations, and the parasympathetic division acts to calm the body after the emergency situation is resolved.

The *sympathetic division* acts to prepare the body in stressful emergency situations, engaging all the organism's resources to respond to a threat. This response often takes the form of 'fight or flight'. The *parasympathetic division* acts to clam the body after the emergency situation is resolved. When we are afraid, the sympathetic division of the ANS accelerates the heart rate. When we relax, the para sympathetic division decelerates the heart rate. The parasympathetic division also provides a means for the body to maintain storage of energy sources such as nutrients and oxygen.

The sympathetic and para sympathetic division work together to regulate many functions of body. For instance, the para-sympathetic division stimulates digestive processes, but the sympathetic branch inhibits digestion. Because the sympathetic division predominate when we feel fear or anxiety, these feelings can cause indigestion.

CHECK YOUR PROGRESS EXERCISE NO. 3

Note : Use the space given below for your answer. Use separate sheet if required.

1. What portion of Nervous System controls functions such as breathing and digestion ?

   _____

   _____

   _____

2. What division of autonomic nervous system is activated during excitement and during relaxation ?

   _____

   _____

   _____

1.2.3 LET US SUM UP

The Central nervous system is made up of spinal cord and brain. Spinal comprises of a thick bundle of nerves running from the brain down the length of the back.

The peripheral nervous system includes all parts of the nervous system other than the brain and spinal cord. The peripheral nervous system has two major parts. The somatic division (for voluntary movements) and the autonomic division (for involuntary movement).

The autonomic division with its two parts (Sympathetic and para sympathetic divisions) plays a major role during emergency situations.

NERVOUS SYSTEM : STRUCTURE AND FUNCTIONING OF BRAIN

B.A. SEM – II **Unit - I**

Course No. : PY-201 **Lesson : 3**

Structure

1.3.0 OBJECTIVES :

After going through this lesson the student should be able to :

— know the structure of brain

— know various parts of brain

– understand the functions of brain.

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1.3.1 HUMAN BRAIN :

Brain in the largest and most important aspect of Central Nervous system lying in the cranial cavity surrounded by three membranes such as Duramater, Anachraid mater and Piamater. The weight of an adult's brain is between 52 to 56 ounces and that of a woman from 44 to 47 ounces.

The brain has very important function in human behaviour. This part of the central nervous system is an important and higher centre for various connections in the body. Some nerves do not enter the spinal cord and these enter the CNS through the brain. There are many higher centres in the human brain which control and integrate various activities of the body.

The human brain is in specially protected position. Its color is white and gray. In the gray matter of human brain are mainly the cell bodies whereas in the white matter are present the nerve fibres.

1.3.1.1 Divisions of Brain

Brain may be divided into three main parts. These parts are (i) Hind Brain (2) Mid Brain and (3) Fore Brain. These main parts have been further subdivided into some parts. Thus the hind brain consists of Medulla, Pons and cere bellum Mid brain has two sub parts which are called Tectum and Floor. Main parts of the Fore brain are Thalamus, Hypothalamus and Cerebral hemispheres.

In another type of classification based on embryology, the brain has been divided into five parts i.e. (fig. 1).

1. Myelencephalon] Hind Brain
2. Metenephalon]
3. Mesencephalon] Mid Brain
4. Diencephalon] Fore Brain
5. Telencephalon]

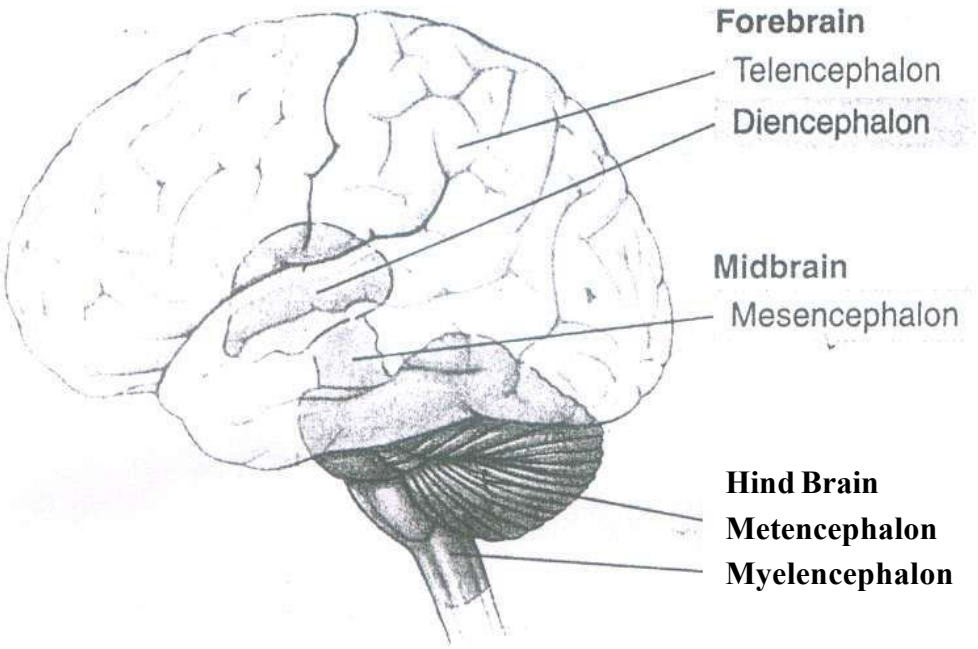


Figure 1 The divisions of the adult human brain

The Myelencephalon, major part of the hind brain, is known as the Medulla Oblongata. The second part of the hind brain, the Metencephalon has three sub parts whose names are (1) Pons, (2) Parts of the fourth ventricle and (3) Cerebellum. The third part of the brain is Mesencephalon which is the mid brain. The fourth and fifth parts of the brain are concerned with the Fore Brain. The first of these parts is the Diencephalon. This part has many structures whose names are : Third ventricle, Mammillary bodies, Thalamus, Hypothalamus, Pitutory body, optic tracts and the Retinae of the eyes. The fifth part of the brain is called the telcephalon. The structures included in this part are – Olfactory bulbs, Olfactory tracts, Cerebral hemispheres, lateral ventricles and Basal Ganglia.

CHECK YOUR PROGRESS EXERCISE NO. 1

Note : Use the space given below for your answer. Use separate sheet if required.

1. Name the three main parts of Brain :

_____

_____

_____

2. Based on embryology the brain is divided into

_____

_____

_____ (give names)

3. Name the sub parts of :

(a) Metencephalon _____

_____

_____

(b) Diencephalon _____

_____

_____

(c) Telencephalon _____

_____

_____

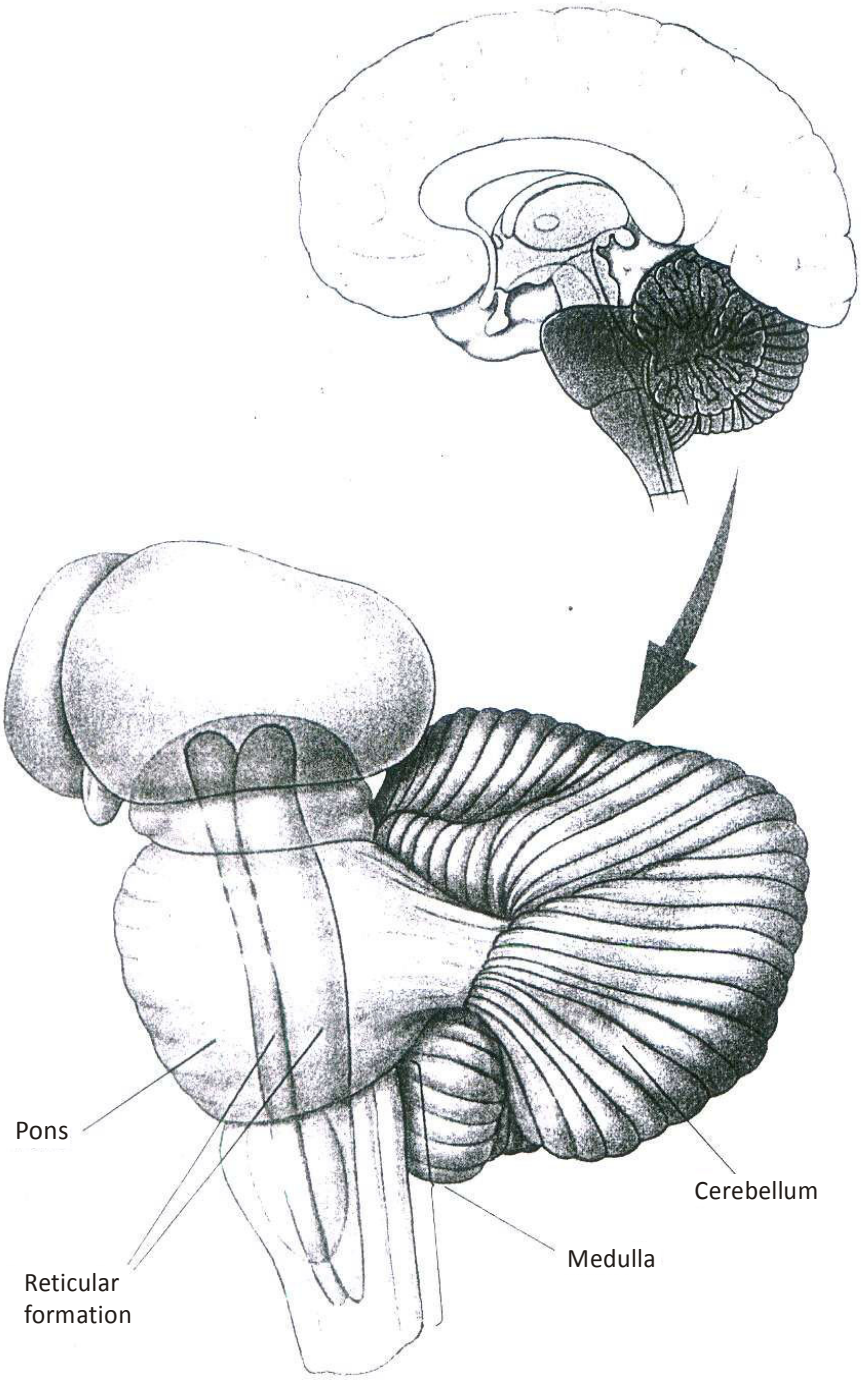


Figure 2 Structures of the human myelencephalon (medulla) and metencephalon

1.3.2 HIND BRAIN :

It comprises of :

(i) Myelencephalon

(ii) Metencephalon

(i) Myelencephalon : This part is known as Medulla Oblongata. The position of Medulla Oblongata in human brain is between the spinal cord and pons. Spinal cord lies below it and Pons above it. Cerebellum lies behind it. Many groups of nerve cells are connected together through thus structure. It is about one inch in length and many cranial nerves are connected with the brain through the medulla. It is considered an important structure of the brain.

Function of Medulla Oblongata :

(1) To establish connection between the spinal cord and higher centres of the brain.

(2) To send various functional units of the cranial nerves from the higher centres of the brain to the parts of body.

(3) Inner side of Medulla contains gray matter and this gray matter is connected with various main organs of body like heart, blood versels and lungs.

(4) To regulate essential body activities like coughing, blinking and sneezing etc.

(5) To control the digestive activity of body, blood circulation, respiration and phonation. Besides controlling them it also regulates these activities to maintain homeostasis in normal conditions.

(ii) Metencephalon : Second major part of the hind brain is called the Metencephalon. Three sub parts of this division are : (a) Pons (b) Cere bellum and (c) part of the 4th Ventricle. Structure and functions of these parts are given below :

(a) *Pons :* The Pons is the upward prolongation of the Medulla Oblongata and situated in the ventral part of brain. It is directly connected with the medulla,

cerebellum and cerebrum. Fibres from the cerebrum pass to and from the spinal cod through this band. As they pass, they cross one another in this area. Fibres from the right hemisphere go through the left side of the pons to the muscels of the left side of the body and from the left hemisphere to the right side. Beside these three are other neural tracts in the pons which connect various higher and lower parts of the central nervous system.

Its functions include maintenance of balance in various movements of the body. It integrates the activity of muscles. It has an important function in connection with the sensation and movements of mouth and face.

(b) *Cerebellum :* Cerebellum is situated just above the medulla at the level of pans. It is separated from the Carebrum by a fold of the Duramater. It consists of two halves or hemispheres. Many tracts from the spinal cord enter the cerebellum.

The structure of cerebellum is quite complex. Generally it is divided into two parts - (i) Hemisphere (ii) Vermis. The outer part is hemisphere and it is gray. The inner part of the cerebellum is called vermis and it has white color. It is made up of white fibres.

Functions :

Its functions have not yet been definitely determined.

— It coordinates the muscular movements of the body.

— It maintains the equilibrium of the body in complicated acts, like walking, running, jumping etc.

— It is responsible for the sense of localisation i.e. a sense which tells us the exact position of various parts of the body, for example, nose, ear, feet, hands, etc.

If this part of the brain is injured or gets diseased, there is loss of above mentioned functions.

(c) *Part of 4th ventricle :* The third sub-part of the Metencephalon is called “Part of the Fourth Venticle”. It runs through the brain stem having pons and

cerebellum on its left and right side respectively. In fact 4th ventricle is connected with the third ventricle and also connected with the front portion of the medulla.

CHECK YOUR PROGRESS EXERCISE NO. 2

Note : Use the space given below for your answer. Use separate sheet if required.

Q1. What are the functions of Medulla Oblongata ?

_____

_____

_____

Q2. Name the subparts of Metencephalon.

_____

_____

_____

Q3. What is the structure and location of cerebellum ?

_____

_____

_____

1.3.3 MID BRAIN :

The second main division of the brain is called mid brain or Mesencephalon.

Mid brain lies mid way between the fore brain and hind brain. Its size is about ¾ inch. Its internal structure is similar to that of spinal cord and pons. Mid brain connects the hind brain with fore brain.

The two divisions of the mesencephalon are the tectum and the tegmentum. The **tectum** (roof) is the dorsal surface of the mid brain and is also called **collicule.** There are two pairs of sensory centres in the tectum. These are called superior tectum and and Inferior tectum. The superior tectum has visual function

and the inferior tectum has auditory function.

The **tegmentum** is the division of the mesencephalon ventral to the tectum. Various sensory and motor tracts pass though it and connect it with the hind brain and fore brain.

The mid brain is like a bridge between fore brain and hind brain and it has a close relationship with both these.

CHECK YOUR PROGRESS EXERCISE NO. 3

Note : Use the space given below for your answer. Use separate sheet if required.

Q1. What is the location of mid brain ?

_____

_____

_____

Q2. Name the two division of mesencephalon.

_____

_____

_____

1.3.4 FORE BRAIN :

The third major division of brain is the fore brain. It is further divided into two parts. These are :

(a) Diencephalon

(b) Telencephalon

(a) Diencephalon : It has many structure in it and the main ones are : (1) Thalamus (2) Hypothalamus (3) Pitutory body (4) Fourth Ventricle (5) Retinae of the eyes (6) Mammiliary bodies (7) Third ventricle.

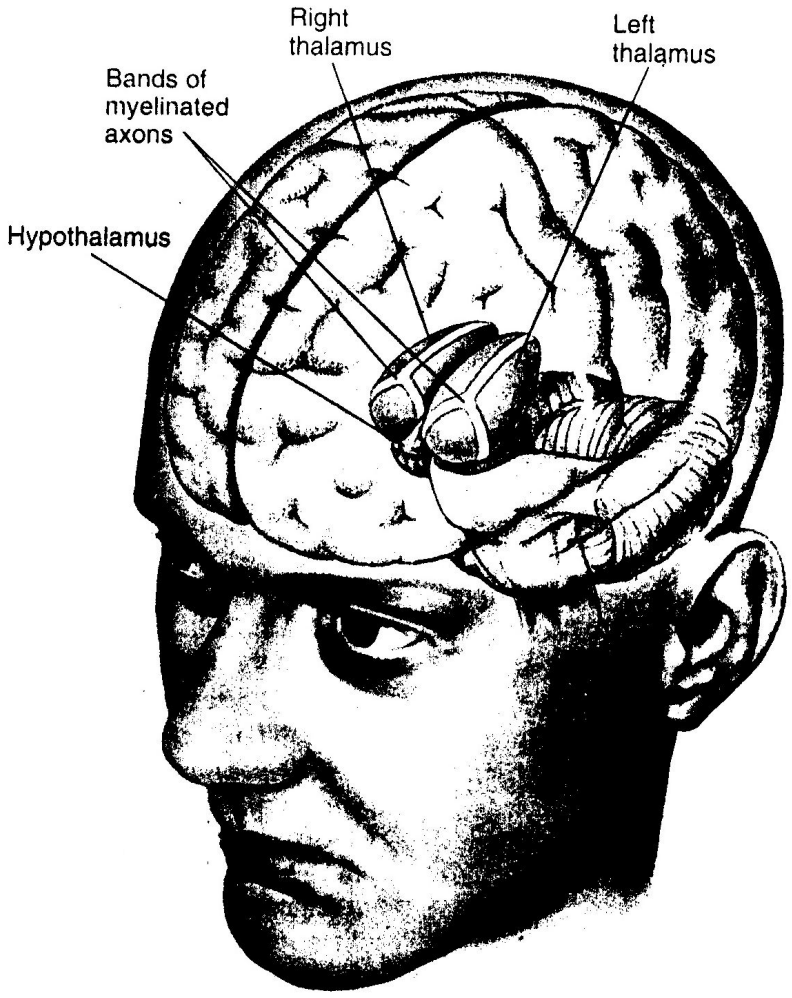


Figure 3 The human diencephalon.

1. Thalamus :

Thalamus in human brain lies between the mid brain and cerebrum. It is intimately connected with the cerebral cortex. It has connections also with the lower centres of the brain and spinal cord.

Thalamus is divided into two parts—(1) Dorsal Thalamus and (2) Ventral Thalamus. Dorsal thalamus is concerned with groups of sensory nuclei whereas groups of motor nuclei lie in the ventral thalamus. The function

of dorsal part is to receive various sensations and then to relay them to different areas of the cerebral cortex. The ventral portion controls various metabolic reactions in the body and helps to maintain homeostasis.

2. Hypothalamus :

Hypothalamus is located just below the anterior thalamus. It plays an important role in the regulation of several motivated behaviours. It is also connected with Pitutory gland. It has various nuclei in it. One group controls sympathetic functions and the other group of nuclei controls para sympathetic functions.

It has important role in many bodily functions. Its functions are concerned with motivational, emotional and behavioural activities of the person. It regulates various visceral reactions in the body and maintains balance in the internal environment. It also regulates metabolic processes in the body, controls hunger, thirst, blood pressure and sexual functions.

3. Pitutary Body :

It receives fibres from the hypothalamus and is connected with the hypothalamus.

4. Third Ventricle :

Third ventricle is situated between thalamus and hypothalamus. It has relationships with lateral ventricles and the forth ventricle. It divides the mid brain into tectum and floor.

(b) Telencephalon : The telencephalon is the largest division of human brain, and it mediates its most complex functions. It initiates voluntary movement, interprets sensory input and mediates complex cognitive processes such as learning, speaking and problem solving. Telencephalon receives tracts from other structures of the brain. It is connected with the other parts of the brain – Diencephalon, Metencephalon and Mesencephalon. The main structures in the Telencephalon are :

(1) Cerebrum

(2) Olfactory bulb

(3) Olfactory tracts

(4) Basal ganglia

(5) Lateral ventricles

(1) Cerebrum :

It is also known as new brain while the medulla, the thalamus, the hypothalamus and the cerebellum together are called old brain.

Cerebrum is the most complex structure of the brain and its largest part also. The cerebrum in man is much larger than in lower animals. Contrary to the spinal cord, the interior of the cerebrum consists of white matter formed by a layer of grayish material.

The cerebrum includes most of the contents of the skull. The outer surface of the cerebrum appears to have many folds which are called the convolutions and fissures of the brain. The large furrows in a convoluted cortex are called *fissures* and the small ones are called *sulci* (singular sulcus). The ridges between fissures and sulci are called *gyri* (singular gyrus). The cerebral hemispheres are almost completely separated by the largest of fissures :

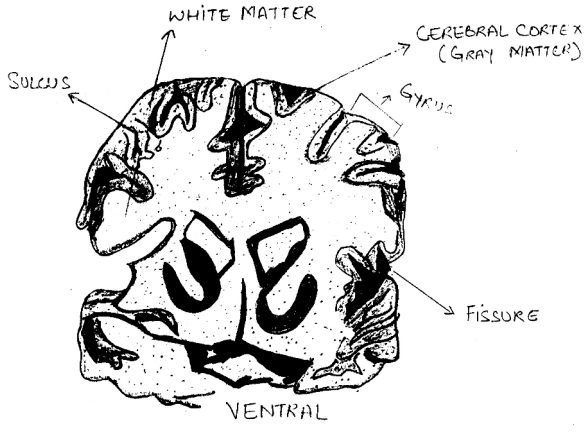
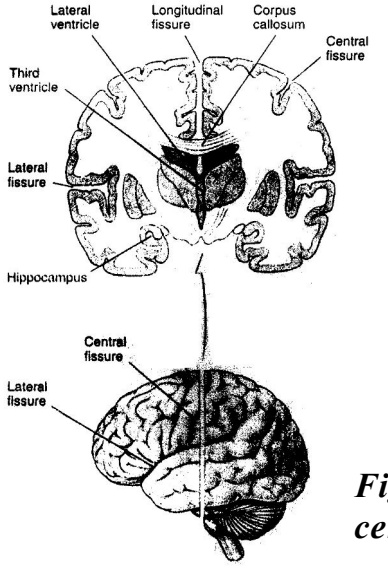


Fig. 4 A Slice of Human Brain Showing Fissures and Gyri and the Layer of Cerebral. Cortex that follows these convolutions

The longitudinal fissure. The cerebral hemispheres are directly connected by only a few tracts spanning the longitudinal fissure ; these hemisphere connecting tracts are called *cerebral connoisseurs* and the largest among them is called *corpus callosum.*



The right hemisphere is connected with the left side of the body and the left hemisphere is connected with the right side of the body. There are several fissures in the cerebral hemisphere. The fissure of Rolando divides the frontal from the parietal lobe. The fissure of Sylvius separates the temporal from the frontal and parietal labes.

Fig. 5 The major fissures of the numab cerebral hemispheres.

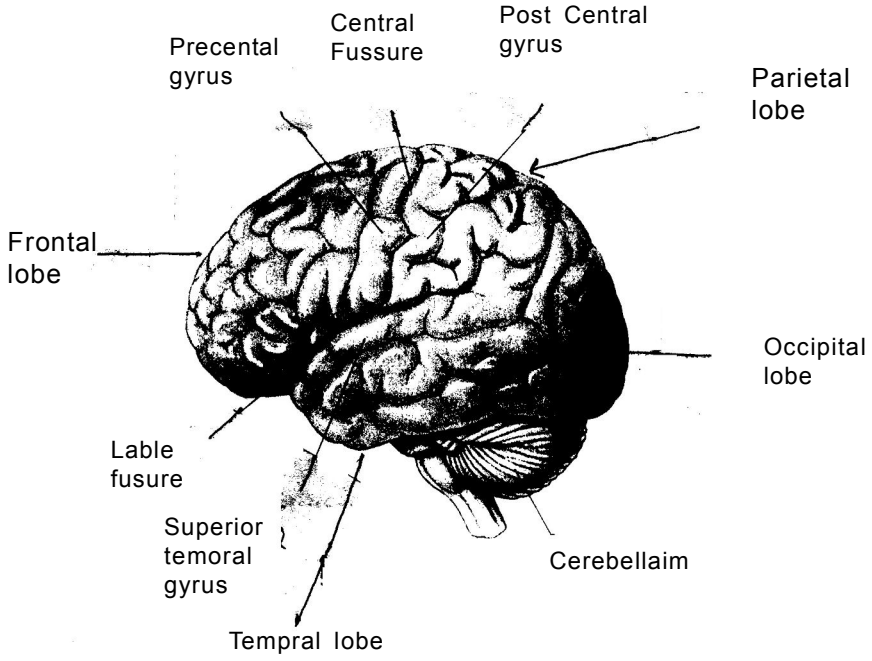


Fig. 6 The lobes of the cerebral hemisphere

The cerebrum is the centre of intellect, memory, will, emotions like love, hatred and fear sensations. It enables us to think, remember, observe things around us through five senses. Different portions of this part of brain are assigned different functions. The functions of different lobes are :

(a) Frontal lobe : The back of frontal lobe controls the motor activity of the body. Its lower part, controls speech and on the under surface an area is responsible for the sensation of smell and taste.

(b) Parietal lobe : It is the seat of intelligence, emotion, love, hatred, fear, pain, heat, cold and sensation of touch.

(c) Occipital lobe : It is the seat of vision or sight.

(d) Temporal lobe : It lodges sensation of hearing.

(2) Olfactory Bulb : Olfactory bulb is the second subpart of the telencephalon. Its position in the human brain is in the region of cranial cavity. In human brain this structure is relatively less developed and less sensitive as compared to that of the lower animals.

(3) Olfactory Tracts : Olfactory tracts lie in the ventral portion of the cerebral hemisphere in the human brain. Nerve impulses from the smell receptors in the nose travel through these olfactory tracts to the smell area of the cerebrum.

(4) Basal Ganglia : Basal Ganglia are a mass of gray matter lying above the thalamus and below the cortex. These have important functions in connection with the posture of the organism and the co-ordination of movements.

(5) Lateral Ventricles : There are four ventricles in the brain. The first two are called lateral ventricles. These are connected to each other and also with the third ventricle which lies below the thalamus.

CHECK YOUR PROGRESS EXERCISE NO. 4

Note : Use the space given below for your answer. Use separate sheet if required.

Q1. Name different parts of Diencephalon.

_____

_____

_____

_____

Q2. Write the structure and functions of Thalamus and Hypothalamus.

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Q3. What are the functions of Cerebrum ?

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Q4. Name the major fissures of the human cerebral hemispheres.

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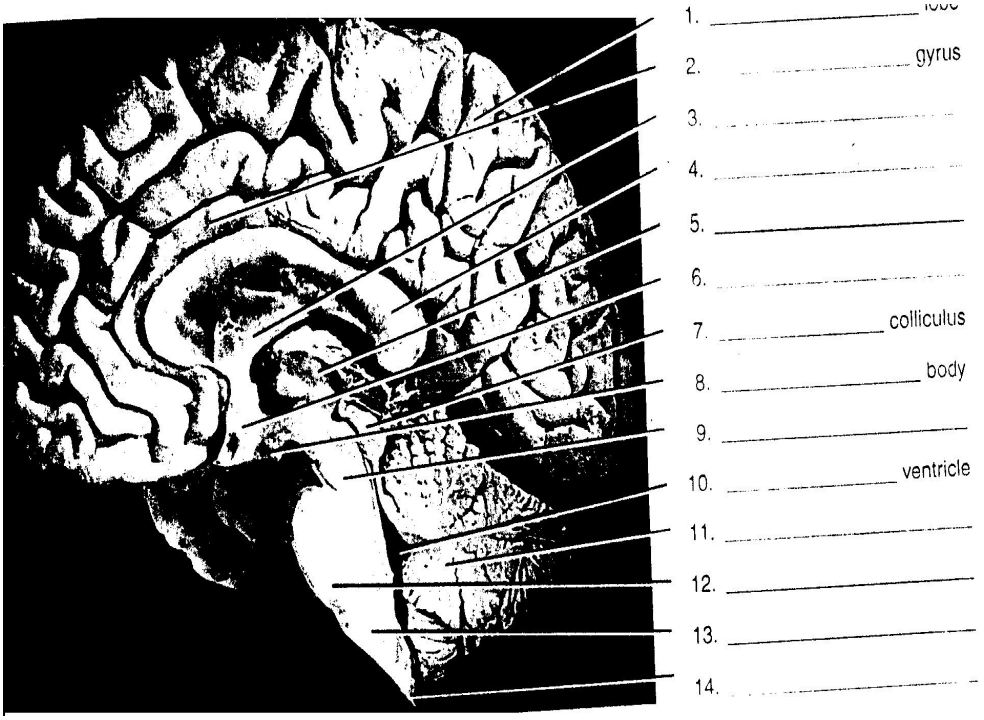
Q5. Label the brain diagram given below :



1.3.5 LET US SUM UP :

The human brain is the largest and most important organ lying in the cranial cavity. It has very important functions in human behaviour. Brain is divided into three main parts Hind brain, Mid brain and fore brain.

Hind brain consists of Medulla, Pons and Cerebellum.

Mid brain has two sub parts called Tectum and Floor.

Fore brain is comprised of Thalamus, thypo thalamus and cerebral hemispheres.

Based on embryology the brain is divided into five parts i.e.

Hind Brain - 1. Myelencephalon

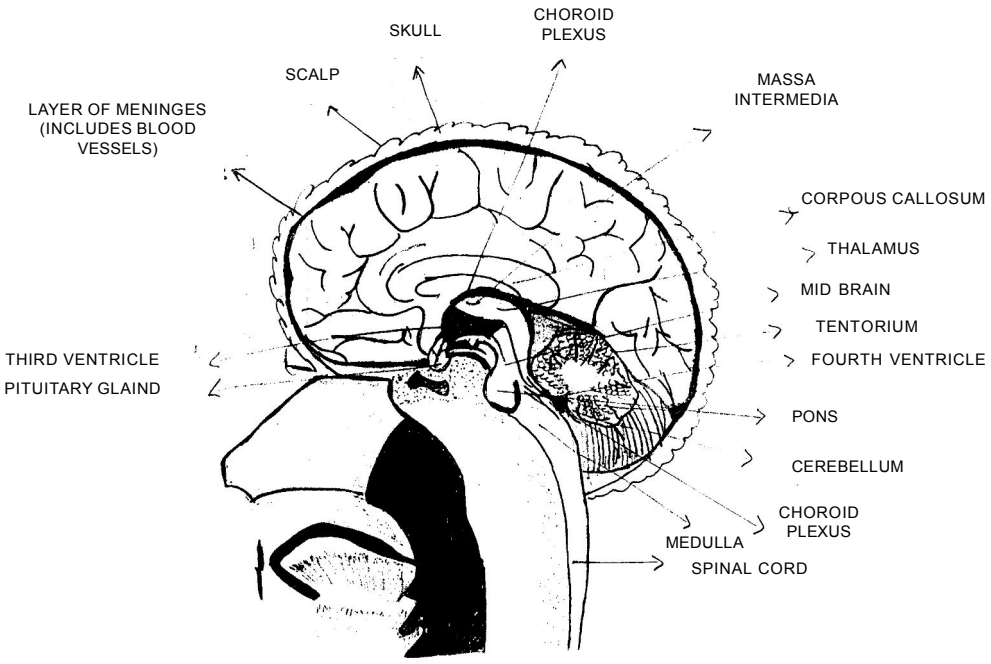
2. Metencephalon

Mid Brain - Mescencephalow

Fore Brain - 1. Diencephalon

2. Telencephalon

The major brain structures are detailed in the diagram below :



A Midsagittal view of the Brain and Part of the Spinal Cord

SENSATION : VISION

B.A. SEM – II **Unit - II**

Course No. : PY-201 **Lesson : 4**

Structure

2.4.0 OBJECTIVES :

After going through this topic, the student should be able to :

(i) have the understanding of the word sensation.

(ii) be able to understand the process of sensation.

(iii) be able to understand the visual sensation.

(iv) know about the structure and function of eye.

2.4.1 INTRODUCTION :

It is through our senses that we know about the world. To appreciate the importance of the sensory processes in behaviour and experience we will have to imagine, what it would like to be without one or more of our senses.

Some simple experiences, called sensations are closely tied to what is happening in the sensory systems themselves. Colour, brightness, the pitch of a tone or a bitter taste are examples of sensations. The study of sensations in the laboratory helps us discover how the sensory systems work, but in real life we seldom experience simple sensations.

2.4.1.0 THE CONCEPT OF SENSATION :

The modern study of sensations started in 1838 when John Muller formulated his doctrine of specific nerve energies. Muller believed that we are not aware at all of sensory stimuli as such we are aware only, to activities of our sensory. A nerve is believed to be a stimulated with resultant sensation which is determined by the nature of nerve.

For example, pressing on the eye or looking at a colourful scene both result in seeing. Senses do not work in the same way. For example the way we smell is very different from the way we see. For, we the psychology students it is essential to know how various sensory experiences are caused ? Thus in very simplest way we can define sensation as 'awareness of sense stimulation'. Titchner has described four characteristics of sensation, 1. Quality 2. Intensity 3. Duration and 4. Vividness.

2.4.2 SENSORY CHANNELS:

Vision, hearing, taste, smell and touch are the so-called five senses. But the number of human senses is closer to ten than five. In addition to touch, the skin contains separate warmth, cold and pain senses. Furthermore, sense organs in the muscles, tendons and joints tell us about the position of our limbs and the state of tension in the muscles. They serve the sense called *kinesthesis*. The vestibular sense informs us about the movement and stationary position of the head, it is the key sense in maintaining balance.

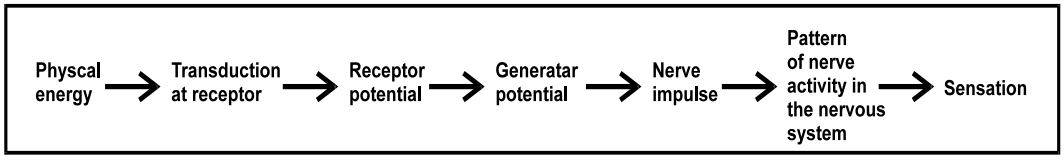
Each sensory system is a kind of channel, consisting of a sensitive element (the receptar), nerve fibers leading from this receptar to the brain or spinal cord and the various relay stations and processing areas within the brain. When a sensory channel is stimulated we have a sensation that is characteristic of that channel. For instance, whether the eye is stimulated by light or by pressure on the eye ball, we have a visual experience.

In order for us to know about the world around and within us, physical energy must be changed into activity within the nervous system. The process of converting physical energy into the nervous system activity is called *transduction.* Transduction occurs at the receptars - cells which are specialized for the most efficient conversion of one kind of energy. During the transduction process, receptor cells convert physical energy into an electric voltage, or potential called the receptor potential. Whether it is the receptor potential it self or some other voltage, the electrical event that triggers nerve impulses is known as the generator potential.

For a given event in the environment, thousands of nerve impulses are generated and conducted to the central nervous system. Since these impulses travel among many different nerve fibers at slightly different times. They form a pattern of input to the control nervous system that is the basis of our sensory experience of the event. Thus, beginning with the transduction process at the receptar, physical energy results in pattern of nerve impulses in the central nervous system.

In other words the physical energy is changed into a code made up of a pattern of nerve firings. In general, this is what makes up the field of study known as psychophysics (psycho = mind or experience ; physics = physical events)

Fig. – I



In a typical sensory channel, these are the steps in going from physical energy to sensation.

2.4.3 THE PROCESS OF SENSATIONS :

For sensations it is essential that organism have at least a stimulus which has been considered as one form of energy, either from an extenral source or from within the body. In human body there are several receptor cells like the receptor in eye, ear nose etc.

Eight types of sense organs and sensations has been found which are given below:

	Sensation	Sense organs
1.	Visual Sensations	Eye
2.	Auditory Sensations	Ear
3.	Olfactory Sensations	Nose
4.	Gustatory Sensations	Tongue
5.	Cutaneous Sensations	Skin
6.	Muscular Sensations	Muscle
7.	Organic Sensations	Internal Organ
8.	Sensation of Equilibrium	Semi Circular Channel in the ear.

Check your progress Exercise - I

Note : Use the space below for your answer. Use separate sheet if required

1. Explain the concept of sensation

_____

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_____

2. Describe the four main characteristics of sensations given by Titchner.

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3. Write short note on sensory channels.

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4. Diagrammatically explain the process of sensations.

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_____

5. What are the various types of sensations ?

_____

_____

2.4.4 THE VISUAL SENSATION :

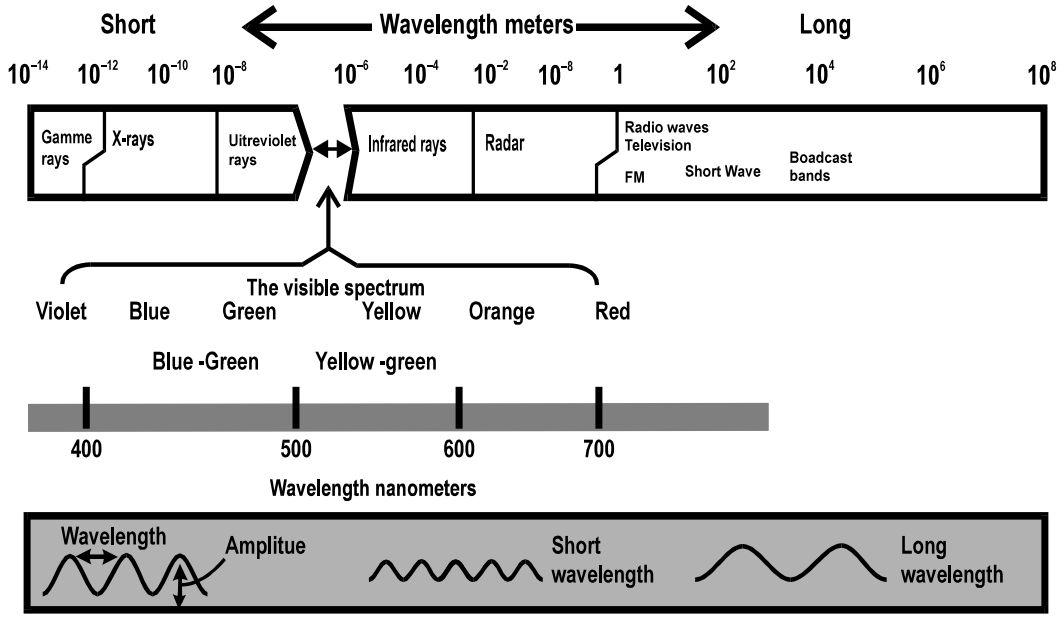
The most important sense for man is ability to see and perhaps due to this reason psychologists and physiologists have made thorough studies on vision. Far this sense, the physical stimulus is like a small part of the spectrum of electromagnetic energy. It is clear that the receptars in the eye are sensitive to only one small segment of the total spectrum which extends, at one end, from the range of energy used in radio communication to all the way dpwm tp ,omite cpzmoc raus at the other. The eye is only sensitive to a small segment of the spectrum, known as visible spectrum.

Vision starts with the electromagnetic radiation that objects emit or reflect. Physicists have described this radiation in great detail, for us it can be used as a electric charges moving through space at approximately 300 million meters per second. Electromagnetic radiation has wave like properties and it is therefore conventional to speak of it in terms of electromagnetic waves. Electromagnetic waves can be measured and classified in terms of the distance from the peak of one wave to the peak of the next-that is in terms of wave length. Some electromagnetic radiation have wave lengths as short as 10 trillionths of a meter (the gamma rays) some have wave

See fig II. The entire range of wave length is called the electromagnetic spectrum.

Although all radiant energy - all wavelengths of the electromagnetic spectrum - is very much the same physically only a small portion of it is very visible. Some where in the middle of the range of radiant energies are the wave lengths that we can see (fig - II). These wavelengths are known as the visible spectrum. To express wave length, we use the metric scale; in the visible spectrum the wavelengths are expressed in billionths of a meter or nanometers (nm). As fig II shows, the visible spectrum extends from about 380 to 780 nanometers. Lights has been considered as a radiant energy and its originated waves can only be studied in the form of magnetic and electrical waves. In the absence of light human beings are unable to see. The eyes are only eligible to receive light wave whose length varies from 390 mili microns (mu) to 760 mili microns (mu). Although the biggest and the lowest length wave are 4000 mu and 1/1000 mu respectively. It has been seen that eye is more sensible to the 560 mu light wave in day time and in night 510 mu light wave. Newton (1666) had concluded that the light of sun has all colours of rainbow. He had used prism to analyse the light of sun and come to the conclusion that sun's light is made of different colours.

Fig. II



2.4.4.0 *Spatial and Temporal Summation and Roscoe Bunsen Law*

If the size of stimulus is increased then the intensity of sensation of particular stimulus will also be increased. Similarly, if the intensity of stimulus is increased, more receptor will be stimulated and it will be combined with previous stimulated receptors. This Joint effect of retina is called "Summation effect".

Roscoe-Bun Sen has formulated a low of Temporal summations which can be described on the basis of following equation.

$I = T \times C$

here I = Intensity

T = Time or duration

C= Constant,

This equation means that the effect of stimulus depends upon the multiplication of stimulus intensity and its time or duration.

2.4.4.1 *Visual Adaptation*

The eye has to adopt itself according to increasing or decreasing amounts of light and the corresponding adaptations are known as light adaptation and dark adaptation respectively.

When we enter a dark room from daylight we are unable to locate any defect in the room as our eyes are unaccustomed to darkness at that time. This is because when we go from bright light into the dark there is not sufficient light to make the Cones activated, the rods not being sensitive at all.

When we go out from a dark room into bright light, we are over whelmed with light. We try to shield our eyes against bright light and the eye muscles also contract the pupil to a smaller size. Our eyes become less sensitive. The sensitivity of the eye receptors also get adapted to light, becomes decreased and thus the light that was seemingly extra bright, a few minutes earlier becomes just ordinarily bright.

Light adaptation is faster as compared to dark adaptation.

2.4.4.2 ***Visual Acuity :***

Visual acuity is the capacity to see clearly very minute details of stimuli and to differentiate between two closely resembling stimuli. Visual acuity is directly and strongly related to the intensity of stimulus. It also depends upon the intensity of light. Other factors affecting considerably the visual acuity are nature and colour of the surface on which the stimulus is produced.

2.4.4.3 ***After-Images :***

The term after-image refers to the retained feelings of vision of the stimulus even after the later has been withdrawn from sight. This phenomenon is supposed to be due to the sustained activity of cones after the removal of stimulus.

After images can be calegorized as positive after-images and negative after-images.

2.4.4.3.0 ***Positive After Image :*** If we stare at a brightly illuminated stimulus and then look at on ordinarily lighted surface, we will for some time see the illuminated image on this ordinary surface. This is a positive after image and it varies positively with increase in stimulus intensity and decrease in the light intensity of the background presented after the removal of the actual stimulus.

2.4.4.3.2 ***Negative After Image :*** If we concentrate at a red spot and then look at a plain gray rectangle, we will be seeing a green spot on it. This happens because green is the complementary colour of red and what we experience in this case, is a negative after image. Conversely, if the stimulus is green, it will produce a red after image Blue Colour shall be similarly giving yellow after image and *vice versa* negative after images occur more frequently than positive after images. The strength of the afterimage increases longer as we look on the stimulus.

2.4.4.4 ***Colour Blindness :*** The normal eye can discriminate three pairs of colours : Light dark, yellow-blue and red-green and the person with such vision is called a trichvomat. A person lacking in one of these three colour system is called a dichvomat while a monochvomat is that who can only distinguish between light-dark system. Colour blindness can be

explained as a deficiency in one or two of these three systems, a dichvomat thus being partially colour blind and the monochvomat being totally colour blind.

2.4.4.5 *The* Colour Vision

All type of visual sensations can be conveniently differentiated into two types chromatic and achromatic sensations. Chromatic sensations refers to colours like red, green, blue etc. while achromatic sensations are for colours –White, black and the intermediate grays. The rods, under reduced brightness (Nightvision) enable us to see only achromatic colours while cones make us differentiate among chromatic colours, mostly in bright illumination.

Colours are also divided as primary and secondary colours. According to young–Helmholtz, primary colours are red, green and blue. Hering has considered six colours as primary colours, the red, green, blue, yellow, black and white. The scientific analysis of visible spectrum has revealed that there are only four primary colours red, green, blue and yellow. Rest of the colours result from the mixture of these primary colours.

Check your progress Exercise - II

Note : Use the space given below for your answer. Use extra sheet if required.

1. What is Visual Sensation ?

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2. Write Short Note on the spatial and Temporal Summation.

_____

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_____

3. What is Roscoe Bunsen Law ?

_____

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_____

4. Explain what is visual adaptation.

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_____

5. Write short note on visual Acuity

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_____

_____

6. What is after image ? Explain the various after images.

_____

_____

_____

7. Write short note on the colour vision.

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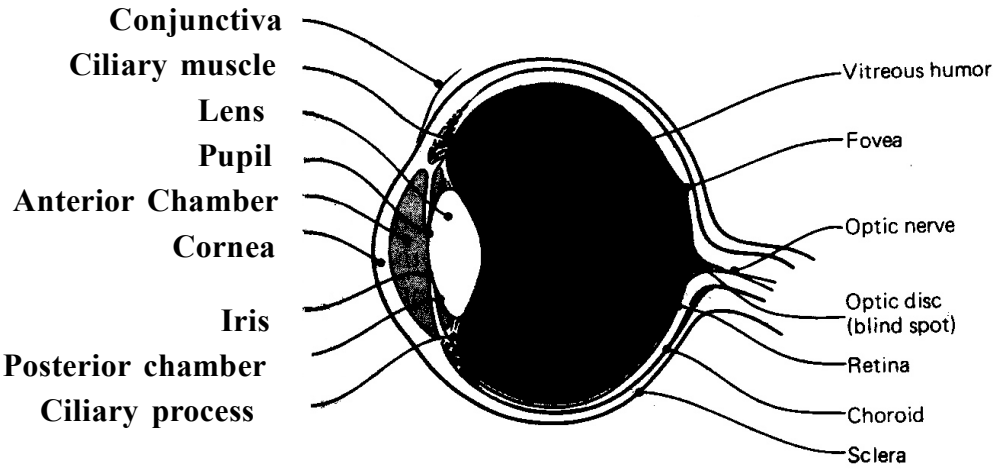
2.4.5 STRUCTURE AND FUNCTION OF EYE :

The structure of human eye is shown in the following fig.

Some of the Principal Parts of the eye.
(Based on Walls, 1942)



The structure of eye looks like a camera. The light enters the eye through the cornea, the transparent protective coating over the front part of the eye. From the Cornea it passes through the pupil, the opening in the centre of the iris (coloured part of the eye). This iris has a very important function in the eye. In very bright light, iris contract to make the pupils smaller and protect the eye from damage and in dim light extends to open pupil wide.

Although eye is a sense receptar, but it is composed of many small receptors. At the back of eye is the retina. Actually, inside the pupil, light passes through the lens which focuses it on to the retina. That is why retina is called a photosensitive. The retina contains the receptors cells. But before reacting the light in receptars, it pass through a layer of nerve cells and blood vessels and a layer of neurons that make the connection between the receptor cells and nerve path ways then it reach to brain (see fig. IV).

The three layers of neurons are available in retina. In the first layer, recepetive neurons are available. In this layer, two specific kinds of receptars cells has been found which are technically called as Rods and Cones. In the second layer of retina, bipolar neurons are found and these neurons send impulses to the Ganglion cell. The Ganglion Cell is the third layer of retina. The third layer is the internal layer.

Rods and cones have specific functions in visual sensations. As pointed out earlier, retina has characteristic of photosensitive and composes of many small,

specialized nerve cells called 'rods' and 'cones'. When ever light strikes these cells, a photo chemical process is set off and rods and cones start their function. Rods are more sensitive to light than cones. Rods are mainly responsible for night vision whereas the operation of cones is mainly related to day light. Due to cones we respond to colour. In better light more cones will be stimulated and this leads to the visual acuity ("The ability to distinguish fine details and spatial separations"). In each eye, about 130 millions rods and cones are available.

Behind the lens a depressed spot on the retina has been found which is called Fovea or Yellow spot. Fovea contains millions of cones but no rods.

This portion of the eye has been considered as one of the most sensitive portion of the eye, which focuses light, that comes from the centre of visual field. There is one spot in each retina and not for from fovea (for only 3 cm approx.) is an insensitive area, where there are no light receptors. This insensitive area has been technically called as Blind Spot. No rod and cones are available in this area. This blind spot occurs because the nerve fibers from the cells in the ritima come together to form the bundle making up the optic nerve. The importance of fovea in eye has been well described by Hilgard (1962).

"Fovea, equivalent in area to a photographic film of 1 square milimeter is able to detect it telephone wise at a distance of a quarter of a mile. At its best the eye can detect a wire whose thickness covers O.5. seconds of acc, about 1 two-million of the are of a circle this discrimination is all the more remarkable because a Single Cone fills an angular part of the retina 60 tins as large as the thickness represented by the image of the wire. The fine discrimination takes place while the eye is in constant motions through an arc larger than the size of the minimum visible object".

Fovea has a very small area which contains only cones and the numbers are 50,000 approx.

2.4.6 SUMMARY

John Muller gave the modern concept of sensation. Sensation is the awareness of sense stimulation. Vision, hearing, taste, small, touch are the five senses. Sensory channel consists of a sensitive element, nerve fibers leading from

this receptor to the brain or spinal cord and the various relay stations and processing areas with in the brain. Eight types of sense organs and sensation has been found e.g. visual sensation (Eye), Auditory Sensation (Ear) etc. Visual sensation is the most impsense for man. The eye has to adopt itself according to increasing or decreasing amount of light.

The structure of eye looks like a camera.

2.4.7 REFERENCE

–Experimental Psychology–Dr. Govind Tiwari and Dr. Roma Pal.

–Introduction to Psychology–Morgan and King.

SENSATION : AUDITION–THE AUDITORY STIMULUS "STRUCTURE AND FUNCTIONS OF EAR"

B.A. SEM - II **Unit - II**

Course No. : PY-201 **Lesson - 5**

Structure

Prof. Manisha Kohli, MAM College, Jammu

2.5.0 OBJECTIVES :

- ➔ To Enable the students to understand the Physical stimulus for Hearing.
- ➔ To make the student aware of the structure of the Ear and the process of Hearing.
- ➔ To provide knowledge to the students about the Frequency and Complex wave forms.
- ➔ To make the student aware of Pitch and loudness.

2.5.1 INTRODUCTION :

Sensory Processes : Hearing

Hearing is probably second only to vision as a channel through which we can learn about and appreciate our world. Through hearing, we can understand speech -our chief medium for imparting and acquiring knowledge. Through hearing, too, we receive a great many signals and cues-the warning automobile horn, the chime of a clock, the fire engine's siren, the footsteps of a person approaching from behind. Through hearing, we also derive one of our greatest pleasures : listening to music. Our ears give us the greatest joys of listening to the music.

2.5.2 THE PHYSICAL STIMULUS FOR HEARING

When an object vibrates, the molecules of air around it are pushed together and thus are put under positive pressure. In turn, they push against the molecules close to them and these molecules transmit the pressure to neighbouring molecules. A wave of pressure moves through the air in much the same way that ripples move on the water. (see fig I, Top). However, Sound-pressure waves travel much faster than do waves of water; at sea level, and at a temperature of 20ºC, they travel at about 760 miles per hour, or approximately 1,130 feet per second.

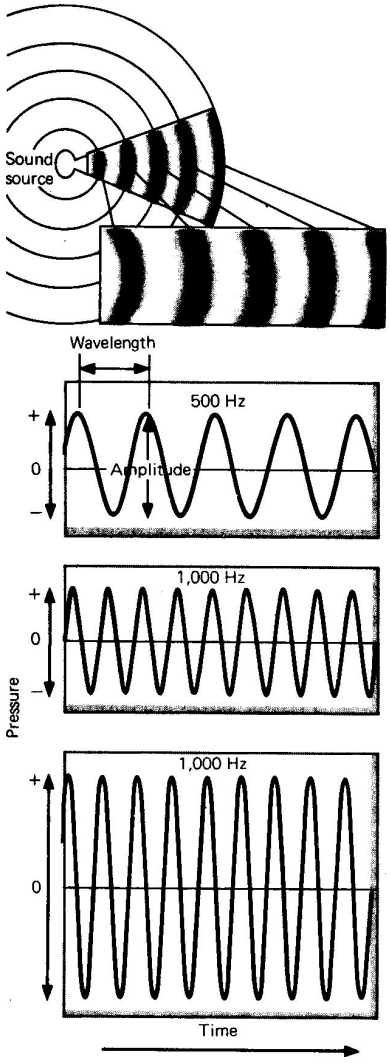


Figure - I

Top, a sound wave produced by a sound source. As the sound vibrates, it alternately compresses and scarifies the air around it. This generates a pressure wave that is transmitted outward in all directions by the air molecules which impinge each other and so transfer the pressure. The inset shows a sound wave represented graphically. The darker bands represent peaks of compression, the lighter areas between the bands represent tiems of rare faction. The more densely packed the air molecules are, the greater, the amplitude are, the greater the amplitude of the sound wave. The frequency of the sound wave is measured by the number of peak compression occurring in I second. Below, simple sound waves. The upper and middle waves have the same amplitude, or pressure, but that the middle one has a frequency twice that of the upper. The middle and lower waves have the same frequency, but the lower one has an amplitude twice than that of the middle one.

Most objects do not move, or vibrate, in only one direction when struck. A plucked sting, for example, vibrates back and forth. As the string moves in one direction, a positive pressure wave begins to move through the air. But when the string swings back to its original position and beyond, a little vacuum, or negative pressure is created just behind the wave of positive pressure. The vacuum moves with the speed of sound, just as the positive pressure wave does. The alternations in air pressure moving in all directions from the source are called sound waves and such sound waves are the physical stimuli for everything we hear.

2.5.3INTENSITY AND DECIBELS

As shown in fig I, sound pressure can vary in intensity as represented by the heights, or amplitudes of the waves. Intensity refers to how great the pressure changes in the wave are, and degrees of intensity are related to the sensations of Loudness.

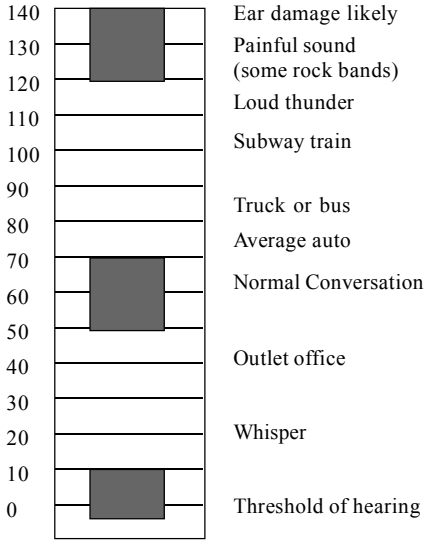


Fig II

Each of the sounds listed at the right has a physical intensity of approximately the number of decibels shown at the

The unit used to measure the intensity of sound pressures is the decibel (db). For most practical purposes, we can regard a decibel scale as simply a set of numbers, like a scale of temperature and then learn that certain numbers correspond to certain sensations of loudness. To get an idea what the number means we can see in fig II, the correspondence between decibels and some sounds with which we are familiar.

2.5.4 FREQUENCY

The frequency of a sound wave is simply the number of cycles of pressure change occurring within 1 second. One cycle per second is called a hertz (Hz). In the lower portion of fig.1, the sound wave at the top has fewer pressure changes per second than do the other two waves; it therefore has a lower frequency. If a sound wave goes to positive pressure, then to negative pressure and back 500 times in a second, its frequency is 500 hertz because the wave has completed that many cycles in 1 second. The physical frequency of sound waves is related to sensation of pitch.

2.5.5 COMPLEX WAVE FORMS

The sound waves shown in fig 1 are simple ones. They are known as sine waves because their shape can be expressed by the sine function of trigonometry. But most of the sounds we hear in everyday life are the result of complex waves. Three examples of such waves are shown in fig III. Complex waves can take many, many forms, but, in general, they are either periodic or aperiodic. This means that they either have a repetitive pattern occurring over and over again or they consist of waves with various amplitude and frequencies occurring irregularily. What we call "Noise" is usually aperiodic in wave form.

Periodic waves are composed of several sine waves that are multiplies of each other. The lowest frequency in such waves is called the fundamental frequency; the higher multiples are called the harmonic frequencies.

Three complex sound waves. The wave at the top shows what a musical note played on a harmonica looks like.

The middle wave is the sustained vowel sound oh. These two sound patterns are periodic the same pattern repeats itself. The sound wave at the bottom is aperiodic; it is the record of a hissing noise and is completely irregular.

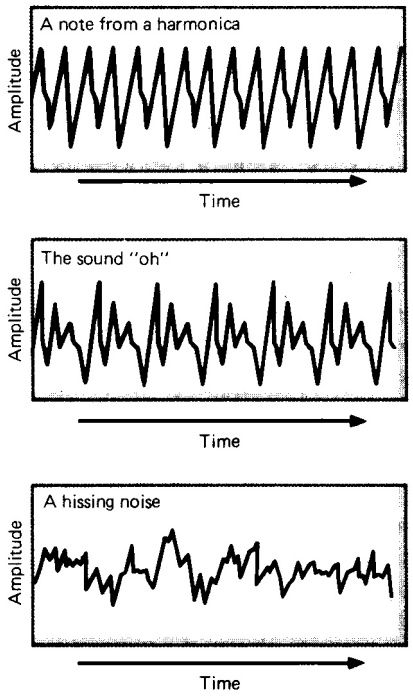


Fig-III

CHECK YOUR PROGRESS EXERCISE NO. 1

Note : Use the space give below for your answer. Use separate sheet if required.

1. Write short note on the Sensory Processes Hearing.

_____

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2. Explain the physical stimulus for Hearing.

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_____

_____

3. What is intensity and decibels?

_____

_____

_____

4. Write short note on the Frequency.

_____

_____

_____

2.5.6 PITCH AND LOUDNESS

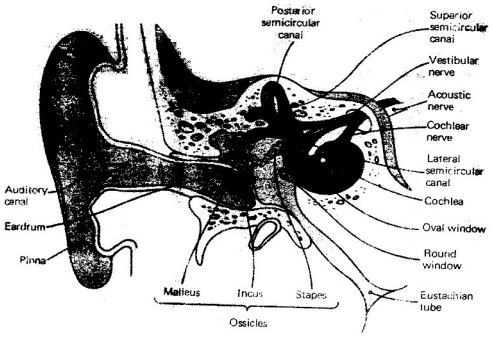
The frequency (number of oscillations per second, expressed in hertz or Hz) of a sound determines its pitch ; Low frequencies produce low pitched tones and high frequencies produce high pitched tones. The healthy young human ear hears an enormous range from about twenty to 20,000 Hz. Most types of Hearing loss involve insensitivity to higher frequencies like violins rather than lower frequencies like drumbeats or bass.

Loudness is determined by the size of the waves, and is measured in decibels (dB). The decibel range increases exponentially. This means that as sound increases by ten dB over the previous level the new sound is actually ten times louder than the first. For example, the sound of a single train roaring through a subway tunnel is about 90 dB ; the sound of ten trains running by simultaneously is 100 dB ; and the sound of one-hundred trains is 110 dB.

Normal Conversational sounds range from about 40 to 60 dB, while prolonged exposure to sound levels of greater than about 100 dB can damage the ears.

Structure of the Ear and Hearing

In order for us to hear, our nervous system must be set into motion. Physical energy must be converted or transduced into electrical activity by the auditory receptars. The ways this is done has been the subject of intensive investigation. It all begins with mechanical events in the ear. Fig IV shows the ear's major features. It has three principal parts ; the external ear, which collects the energy ; the middle ear, which transmits the energy ; and the inner ear, where the transduction of energy into nerve impulses actually occurs.



Human auditory structures (After a modification from M. Brodel in Fundamentals of Neurology, 6th ed. 1975, by E. Gardner, Philadelphia : Saunders. Labels are somewhat different.

1. The External Ear–The external ear serving as an "ear trumpet" is more or less similar to the larger movable ears of Lower animals but like them, it does not serve as sound receptar. The muscles controlling the movement of external ear are found in human ear but for the most part, however, man's external ear is a degenerate organ and can be referred to as an evolutionary remnant.

The external ear can be differentiated into three distinct parts–the prnna, ear canal and ear drum or tympanic membrane. Pinna only serves to turn the sound waves

bumping upon it towards the ear canal or auditory meatus, measuring about 25 mm. in length and 7mm in diameter. Ear canal leads to the eardrum, a sensitive, movable, membranous diaphragm, demarcating the beginning of middle ear. This diphram is activated by the sound waves entering the ear.

2. The Middle Ear–The vibrations of the eardrum make three little bones in the middle ear-namely the hammer, the anvil and the stirrup to hit each other in sequence and carry the vibrations to the inner ear.

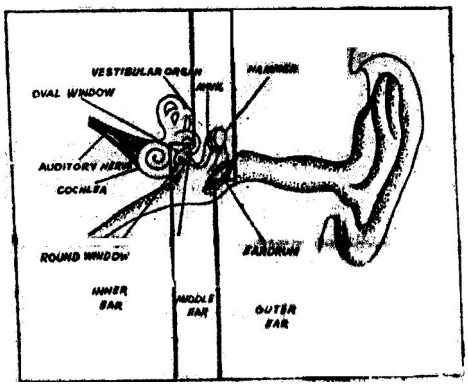


Fig. V

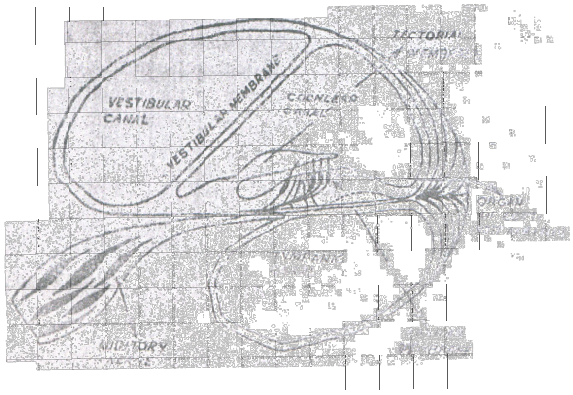


Fig. VI

The Structure of Human ear

Fig. VI A section through the smaill shaped cochlea. The true auditory receptors lie in the organ of corti, resting upon the basiler membrane. (Adopted from Hilgards Intro, to Psy. p. 235)

These three bones remain attached to the ear drum and also serve to reduce the amplitude of sound waves before sending them to the internal ear, causing a remarkable increase in the pressure of sound waves. This magnified pressure per unit area of about 30 to 1, facilitates the movement of sound waves in the oval window, another membrane attached to the stirrup bone. The eustachian tube in the middle ear serves to equalize the pressure inside and outside the ear. Just below the oval window, lies another membrane called the round window. It equalizes the pressure in the inner ear when the stirrup hits against the oval window.

3. The Inner Ear–The main auditory portion of the inner ear is cochlea, a coiled snail-shaped structure ending narrowly. The cochlear cavity consists of three canals, namely scala vestibuli, scala media and scala tympan and is filled

with a fluid. The Cochlea is divided lengthwise by a basilar membrane, which is narrowest near the oval and round windows and gets gradually wider as it coils inward towards its other end. Thus, the basilar membrane lies between the scala media and scala tympani. Another membrane lying between scala vestibuli and scala media is termed as Reissner's membrane.

Pressure at the oval window transists the vibrations into the fluid inside the Cochlea. This causes the fluid to set into motion which in turn makes the basilar membran pushing up and down, bringing the vibration further in inner ear. The pressure on the fluid in the cochlea stimulates the true auditory receptors lying in the organ of corti, situated at the basilar membrane between scala media and scala tympani. The organ of corti contains the auditory equivalent of the retina. It consists of the receptar cells for the sense of hearing in the form of millions of tiny hair cells, getting pushed and pulled by the movements of the Cochlear fluid. These hair cells are found to be distributed throughout the organ of Corti which again runs through the whole cochlea. Pressure changes in the fluid displace the basilar membrane upon which the organ of corti rests and consequently the sensitive elements in the hair cells of the organ of corti get stimulated. The hair cells also cause their adjacent bipolar neurons to fire sending out through the auditory nerve a coded message to the brain. This ultimately causes hearing in accordance to the coded message about the particular pattern of vibrations the sound has created.

CHECK YOUR PROGRESS EXERCISE NO. 2

Note : Use the space give below for your answer. Use separate sheet if required.

1. Explain what do you mean by Pitch and Loudness.

   _____

   _____

2. What is the range of Normal Conversational sounds ?

   _____

   _____

_____

3. Draw a diagram of Ear.

_____

_____

_____

4. Explain the structure of Ear.

_____

_____

_____

5. Name the main auditory portion of the inner ear.

_____

_____

_____

2.5.8 SUMMARY

- ➔ Hearing is probably second only to vision.
- ➔ Through Hearing we can understand speech.
- ➔ Sound pressure waves travel much faster than do waves of water.
- ➔ The unit used to measure the intensity of sound pressures is the decibel (dB)
- ➔ The physical frequency of sound waves is related to sensations of pitch.
- ➔ Periodic waves are composed of several sine waves that are multiples of each other.

➔ The frequency of a sound determines its pitch.

➔ In order for us to hear, our nervous system must be set into motion.

➔ The structure of ear has three principal parts. The external ear–which collects the energy. The middle ear–which transmits the energy and the Inner ear–where the transduction of energy into nerve impulses actually occurs.

2.5.9 REFERENCES

1. Experimental Psychology–Dr. Govind Tiwari and Dr. Roma Pal.
2. Introduction to Psychology–Morgan and King.

SENSATION : SKIN AND ITS DIFFERENT SENSES CHEMICAL SENSES–TASTE AND SMELL

B.A. SEM - II **Unit - II**

Unit–II **Lesson - 6**

Structure

2.6.0 OBJECTIVES :

- To know the cutaneous sensation and its types.
- Identify and analyse the skin and its different senses.
- To enable the student to understand the chemical senses.
- To make the student aware of the sensory processes in smell.
- To provide knowledge to the students about sensory processes in taste.

Prof. Manisha Kohli, MAM College, Jammu

2.6.1 CUTANEOUS SENSATION :

Primarily four types of cutaneous sensations have been described—Warm, Cold, Pain and Pleasure. Although sense receptors in the skin mediate a number of experiences as–cold, warm, softness, roughness, wetness and dryness. But, classical opinion tell us that there are only four primary skin sensation and other skin experiences are regarded as patterns or fusians of these four–warm, cold, pain and pleasure. Although, all the psychologists do not agree regarding the four main parts of Cutaneous Sensation (Stevens, S. S.).

In addition to above four types of cutaneous sensations Katz has described one more sensation–Vibration sense. Nafe (1929) has described only two types of Kinesthetic sensation–warm and cold. Human being get experience of this sensations on certain point or spot of the skin. According to Moriss, C. G. (1976), "Usually messages from all these senses are combined. Some areas of the skin are extremely sensitive to pressure, others to warmth or cold or extreme heat. Generally, the most numerous are the spots that respond to pain, than the spots that record pressure and finally the spots that are sensitive to cold and warmth. Each of these touch spots is surrounded by areas that are much less sensitive to tackle stimulation. The specific spots on skin create sensation of specific type of sensation. All the parts of the body do not have same magnitude of sensitivity.

Actually some parts of the body (for example face-lips and tongue) are more sensitive than others (e.g. back, the upper arms or the calves of the legs). The most sensitive parts of the body are represented in the Cerebral cortex by many more fibre endings and that is why these parts of the body are more sensitive. Psychologists have pointed out there is no equal distribution of different type of sensation spots. Cutaneous sensation has another characteristic i.e. cutaneous adaptation. Vonfrey and Kiesow (1899) had established this fact on the basis of their experiments that cutaneous sensation may be aroused by unnatural stimulus. Vonfrey (1899) has also proved that cold sensation can be originated through the warm stimulus.

2.6.2 SKIN AND ITS DIFFERENT SENSES

2.6.2.0 Pressure and Touch Sensation :

Several experiments have been conducted in this respect. Generally people

believe that the stimulus of pressure sensation is deformation of skin. For mapping the areas of the skin which respond to pressure sensation, Psychologists touch the skin with stiff hairs or ting hammers. For doing this experimentally a millimetre grid is stamped on the skin and a small horse hair is lightly touched to one of the squares. On some of the squares the subject does not feel any sensation whereas on other squares he reports that something is being touched to his skin. A very light pressure can stimulate the skin and most humans are aware especially on the lips, tongue and fingertips Several studies have been conducted in this area. Holway and Crozier (1937) used different types of glass tubes as the stimulus for pressure sensation but their subjects were unable to differentiate pressure sensation. Gray and Malcolm (1950) believe that pressure sensation is the response of Pacinian Corpuscles which are found in Cutaneous tissues. But Gray and Matthews (1951) belief that mechanical stimulus is not aroused only from the fiber but by the receptor. According to Candland (1968) "Basket endings, which surrounded the root of hairs, appear to respond to pressure and there have been reports that Markel disks, Meissner Corpuscles and free nerve endings may report pleasure also." It is estimated that human skin has about 5 lakhs touch points and their distribution is unequal. One square centimetre has pressure points between 0 to 300. It has been noted that if any pressure sensation stimulus is touched to the skin for long time then skin gets adapted to this touch stimulus because the skin is conditioned due to touch adaptation. It has been seen in daily life, if a person wears ring in his fingures for long time then the concerned person does not feel any touch sensation. Zigler (1932) conducted a study to know the intensity of stimulus on touch adaptation. He has noted that frontal part of hand has more touch adaptation in comparison to other parts of body. In this context some important experimental studies have been carried on by Gold Sheider (1952), Howill (1956), Golard (1957), Hocks (1960). Ziglar (1932) has given adaptation time for steady pressure of different regions of the body as given below.

Table showing Adaptation Time for steady Pressure (Zigler 1932)

Applied Wt m.g.	Back of hand	Region Stimulated		
		Foream	Forehead	Cheek
50	2.42	2.31	5.07	5.71
100	3.82	3.28	6.22	6.37
500	6.01	4.86	9.96	11.63
1000	6.71	5.60	10.43	13.51
2000	9.52	7.70	16.03	19.36

CHECK YOUR PROGRESS EXERCISE NO. 1

Note : Use the space give below for your answer. Use separate sheet if required.

1. Describe the various types of cataneous sensations.

   _____

   _____

   _____

2. Name the sensation Katz has described.

   _____

   _____

   _____

3. Name the various spots that are more sensitive towards pain.

   _____

   _____

   _____

4. Define skin and its different senses.

_____

_____

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5. Make a table of Zigler's adaptation time.

_____

_____

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2.6.2.1. Pain Sensation : According to Stagner and Solley (1970) "Pain is one of our most important sources of information in our never ending quest for survival. As a matter of fact, some people cannot experience pain, probably due to degeno of the nerve carrying the pain message to the brains. These people may stand against the stove untill they smell their own flesh cooking or they may walk on glass at a beach and never know it until they see the blood streaming out from their feet".

Mowrer (1950) "Pain sensation can be stimulated through mechanical heat, electrical or chemical stimulus when our skin is more deformed than we feel pain sensation instead of pressure.

Collins and Drever (1976) "Pain was experienced only as a result of the stimulation of particular free nerve endings. There is a sense in which they may possibly be true but pain is also experienced in association with the other cutaneous sensation when the stimulus reaches a certain intensity. Too great intensity of stimulation will produce pain in case of all receptors. Quick changes of intensity in stimuli giving temperature sensations will also produce pain". Candland (1968) was of this opinion that no single receptor is responsible for the pain sensation and for this it is important to have the knowledge of the functions of nervous system.

Monnier (1949) David and Dell (1949) and other psychologists have conducted experimental studies on human subjects and stimulated their thalumus and did not find any relationship between thalamous and pain sensation. The different parts of the body have different pain thresholds. The following table clears out this contention.

Table : Showing Stimulus Threshold for Pain.

		Pains per sq. mm
1.	Cornea	0.2
2.	Conjunctiva	2
3.	Abdomen	15
4.	Front of Forearm	20
5.	Back of Forearm	30
6.	Calf of Leg	30
7.	Back of hand	100
8.	Sole	200
9.	Finger Tip	300

Bishop (1944) Weddell (1951) and other scientists believe that free nerve ending is the only receptor for pain sensation because it has been found in the skin of all the human. According to Hebb (1949) the feeling of pain sensation is only due to the intense stimulation. The number of pain spots on skin has been estimated between 20 to 40 ks approximately. In our psychological lab, we deal with pricking pain which is aroused by stimulation of a pain spot. Pricking pain is not particularly unpleasant for the subject. When stronger estimation is applied over a wider area then one feel dull or aching pain. Our skin has the characteristic of pain adaptation. In this context, an experiment was conducted by Stone and Dallenbach (1936). In this experiment "when several needles are simultaneously applied to an area 15 mm. in diameter on the foream adaptation may take as long as 5 minutes but it is eventually complete in practically all cases".

According to Evsenck, et. al, "Pain : A shift of metabolic into pathological processes, whether caused by damage to the skin or by chemical substances, leads to the sensation of pain through depolarization in fine nerve fibres situated in the upper layers of the epithelium.

CHECK YOUR PROGRESS EXERCISE NO. 2

Note : Use the space give below for your answer. Use separate sheet if required.

1. Give the definition of pain sensation by Mowver.

   _____

   _____

   _____

2. Write down the stimulus threshold for pain.

   _____

   _____

   _____

3. Define pain as described by Eysenck.

   _____

   _____

   _____

4. Give the number of pain spots on skin.

   _____

   _____

   _____

2.6.2.2. Temperature Sensation : Heat And Cold. Both heat and cold spots are related to temperature sensation. "The experiences of 'warm and 'cold' depend upon a level of adaptation this level providing a kind of zero point' (Hilgard, 1962). Generally human body bears temperature 30° centigrade and 35° centigrade in open and close parts of the body respectively so the stimulus of cold sensation will be below 33° centigrade and the stimulus of hot sensation will be above 35° centigrade. This type

of sensation appears to depend on two different kind of recepters. “One spot on the skin may be sensitive to only objects that are 1 or 2 degree centigrade warmer than body temperature ; another area will be sensitive only to objects that are 1 or 2 degree centigrade cooler than body”. (Morris, C. G. 1970). Weber (1946) has found from his experiment that the same temperature may seem simultaneously warm to one hand and cold to other hand. For this experiment, he has taken 3 bowls of water at 20°, 30° and 30°C. In this experiment, Weber instructed the subject to dip one hand in warm water and other in cold water for a minute or two and then transfer both hands to the medium water. In this experiment, Weber had formulated a theory of the adequate stimuli for the temperature sensation. According to this theory, warmth sensation is the result of the rise in temperature of the skin, whereas the cold sensation is due to the fall of temperature. Hearing (1877) has formulated an opposed theory in which he had pointed out that when the skin is adapted to any temperature, a higher temperature constituted a warmth stimulus and a lower temperature a cold sense stimulus. Actually warmth and cold are different type of sense organization. Vonfrey has found from his experiments that warmth stimulus (40° to 50° centigrade) originate cold sensation if stimulated by the cold spots of the skin. This situation can be termed as Paradoxical cold and opposite of this is Paradoxical warmth. We can study cold receptors easily in comparison to warm because cold receptors can easily be found. The cold receptors are always firing at about 5 to 15 impulses per second and at the sudden temperature change, this rate increases over 100 impulses per second (Hahn, 1974).

Strughold (1926) repeated the experiments of Vonfrey (1895) with the use of camel’s hair brush lightly covered with cotton wool, dipped into warm physiological salt solution. He applied this instrument to the cornea or conjunctive and tested the outer skin of the eyelid. The obtained results are tabulated below.

Area	**20–30**	**30**	**32–38**	**39–46**	**47–51**	**52–55**	**55–60**
1. Skin on the lid	Cold	None	Warm	Warm	Hot	Burning hot	Burning

2. Conjunctive Side	Cold	None	None	None	Cold	Burning Cold	Burning
3. Conjunctive below	None	None	None	None	None	Burning	Burning
4. Cornea Margin	Cold	None	None	Burning		Unendurable burning	

The receptors of cold and warm are called as Krause's end bulb and Ruffini's corpuscles. The Krouse's end bulbs (cold receptor) is situated at a depth of .1 mm, whereas Ruffine's corpuscles at .95mm. Due to this, we can experience warmth sensation immediately in comparison to cold sensation. Body temperature is regulated by these receptors.

The distribution of cold spots are uneven which indicates some parts of the skin possess too much cold spots whereas some parts little or totally absent. The total number of the cold spots in human skin is estimated 5 lakhs approximately. The number of warm points is less than cold. In nut shell, we can say that the skin has been widdy explored by Strughold and his associates. Von Skramlik (1937) assembled the different results of different experiments which we are going to present in following table :

Table : Showing Spots Per Square Centimeter

	Pain	**Touch**	**Cold**	**Warmth**
Forehead	184	50	8	.6
Tip of Nose	44	100	13	1.0
Chest	196	29	9	.3
Volar side of Forearm	203	15	6	.4
Back of hand	188	14	7	
Ball of Thumb	60	120		

CHECK YOUR PROGRESS EXERCISE NO. 3

Note : Use the space give below for your answer. Use separate sheet if required.

1. Discuss the two spots related to temperature sensation.

_____

_____

_____

2. What is Paradoxical Cold and Paradoxical Warmth ?

_____

_____

_____

3. What is the total number of cold spots in human skin ?

_____

_____

_____

4. Name the receptors of cold and warm.

_____

_____

_____

2.6.3 THE CHEMICAL SENSES :

Primarily two types of chemical senses have been described by the Psychologists – (i) difaction or smell and (ii). Gustatory senses. Both type of chemical senses have a significant impact in human life. The human beings are accustomed with different type of chemicals salt, vinegar, benzene and hydrogen sulphide and the corresponding sensory

mechanisms are grouped in the heading of chemical sense. Parker (1922) pointed out that besides the two main chemical sense, there is some reason for recognizing a more primitive common chemical sense. Most of the animals who live in water (from paramecium to frog) react whenever certain chemicals are applied to almost any body surface. Due to chemical sensation they avoid harmful substances. Smell and taste are highly developed senses and each has its own specified receptors. The receptors of taste and smell are free nerve endings in the mouth and nose respectively.

2.6.4 SENSORY PROCESSES : SMELL

It is through smell of course, that we detect and experience many of the events in the chemical world that surrounds us. But smell may also have a special role to play in behaviour. Smells seems to trigger behaviour and start trains of thought ; smells judged as pleasant may set off approach behaviour, while smells judged as unpleasant may arouse avoidance behaviour. And smells can also serve to trigger memories of past emotional experiences.

The receptors for smell respond to chemical substances, especially if those substances are volatile. Smell receptors are located high up in the nasal passages leading from the nostrils to the throat (Fig. 1). They lie in two small patches, one on the left and one on the right, in the roofs of these passages. Since they are a little off the main route of air as it moves through the nose in normal breathing, our sense of smell is relatively dull when we are breathing normally and quietly. A sudden sniff or vigorous intake of air, however, stirs up the air in the nasal passages and brings more of it to the receptors. This is why animals and people sniff when they are trying to idlentify an odor.

The sensitivity of the smell receptors is impressive. People can detect incredibly small amounts of odorous substances. For instance, artificial musk, one of the most odorous of all scents, can be sensed by human beings in a concentration of 0.0004 milligrams in a liter of air. The smell receptors must be responding to only a few molecules per sniff and the sense of smell in many animals surpasses that of human beings.

If we recall all of the odours that we encounter in a day, we will realize that they have many shades and qualities. Scientists have raised the questions of whether such

a multitude of sensations might not result from mixtures of a relatively few primary qualities. There are a few unique odors which mixed in different proportions might account for the various discriminable odors. If we could identify the basic odors, we might be able to relate the basic odors to particular features of the smell receptor. But smell has not proved to be this simple. A number of basic odor systems have been proposed. For instance one system says the four basic odors are fragrant (musk), acid (vinegar), burnt (roast coffee) and caprylic (goaty or sweaty). Each system serves some particulars purpose well.

Adaptation : The most familiar change in sensitivity is adaptation resulting from continuous exposure to an odor. Zwaardemaker (1895) pointed two basic factors in adaptation exposure time and the strength of adapting order. For example, due to the olfactory adaptation, the workers in the hospital do not feel irritation at the smell of the medicines whereby a newcomer may feel irritated at the smell of the medicines in the hospital ward.

CHECK YOUR PROGRESS EXERCISE NO. 4

Note : Use the space give below for your answer. Use separate sheet if required.

1. Discuss smell sensation.

   _____

   _____

   _____

2. What are the fundamental odours ?

   _____

   _____

   _____

3. What are the two basic factors in adaptation as given by Zwaardemaker ?

   _____

   _____

   _____

2.6.5 SENSORY PROCESSES : TASTE

Taste Sensation or Gustatory Sensation

The potential stimulus for taste must be dissolved or soluble substance. Normally in order to taste a substance, it must go into solutions on coming in contact with the saliva. Thus the sense organ for sensation of taste is tongue. It has two layers :

1. Outer Layer
2. Inner Layer

The inner layer is shaped into various folds. There are taste buds which contain a number of taste cells. Thus the receptor cells for this sensation are activated by some chemical stimuli. The receptors are clustered into structures know as taste buds. These buds are present in the surface and edges of the tongue. The surface of tongue appears to be rough because of a large number of elevations called papillae. The taste buds are burried into these papillae. The number of taste buds in man in about 10,000 in each taste bud, there are about 6 to 18 gustatory cells. The taste bud thus is made up of a cluster of sensory cells which are receptors, connecting the nerve fibres leading to the brain. Unless the stimulus or part of it dissolves in the saliva, taste sensation cannot be obtained.

Basic Taste **:** These are of 4 types :

1. Sweet
2. Sour
3. Bitter
4. Salt

Different parts of the tongue are sensitive to different kinds of taste.

1. Sweet (Tip of tongue)
2. Bitter (Back of tongue)
3. Sour (Side of tongue)
4. Saltish (Tip/sides all the surface of tongue)

Taste of many things we taste are known as compound tastes e.g., grapes which give combination of bitter /sour/sweet taste. There are blend of taste. Blend of taste occurs when the taste in mixed with smell. For example, flavour of food is a combination of taste and smell. The development of taste receptors are completed till 21 years and decreases after 45 years, Alara (1939) studies of taste receptors have

shown that a single taste receptor is stimulated not by specific stimuli but by several receptor cells.

Taste Adaptability **:** If a taste stimulus is presented to our taste organ for a long period of time, then rapid decline appears in our taste sensation and after sometime, the stimulus appears more neutral. This process is called as adaptation.

CHECK YOUR PROGRESS EXERCISE NO. 5

Note : Use the space give below for your answer. Use separate sheet if required.

1. Name the sense organ for sensation of taste.

   _____

   _____

   _____

2. Describe the two layers of tongue.

   _____

   _____

   _____

3. How many taste buds are present in a man ?

   _____

   _____

   _____

4. Name the basic types of taste with reference to different parts of the tongue.

   _____

   _____

   _____

5. What is taste adaptability ?

   _____

   _____

   _____

2.6.6 SUMMARY

Four type of cutaneous sensations warm, cold, pain and pleasure. Skin has different senses i.e. pressure and touch sensation, pain sensation, temperature etc.

2. Types of chemical senses are known olfaction or smell and Gustatory senses. Two main sensory processes are smell and taste. Smell related to olfaction and taste is related to Gustatory senses.

2.6.7 REFERENCES :

— Experimental Psychology–Dr. Govind Tiwari and Dr. Roma Pal.

— Introduction to Psychology Morgan and King.

PERCEPTION

B.A. SEM - II **Unit - III**

Course No. : PY-201 **Lesson : 7**

7.1.0. OBJECTIVE

After going through this lesson the student will:

(1) Be able to understand meaning of perception

(2) Be able to understand Gestalt law's of perceptual organization.

7.1.1. MEANING OF PERCEPTION

We live in a world of objects and people– a world that constantly bombards our senses with stimuli. Only under the most unusual circumstances are we aware of a single stimulus, such as a point of light in a dark room or a pure tone in a sound proof chamber. We see pictures instead of spots of light and hear words or music instead of pure tones. We react to patterns of stimuli, usually with little awareness of the parts composing the pattern. A detail of an oil painting may appear to be a meaningless collection of daubs of paint. The total impression from organized stimuli has properties not predictable from the parts in isolation.

Dr. Rashmita Swain, Department of Psychology, University of Jammu, Jammu

The perception of objects and events takes place within a framework of space and time. Vision and audition provide the most complex patterns of these perceptual experiences. Vision is our preferred spatial sense, giving us variegated patterns of form and color in three dimensions. But it also provides a sense of time, because we see succession, movement and change. Audition is a spatial sense too; we can be aware simultaneously of many sounds coming from different locations. But spatial patterns in audition are more limited than those of vision. Audition is primarily a time sense; its main patterns are those of succession, change and rhythm.

Carr (Functionalist 1925), states that perception may be defined as the cognition of a present object in relation to some act of adjustment. Perception is selective, organized and meaningful.

Gestalt psychologist states that our perceptual experiences arise as molar configuration, which are not mere aggregations of sensations but organized and meaningful wholes.

From above definition it can be concluded (1) perception is a mental activity (2) perception is selective (3) perception is an organised process (4) perception leads to some change, pressure, temperature or visual change (5) we perceive the objects as stable and enduring. The stability depends on the various constancies of brightness, color, shape and location.

Check your progress exercise-1

Note: Use the space below for your answer. Use separate sheet if required.

(1) What is perception?

_____

_____

_____

(2) What is the definition of perception according Gestalt school of psychology?

_____

_____

_____

(3) From various definitions? What you conclude about perceptual process?

_____

_____

7.1.2. GESTALT LAW OF PERCEPTUAL ORGANIZATION

Perception as an organising activity

Perception is an active process may be understood from a characteristic of organisings activity not only in selecting a particular stimulus at a particular time but also in the process of combining and grouping stimuli. This activity of combining and grouping enables us to perceive definite patterns or exact figures, which have some meaning for us. This process of forming patterns has been greatly emphasized as an important characteristic of the perceptual process by the Gestalt school of psychology. This school has contributed a great deal to our knowledge of the various factors, which determine this kind of grouping, and organising. They have demonstrated a number of factors, which affect and direct this process of patterning and forming of wholes within the perceptual field. We shall considered here the major factors:—

(i) Figure and ground relationship: William James characterized the perception of an infant as a 'blooming buzzing confusion'. By this he meant that the young infant cannot perceive anything clearly and that within its perceptual field nothing takes any definite or clear shape. The Gestalt psychologist have taken serious objection to such a view. They have shown that even in the simplest form of the perceptual process the factor of figure and ground relationship operates. If the mother, for example, comes with the perceptual field of the infant, it may not perceive the mother as it would perceive her some years later with all the richness of the concept ‘mother’. But the Gestalt psychologist claim that even in the early stage, the furniture of the mother, will stand out as one single harmonious unit as against the other things of the environment viz., the room of the walls or the furniture. The perception of the mother's figure may itself be very vague and may be devoid of all meaning. Still it will be perceived as a unit and as different from the background against which it is seen. In this example, the face of the mother becomes the ‘figure’ and the rest of the room the ‘ground’.

According to these psychologists, the very innate nature to the perceptual process is to form such figures and grounds or background. The most primitive perception is only figure and ground perception. More details about the figure may be learned gradually making the percept more meaningful. It is certainly true that all perception is done against a background. Attention which result in perception always makes some part of the perceptual field clearer. At any particular time our field of awareness has certainly extensity. But all things within that field are not perceived with equal clarity. There is always a focus and a fringe. The focus is determined and directed by the process of attention. Even in most primitives and elementary stages there is some kind of focus which determines the figure in the perceptual field at that particular moment.

The information of the figure may mostly depend upon the more advantageous compactness of shape or contour or colour etc., if some particular part of the field of awareness. It is true of course that sometimes when there are various parts within the general field of awareness, which have equally balanced qualities there may be a conflict and two or more figures may be formed. In such a case there will be a shifting of ground and figure. One part may be the ground at the moment and at the next moment the ground may become the figure. Such a shifting or conflict will depends upon the various factors that help to form steady and significant figures.

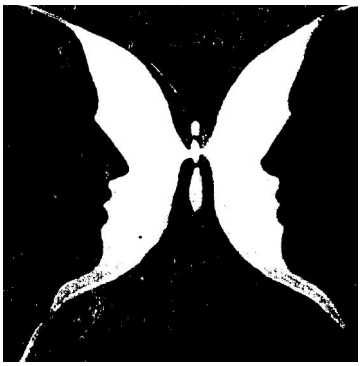

Fig. 1 A butterfly or two faces ? An example of figure ground relationship. Also illustrates shifting in perception.

(ii) Proximity or being near in space: If there are some dots or small figures lying close together, they will be seen together as one pattern or group. Dots that are widely separated in space may not be so easily included to form one group.

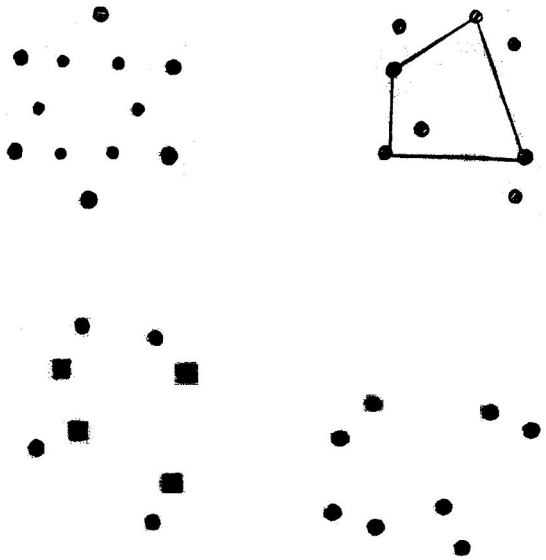

Fig. 2 Illustrating the factors in grouping during perception.
A. Inclusiveness. B. Continuity. C. Similarity. D. Proximity

(iii) Similarity or likeness: Suppose there is a group of dots and some other figures say, small squares or triangles. If you just glance at such a picture invariably you will perceive all the similar things as one pattern or group. All the dots will form one group and force themselves in your perceptual field as one unit. Similarly all the rectangles may be seen together. Thus even if a rectangle and a dot are situated together in space, the factor of similarity has the advantage over the factor of proximity.

(iv) Inclusiveness: If a pattern could be found using up all the elements in the field, such a pattern will have an advantage over any other less inclusive pattern. Here all the dots are perceived together as one pattern, the meaning depending upon one's experience and training. This factor of inclusiveness sometimes plays only a secondary role to the factor of familiarity. This factor of inclusiveness may also operate in a slightly different form by giving the qualities of the figure only to the outside elements, forming almost a fence or an enclosure within which all other elements are included.

(v) Continuity: A continuous line has an advantage forcing itself into a figure. When there are several dots may form a vertical and a horizontal line,

irrespective of the factor of proximity, a vertical and a horizontal line may be perceived. The whole perceptual field is organized into two lines even though the dots are not actually connected. The factor of continuity operates in a more direct form if such dots are actually connected together by lines. Dots that are connected together are seen more readily as one group.

(vi) ***Closure:*** One of the fundamental principles which the Gestalt school emphasizes as operating not only in the process of perception but also in all psychological phenomena is the principal of closure. They have shown that there is always a tendency for incomplete figures or nearly complete figures to complete themselves. Forming the figures will of course depend upon the conditions of our past experience. In this figure one invariably sees as incomplete star or even a complete star glossing over the gaps. Actually the figure is nothing but a collection of open angles. But very seldom we see the figure as such. The innate nature of the brain process is such that it is easier for us to see a complete and balanced figure than a mere collection of disconnected lines or angles.

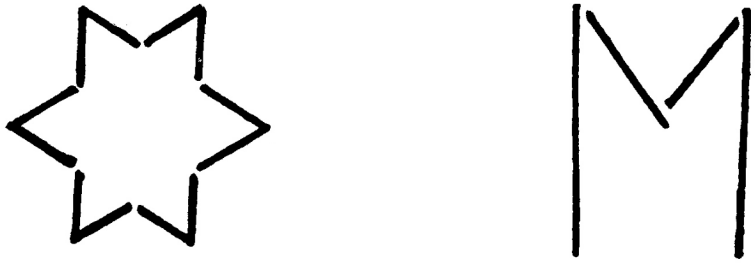

Fig. 59. Illustrating the fact of closure in perception, the small gaps are overlooked while perceiving the figures.

(vii) ***Familiarity or past experience:*** In some miscellaneous mass of dots or lines the pattern of a familiar object or figure, say, a circle or a human figure will stand out more easily as one organised unit than others. This of course, depends to a large extent on our past experience. In fact, familiarity or past experience is a very strong factor of advantage.

CHECK YOUR PROGRESS EXERCISE - 2

Note: Use the space below for your answer. Use separate sheet if required.

(1) What are the principles of perceptual organization given by Gestalt psychologists?

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(2) How contours play important role in perception? Give an example?

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(3) Explain role of Symmetry in perceptual organization?

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(4) Define closure in perception?

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7.1.3. SUM UP

Perception is defined as what is experiences by a person. Sensory-input patterns are said to provide only the "raw material" for experience. Perception-our experience of the world-arises from sensory inputs plus the way in which we process this sensory information. Illusions are example of perceptual process at work. According to Gestalt psychologists (Mary Wertheimer, Kurt Koffka and Wolfgang Kohler) the major principles of perceptual organization are (1) figure and ground relation principles (2) proximity (3) similarity (4) symmetry (5) continuation and (6) closure.

7.1.4. REFERENCES

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PERCEPTUAL CONSTANCY

B.A. SEM - II **Unit - III**

Course No. : PY-201 **Lesson : 8**

8.1.0. OBJECTIVE

After going through this lesson the student will:

(1) Be able to understand meaning of perceptual constancy

(2) Be able to understand depth perception.

(3) Be able to understand visual illusions.

8.1.1. PERCEPTUAL CONSTANCY

Perceptual Processes: Constancy

The world as we perceive it is a stable world, and this stability is present early in life. For instance, a man's size does not appear to change much as he walks toward us; a dinner plate does not look like a circle when viewed from one angle and an

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elipse when viewed from another; and the location of a sound does not appear to change when we move our heads. Stability of perception helps us to adapt to the environment. It would be virtually impossible to operate in a world where sounds changed their location as we moved our heads and objects changed their shapes and sizes when viewed from different positions and distances. Imagine what it would be like if your friends assumed a multitude of sizes and shapes. The stability of the environment as we perceive it is termed perceptual constancy.

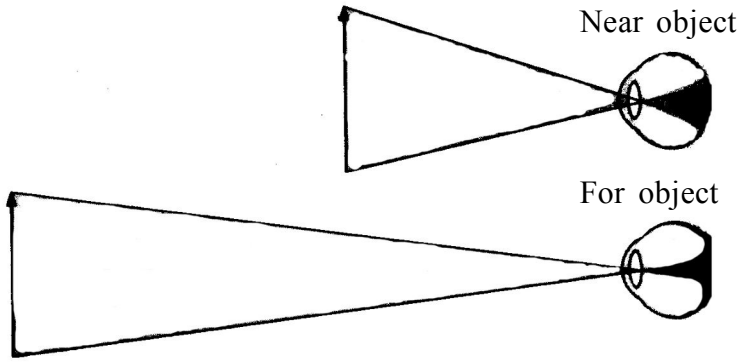


Fig. 1

SIZE CONSTANCY

The size of the representation, or "image", of an object on the retina of the eye depends upon the distance of the object from the eye; the farther away it is, the smaller the representation. This geometric fact is illustrated in Figure 3.40. Similarly, a representation of the same size can be produced on the retina by a nearby small object or a larger object at some distance.

Yet when you cross the street to speak to a friend, your perception of the friends size does not change much, even though the retinal representation alters greatly in accordance with the geometry of the situation. Contributing to this constancy is a great deal of additional information you have about the circumstances. You know something about the distance of the friend from you; you perceive the changes that take place in other objects as you approach your friend; and you know how large your friend is supposed to be-the friend's assumed size.

The importance of distance and background information in maintaining size constancy as shown in a classic experiment by A.H. Holway and E.G. Boring in the

1940s (Holway & Boring, 1941) they used ambiguous stimuli-disks of light-which could have no real assumed size, and they changed the amount of distance and background information available to the subjects in the experiment. They found that size constancy decreased as the distance and background information available to the subjects decreased. In other words, the subjects perceived the size of a disk of light more in accordance with the size of the retinal representation when they lacked information about distance and background.

One interpretation of this result might be that people somehow automatically use information about distance and background to "correct" the size of their retinal representations, thus keeping their perceptions relatively constant. Another interpretation is that no "correction" is necessary-that size constancy occurs because the object and its background change together as the distance of the object changes. For instance, the texture of the object-the number of fine grained details that can be seen-and the texture of the background change together as distance changes. Also, the retinal size of the object changes with the retinal size of the background objects. Thus, according to the interpretation (Gibson, 1950), perceptual size constancy results when an object and its background change together in such a way that the relationship between them stays the same. We will see another example of the importance of relationship in perceptual constancy when we discuss brightness constancy.

Our knowledge of the size of a familiar object-the assumed size-can sometimes be an important factor in size constancy, especially under conditions in which other information is not available or its ambiguous. But under everyday conditions of perception, conditions in which distance and background information are available and unambiguous, the assumed size of familiar objects is not an important factor in maintaining size constancy (Fillenbaum et al., 1965).

SIZE CONSTANCY AND ILLUSIONS

Some of the illusions have been "explained" in terms of "misplaced" size constancy (Gregory, 1978; Coren & Girgus, 1978). In the "railroad-track", or Ponzo, illusion, for example, even though the two horizontal bars are the same lengths, we perceive the upper one as longer than the lower one. The illusion is said to work because the railroad tracks covering in the distance provide a strong cue for depth-linear perspective. Figure 2.

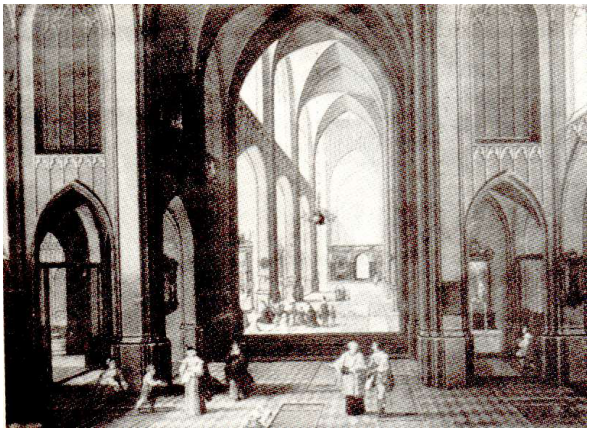


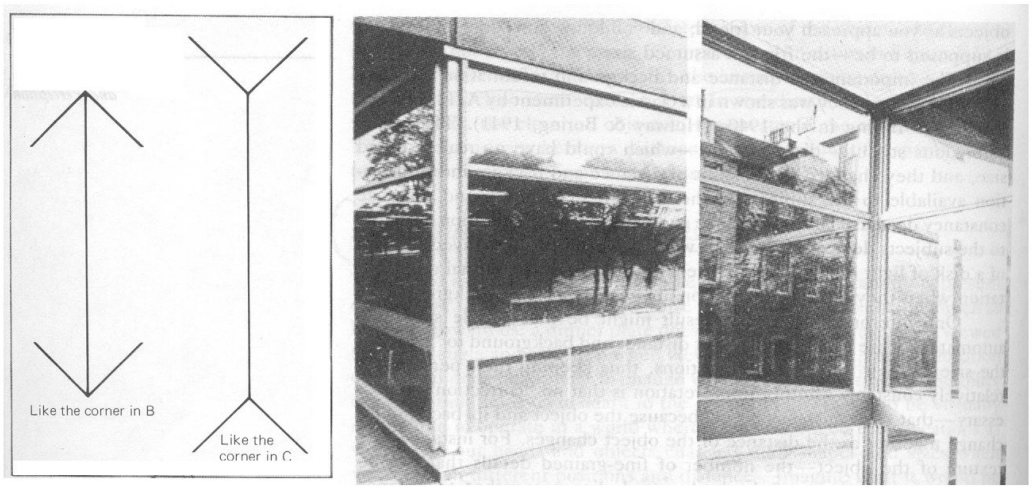
Figure 2.

Thus we receive information that the upper bar if farther away than the lower one. Now, from what we said about size constancy above, you know that we tend to perceive distant objects as larger than we would if we considered only the size of retinal representation (your distant friend, remember, looked about the same size as when he or she was closer). In the illusion, the horizontal bars are the same lengths, but size constancy leads you to "magnify" the distant one. A similar explanation having to do with depth cues can be given for the "cylinder illusion" at the beginning of this chapter. In these examples, and in the illusions to be considered below, size constancy is said to be "misplaced" because it leads to an illusion.

The arrowhead, or Muller-Lyer, illusion shown in figure 3 and in Figure a, has also been explained in terms of depth cues and "misplaced" size constancy. If the arrows point outward, as in the left part of (Figure a), we perceive the line connecting them as relatively near. On the other hand, the line connecting the inward pointing at rowheads is perceived as distant. Once again then size constancy mechanism go to work to "magnify" the length of the distant operating line, but since the lines in are the same length, size constancy is "misplaced" and the illusion results (Gregory, 1978).

As another example, consider the moon illusion. Whether the moon is high in the sky or on the horizon, its representation on the retina is the same size, but it is perceived as much larger on the horizon. One explanation of the illusion says that when the moon is near the horizon, building and trees provide depth cues indicating that the moon is indeed far away; farther up in the sky, these cues are absent. From what

has already been said about size constancy and illusions, you can see how the moon illusion might be partially explained.



A **B** **C**

Fig. 3

Fig. 5

BRIGHTNESS CONSTANCY

Visual objects also appear constant in their degree of whiteness, grayness, or blackness, even though the amount of physical energy reflected from them may change enormously. People are not like photoelectric cells, simply registering the amount of light being reflected from a surface. Our experience of brightness stays relatively constant despite great changing in the amount of physical energy reaching our eyes. For example, objects or surfaces that appear white in a bright light are

still perceived as white in dim illumination. Similarly, what looks black to us in dim light still looks black in intense light. Coal looks black even in very bright sunlight, while snow continues to look white even at night. Another example of brightness constancy is the appearance of a white paper that lies partly in shadow. We perceive the paper as uniformly white; we do not perceive the shadowed portion as gray, but rather as white in the shadow.

We have brightness constancy, because in most situations, when the illumination changes, it changes over the whole field: the physical energy ratio between an object and its surround stays constant. For example, if I turn up the lights in my room, the cover of the book on my desk looks just as bright as it did before because the ratio of the illumination falling on the book cover and that falling on its surround has not changed. In other words, unchanged-brightness ratios give constant brightness experiences, or brightness constancy. While this rule must be accepted with some reservations because it probably does not hold for the entire range of stimulus intensities (Jameson & Hurvich, 1964), it is a useful first step toward an explanation of brightness constancy.

Check your progress exercise-1

Note: use the space below for your answer. Use separate sheet if required.

(1) Define perceptual Constancy?

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(2) What is colour constancy?

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(3) What is size Constancy?

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(4) What is location Constancy?

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8.1.2. DEPTH PERCEPTION

Perceptual Process: Visual Depth Perception

Hundreds years back Scientists could not understand how we could see a three dimensional world with only a two dimensional, or flat, retina in each eye. Today we realize that the ability to perceive depth is no more amazing than is any other perceptual accomplishment. We are able to make use of information, or cues in the sensory input to 'generate' the three dimensional world that we see. Thus the question is: what are the cues we use to see depth and distance? Part of the answer lies in the cues received by each eye separately - the monocular ("one-eyed") cues for depth perception. Another part of the answer is found in the cues received from both eyes working together - the binocular ("two-eyed") cues.

MONOCULAR FOR DEPTH PERCEPTION

As the name suggests, monocular cues are cues that can operate when only one eye is looking. These cues are the ones used by painters to give us a three-dimensional experience from a flat painting Fig. 1 the eye picks them up and we perceive depth.

Linear perspective the distances separating the images of far objects appear to be smaller. Imagine that you are standing between railroad tracks and looking off into the distance. The ties would seem to gradually become smaller and the tracks would seem to run closer and closer together until they appeared to meet at the horizon. Figure 2 owes part of its depth effect to such linear perspective.

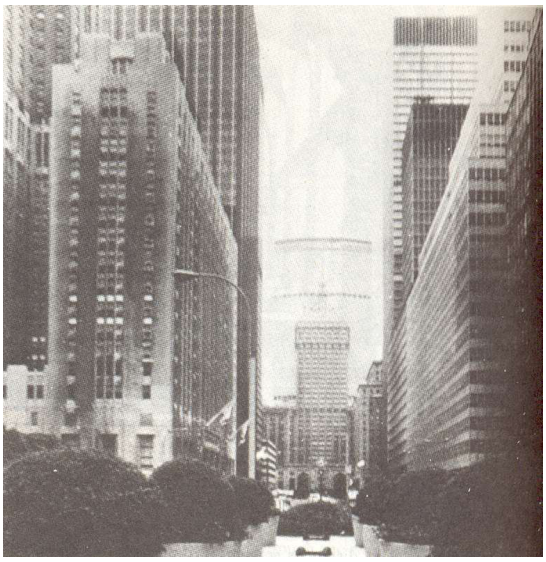

Fig. 2

Clearness learness In general, the more clearly we see an object, the nearer it seems. A distant mountain appears farther away on a hazy day than it does on a clear day because haze in the atmosphere blurs fine details and we can see only the larger features. Ordinarily, if we can see the details, we perceive an object as relatively close; if we can see only its outline, we perceive it as relatively far away. Figure 2.

Interposition Still another monocular cue is interposition, which occurs when one object obstructs our view of another. When one object is completely visible while another in partly covered by it, the first object is perceived as nearer Figure 2.

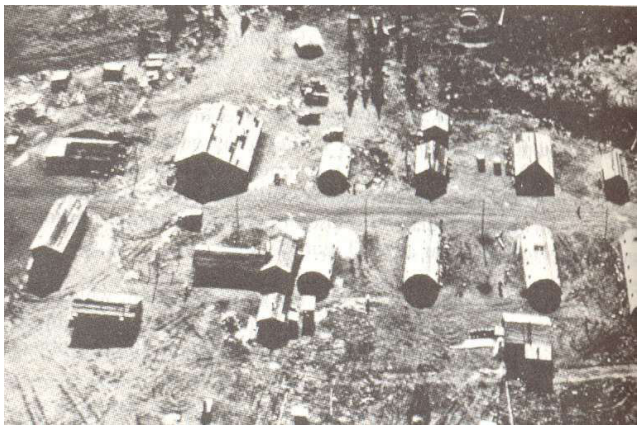

Fig. 3

Shadows, as Figure 3 shows the pattern of shadows or highlights in an object is very important in giving an impression of depth. When this aerial photograph of a group of Quonset huts is turned upside down, the Quonset huts look like towers. If you carefully note the differences between the Quonset huts and the "towers", you will discover that the shadows are responsible for this effect. The reason is that we are accustomed to light coming from above. When the picture is turned upside down, we don perceive the Quonset huts as illuminated from below.

Instead we see towers with black-painted tops because the dark areas are now of such a size and in such a position that they cannot possibly be shadows if the light is coming from the above. We do not, of course, reason this out. The perception is immediate, based on whether or not the dark areas appear to be shadows.

Gradients of Texture A gradient is a continuous change in something-a change without abrupt transitions. In some situations, we can use the continuous gradation of texture in the visual field as a cue for depth (Gibson, 1950). The reasons closest to the observer have a coarse texture and many details; as the distance increases, the texture becomes finer and finer Figure 4. This continuous gradation of texture gives the eye and brain information that can be used to produce an experience, or perception, of depth.

Fig. 4

Movement When you move your head, you will observe that the objects in your visual field move relative to you and to one another. If you watch closely, you will

that the objects nearer to you than the spot at which you are looking-the fixation point-move in a direction opposite to the direction in which your head is moving. On the other hand, objects more distant than the fixation point moves in the same direction as your head moves. Thus the direction of movement of objects when we turn our heads can be a cue for a relative distance of objects. Furthermore, the amount of movement is less for far objects than it is for near ones. Of course, as is the case with all depth cues, we do not usually think about this information; we use it automatically.

A BINOCULAR CUE FOR DEPTH PERCEPTION

As we have just seen, many of the cues for depth require only one eye. In fact, one-eyed people, under most conditions, have quite adequate depth perception. Most of us, though, look out at the world with both eyes simultaneously, and we are thus able to add binocular cues for depth perception to the monocular ones. By far the most important binocular cue comes from the fact that the two eyes-the retinas-receive slightly different, or disparate, views of the world. Therefore, this cue is known as retinal disparate; it is the difference in the images falling on the retinas of the two eyes.

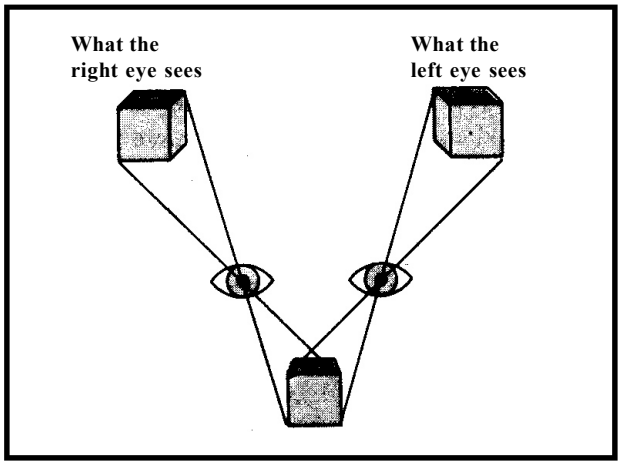

Fig. 5

To understand retinal disparity, consider the geometry of the situation when the two eyes view an object. Figure 5. The fovea in the center of the retina is much more sensitive then is the rest of the retina. When we look at an object, we fixate our eyes-point them, in a manner of speaking-so that the image of the object falls mostly on

each fovea. But since the two eyes are separated from each other by about 65 millimeters, they are slightly different views of the object, and the two images are not exactly the same. Moreover, , and this is the main point, the images are more dissimilar when the object is close than when it is far in the distance. In other words, within limits, the closer an object is, the greater is the retinal disparity. The correspondence between distance and the amount of disparity is the reason retinal disparity can be used as a depth cue.

Check your progress exercise-2

Note: use the space below for your answer. Use separate sheet if required.

(1) What is depth perception?

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(2) Define monocular cues of depth perception?

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(3) Define the binocular cues of depth perception?

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8.1.3. VISUAL ILLUSION

Visual Illusions

An illusion is a wrong or mistaken perception. We get the sensory experience of a stimulus, which has a real existence. The perceptual process always involves an interpretation of the sensory experience in the light of our past experience, or present attitude, or organic needs, etc. In some cases this interpretation is done wrongly and so the stimulus is perceived wrongly. Such a phenomenon is called illusion. The

illusion the classical example of illusion is our perception of a coil of rope in darkness as a snake. The stimulus is exactly like that coming from a snake and it is quite real and objective. Because of the similarity, we perceive the rope as the snake, guided mostly by our past experience, our fear and the darkness. When there is thus a well defined and very similar stimulus, an error in its perception is called illusion. Psychologists have experimented with a number of geometrical designs to understand the phenomenon of illusion. Two of the well-known examples are The Muller-Lyer illusion and horizontal-vertical illusion Fig.2. Also see Figs. 1, 3 and 4 for more examples). In the Muller Lyer illusion there are two straight lines of equal length. One is bounded at the two ends by pairs of short opening outwards. The other is bounded by two pairs of short lines, which are reversed and give the idea of closure. Though the two lines are equal in length invariably the latter is perceived to be shorter than a former. This of course, is an illusion. In the horizontal-vertical illusion there are two straight lines, one horizontal and the other vertical. Both are of equal length. But in other interesting example is given in Fig. 3. If we look at this figure we would perceive it as a spiral or as a set of concentric circles. Actually it is neither. A close observation shows that it is only a series of unconnected short bits of lines.

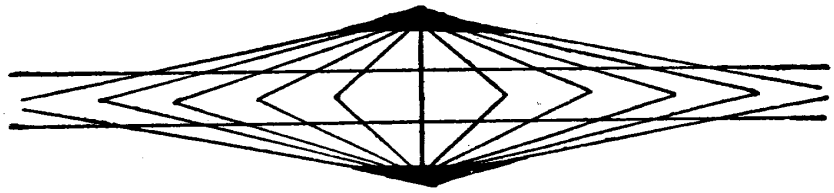

Fig. 1 Hearring's Figure. Are the two Horizontal lines parallel ?

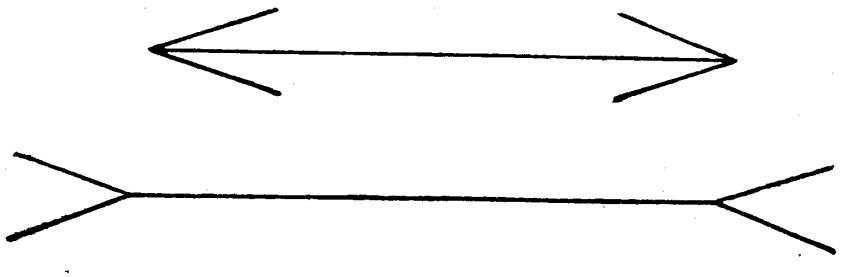

Fig. 2 Muller-Lyer illusion. Which line is longer?

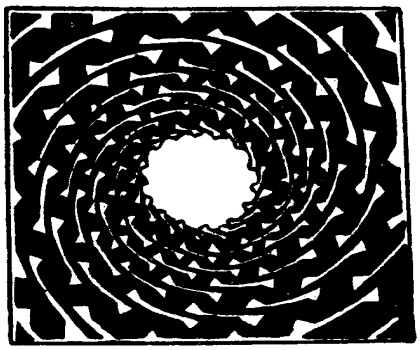

Fig. 3 A spiral or concentric circles ? (It is neither)

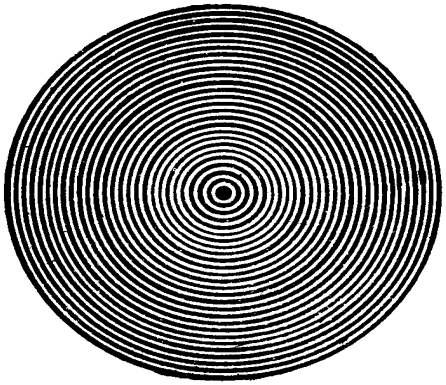

Fig. 4 Another illusion. Give a book circular rotation motion. A moving rading will be seen. After Thompson. S. P. 1876

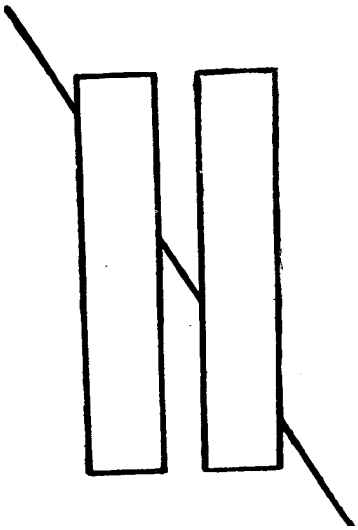

Fig. 5 Illusion of direction B. Pogendorff's. Is AB one straight line ?

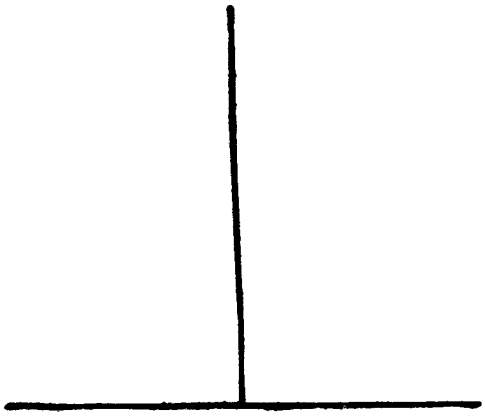

Fig. 6 Horizontal vertifical illusion

All the examples of illusions mentioned above are optical illusions. But the other sense organs are equally subject to the phenomenon. Though optical illusions are easy to be illustrated we do have other illustration such as auditory, tactual etc.

More optical illusions are produced because of a number of factors. In some illusions any one factor may predominate. In other more than one may operate. The following are some common factors, which are responsible for producing optical illusions.

(1) Because of the factor of perspective by which objects appear smaller at a distance we tend to judge distant objects to be larger than the near objects though they may be of the same size.

(2) The factor of eye-movements: sometimes illusions may occur if the eye-movement are disturbed and blocked. When irregular eye-movements are forced by the details of the objects seen illusions may occur. This is also referred to as the factor of direction.

(3) The factor of eye movements also takes a different form in some cases like the Muller-Lyer illusion. As the eye moves along each line in one case the enclosing arrow force the effect of being shut in and in the other the outward directing arrows allow the eye to stretch out or to elongate. The effect of these two experiences in the illusion that the latter is the longer line. This is sometimes called the factor of extent.

(4) The factor of eye movements sometimes works in a still different manner. In the illusion of the vertical and horizontal the vertical is always judged to be longer than the horizontal. This is explained in terms of the energy required to follow the two lines with our eyes. It requires greater effort raise the eyes and follow a line which is vertical than to run them from side to side and follow a horizontal line. Where more energy is required it gives rise to the illusion of seeing a longer line.

Some of the illusions are caused merely because of the subjective conditions that affect our perceptual process. In some cases the particular context and the environment against which the stimulus operates are also responsible for producing the illusion. In most of the illusions dealing with geometrical shapes and lines, the effects produced by the various lines that form the background do play a part in producing the final effect of the illusion. It has also suggested that ‘illusions like constancies are in a natural product of certain kind of nervous structure functioning in a given physical environment.

Check your progress exercise-3

Note: use the space below for your answer. Use separate sheet if required.

(1) Define illusion?

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(2) What is Muller-Lyer illusion?

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(3) What is brightness Constancy and how lead to illusion?

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8.1.4. SUM UP

Perceptual constancy refers to the fact that the environment as we perceive it changes much less than do our sensory inputs; the world remains relatively stable despite drastic changes in the sensory input. For example, size constancy refers to the fact that despite large variations in the size of the representation, or "image", of an object on the retina when it is near or far, we tend to perceive the object as about the same size. A number of experiments have shown the perceptual size constancy results when an object and its backgrounds change together so that the relationships between them stay the same. The phenomenon of size constancy is the basis for a number of visual illusions. In brightness constancy, the perceived brightness of an object changes far less than do the changes in the sensory input. Brightness constancy seems to depend upon the ratio of illumination falling on an object and its background: Unchanged brightness ratios result in constant brightness experiences.

The bias for visual depth perception is to be found in monocular and binocular cues. Among the monocular cues are (a) linear perspective, (b) clearness, (c) interposition, (d) shadow patterns, (e) gradients of texture, and (f) the relative movement of object closer or farther away from the fixation point. The major binocular cue for visual depth perception depends on the slightly different, or disparate, views of the world received by the two eyes; this binocular cue is known as retinal disparity.

8.1.5. References

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CONCEPT, DEFINITION, NATURE & TYPE OF ILLUSION, DELUSION AND HALLUCINATIONS

B.A. SEM - II **Unit - III**

Course No. : PY-201 **Lesson : 9**

STRUCTURE :

OBJECTIVE :

- To understand the concept of illusion, delusion and hallucintion
- To know the definition of illusion, delusion and hallucination.
- To understand the nature of illusion, delusion and hallucination.
- To know the types of illusion, delusion and hallucination.
- To understand the causes of illusion delusion and hallucination.

INTRODUCTION

Perception is more than the sum of all the sensory input supplied by our eyes, ears and other erceptors. It is the active selection organisation and interpretation of such input. It yields final products that differ from raw, unprocessed sensations in important ways. But perception, like any other powerful process, can be a double-edged sword. On the one hand, perception helps us adapt to a complex and everchanging environment. On the other hand perception sometimes leads us into error like illusion, delusion & hallucination.

CONCEPT OF ILLUSION *(Nature and Definition)* **:**

Perception organises sensory information into a coherent picture of the world around us. Perception can also, however, provide false interpretations of sensory information. Such cases are known as illusions, a term used by psychologists to refer to uncorrect perceptions.

Illusions are wrong perception while perception is the correct interprelation of sensation, illusionis the wrong or mistaken interpretation of a sensory experience. In both perception and illusion, the sensory experience of stimulus has real existence, i.e. illusion always has an apparent external stimulieus. It is not a dream nor imagination. The most conventional example of an illusion is taking a coil or rope as a snake in darkness. Similarly, a person who is in search of his lost ring, interprets in darkness a dazzling glass as his ring.

Definitions of Illusions :-

Goddard - "An illusion is a lack of one to one correspondence between physical stimulus of world and one's inner perception."

misinterpreted perception.

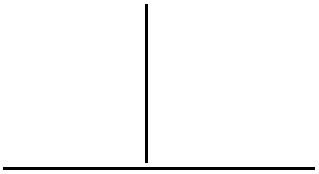
Eysenck - "Illusion is an invalid perception"

Types of Illusions :-

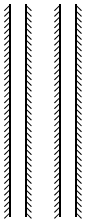
1. ***Universal Illusion*** :- The experience of such illusions is same for most of the individuals e.g, all persons perceive the rope as snake in dark.

2. ***Individual Illusions*** :- When an illusion is limited to a specific person, it is called individual illusion. The different types of individual illusions are :-

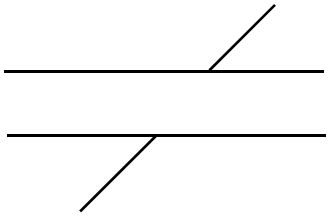
1. ***Vertical - Horizontal Illusion*** :- Although the horizontal & vertical lines are equal in length, still the vertical appears to be longer.



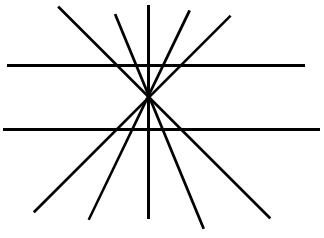
2. ***Zulliner Illusion*** :- Although all the force lines are paralled but these do not look parallel because of the curved lines on them.



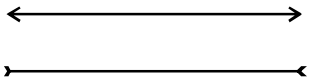
3. ***Poggendroof Illusion*** : In this, there are two parallel lines which are overlapped by two separate vertical lines. But they appear to be cut through a single continuous line.



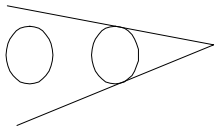
4. ***Herring's Illusion (Illusion of directions)*** : In the following figure, the two horizontal lines are parallel. The distance between 1 and 2 is the same; in this both the horizontal lines are although parallel but they appear to be curved.



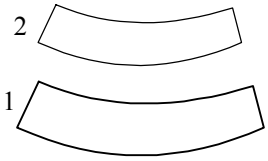
5. ***Muller Lyer Illusion*** : The two lines in the Muller lyer illusion are of the same lenght, but the line on the left, with its reversed arrow heads, look longer.



6. ***Ponzo Illusion*** : Circles 1 and 2 are really of the same size but circle 2 looks bigger than 1.



7. ***Jastrour Illusion*** : The two crescents 1 and 2 are of the same size but 1 appears to be bigger than 2.



8. ***Moon Illusion*** : Moon illusion seems to result from size constancy when the moon is low on the horizon, it appears larger than when it is overhead, yet the actual size of the moon's image on ratina is the same regardless of its position in the sky.

9. ***Height Weight Illusion*** :- A tall hat is put in a short vase. The height and width of the hats are equal. But one tooks taller than the other.

Causes of Illusion :-

1. ***The Eye Movement Theory*** :- Optical illusions sometimes occur if the eye movements are discussed and blocked due to the inward projection of other lines. This theory explains the Muller Lyer Illusion.

2. ***The Perspective Theory*** :- It argues that everyone know that distant objects appear smaller in size than the nearer objects. The perceiver thus compensates for such learning even though they may be equal. Thus, he perceives the objects at a distance to be greater in size than the nearer ones.

3. ***The Confusion Theory*** : The perceiver observes the percept as a whole as one unit and does not analyse it fully.

4. ***Good Figure Theory*** : As a natural tendency we eliminate the irregularites in a particular figure and fill up gaps to give it a complete meaning. We want to see the figure as single, meaningful and compact unit. This leads to illusions.

5. ***Defects of Sense Organs*** :- The defect in sense organs leads to false perception.In fever, one perceiver sugar to be bitter in taste.

6. ***Contrast of Stimuli*** : A dark face or complexion will appear to be more darker when compared to a fair complexion.

DELUSIONS *(Concept, Definition and Nature) :-*

Cognitive dysfunctions, otherwise known as congnitive disturbances, refer to ideas or thoughts that have no basis in reality i.e false ideas without sound bases. These are called delusions and dysfunctions of thinking. Delusions are wrong or false beliefs which cannot be easily corrected by discussion or logical argument.

Definitions :-

A belief that would be seen by most members of a society as a misinterpretation of reality is called delusion or disorder of thought content.

A delusion is essentially a faulty interpretation of reality that cannot be shaken despite clear evidence to the contrary.

Nature of Delusions :-

Delusions can be expressed in many ways. Some types of delusions occur more ofter in schizophrenia than in any other type of psychosis. Among these are bizarre dilusions. e.g., the belief that everyone can hear the person's thoughts, the belief that othera are either inserting thoughts into the person's mind or removing them, and the belief that the person's thoughts, feelings and impulses are controlled by some external forces. Bizarre delusion are considered very characteristic of schizopprenia. Another kind of delusion is referential. The person believes that certain gestures or comments, song lyrics, passages in

books and so forth are specifically intended for him or her. Additional delusions that are typical of schizophrenia but that occur less often include the belief of being persecuted, grandiose thoughs about being an extremely important person, and ideas with a religious theme.

The major feature of delusional disorder is a persustent belief that is contrary to reality. For example, a woman who believes without any evidence that co-workers are tormenting her by putting poison in her food and spraying her apartment with harmful gases has a delusional disorder. They may become socially isolated because they are suspicious of others. The delusions are often long standing sometimes persistent over years.

Types of Delusion

1. ***Delusion of Reference*** :- People suffering from delusion of reference feel that others are talking against them. They feel that someone is spying on them they find others commenting and staring on them.

2. ***Delusion of Indedility*** : In this case, spouse feels that his partner is cheating on him. The male partner feels that female is cheating on him while the female partner feels that the male is unfaithful.

3. ***Delusion of Grandeur*** ; One feels that he is a very important person. He feels that he is smart and is a reincarnation of God. Basically, it refers to a belif that one is really a great figure of the world or country like King Napolean, Prime Minister of India or queen of England.

4. ***Delusion of Guilt*** : In this case, one feels that he has committed some sin or mistake. He is going to get some punishment for his sin.

5. ***Delusion of poverty*** : One feels that he is going to be poor very soon. He perceives that he will soon loose is wealth & become poor.

6. ***Delusion of Love*** : One perceives that a very famous personality, e.g, an actor, or a singer is in love with him or her. He thinks that some important personality will marry him or her soon.

7. ***Delusion of Somatic*** : One perceives that his body organs are decaying.

8. ***Delusion of Bodily Change*** : A belief that one's body is changing in some unusual way like male or female is fingers are growing bigger and bigger day by day.

9. ***Delusion of Persecution*** : The belief that one is being actually persecuted or troubled by some individuals or groups.

10. ***Delusion of Parasitic Infestation*** : One perceives that some parasites have infested into his body and they will eat up the body parts.

11. ***Delusion of nitullism*** : This refers to a belief that nothing really exists, tha all things are simply shadows.

12. ***Erotomanic Delusion*** : It is the irrational belief that one is loved by another person, usually of higher status. Some of the individuals who stalk celebrities appear to have erotomanic delusions.

HALLUCINATION : *Its concept*

Hallucination is a type of perceptual error and is experienced by mentally disturbed or abnormal people. In hallucination there is no real sensory stumulus or apparent objective external stimulus, but we perceive it as some object or figure and demonstrate experiencing hallucination. e.g. when we visulise a ghost every night when there is no such thing, when we hear buzzing sensation inside the stomach when there is no such sensation or when we experience severe pain when there is no pain sensation at all, we experience visual auditory & tactual hallucinations respectively. Hallucinations may be of visual, auditory, olfactory, tactual, gustatory etc. But usually visual and auditory hallucinations are more commonly experienced.

Definition :

The experience of sensory events without any input from the surrounding environment is called an hallucination. Hallucinations are projections of internal inpulses and experiences on to perceptual images in the external world.

Nature :-

Hallucination account for most of the difficulities a person with schizophrenia experiences in percevring reality. Although they may occur during the delirium associated with a high fever or as a result of the effect of drugs or other chemicals on the nervous system.Only is schizophrenia do hallucinations occur when the person is in a clear, conscious state.

Hallucination can be associated with any of the senses. Although many hallucinations are frightening,not all are unpleasant. Sometimes those who experience hallucinations find them so confortable they are unwilling to give them up because they serve as protection from negetive aspects of reality.

Hallucinations represent our inner conflict, fears, anxieties and mental imbalance. Particularly in certain forms of insanity like Schirophrenia, hallucination form a major symptom. Sometimes such patients hear the voice of God, spirit and are found to actually talk with them in their imagination. Especially common are auditory hallucination where the patient hears voices talking about or with their visual hallucinations follow auditory hallucinations.

The Schizophrenic hebephrenic experiences hallucinations which are highly fantastic and imaginative. A patient for instance once claimed that there was a Bee inside his stomach, which was talking to him. Another person strongly felt that a vamp has sucked all her blood she is virtually a skelton.

Types :-

1. ***Auditory*** : Many individuals with schizophrenia report voices, making a running commentary on their behaviour and speaking directly to them, issuing orders or accusuing them, for terrible cirmes or action. Then may hear two or more people talking bad things about him among themselves.

2. ***Visual*** : Patients may have very frightening visual hallucinations in which they can see large number of people coming towards large number of people coming towards them with a variety of weapons to kill them.

3. ***Tactual*** : Hallucinations may also be related to touch. A person may feel buring or tingling sensation. He may feel that cockroches and lizards are crawling over his body.

4. ***Olfactory*** : He may feel that some poisonous gas is injected in his room. Foul odour may be perceived as coming from one's body and sign of decay or death or of some sexual changes.

5. ***Gustatory*** : The person may feel that their food is being poisoned.

Causes :

1. Brain's activity during hallucinations is associated with one of its causal factors. During auditory hallucinations, Blood flow in te Broca's area (brains' speech center) was significantly greater during the time the hallucination was occuring than when it was not. Auditory hallucinations in schizophrenia are associated with increased activity in cortical areas specilised for language, not for hearing.

2. Sometimes some intense desire, wish or aspiration may lead to hallucinatory experience. For instance if the mother very much wants to see her long separated child, she may see the child in her vision or may hear the voice of the child when there is no voice at all.

LET US SUM UP :

In perception and illusion, the sensory stimulus is present. In hallucination, the sensory stimulus is completely absent.

In perception the sensory stimulus is rightly perceived. In illusions it is wrongly perceived. In hallucinations it is falsely perceived. Perceptions and illusion are found is normal people. Hallucination is usually found in mental disorder and in people under the influence of drug or with damaged nervous system and brain.

CHECK YOUR PROGRESS :

1. What do you understand by illusion, delusion and hallucination ?

2. Give a comparative analysis of illusion, delusion and hallucination.

3. Explain the following :

a. Muller Lyer Illusion

b. Auditory Hallucination.

c. Delusion of grandeur.

CONCEPT FORMATION : DEDUCTIVE AND INDEDUCTIVE REASONING

B.A. SEM - II **Unit - IV**

Couirse No. : PY-201 **Lesson : 10**

STRUCTURE

OBJECTIVES

After going through this lesson, the student will be able to:

- Understand Thinking and its meaning
- Concept formation and its different strategies
- Deductive and Inductive Reasoning

INTRODUCTION

Thinking is closely allied with the process of learning, is as much as our chief tools of thought – concepts are learned. Moreover, a great deal of our thinking in everyday life is based on memories, recollections, and memory images. Indeed, much of what is called thinking is actually remembering. For example, when an individual explains, "I wish I could think of his name," he or she is trying to remember something learned in the past.

Varieties of Thinking

Perhaps the simplest and most fundamental type of thinking is simple association, of which there are two varieties: free and controlled. *Free association* occurs whenever the thinker allows the stream of consciousness to wander where it will, as so often happens at night when we are dropping off to sleep. By contrast in *controlled association*, thinking is restricted, since the subject is instructed to respond with a certain type or class of possible reasons. In *reverie, fantasy, and dreams* (both day and night), associations flowing through consciousness are not directed by conscious efforts of the thinker. However, in any of these varieties of thinking, thought patterns are more highly organized and interrelated than is true of thinking in free association.

CONCEPT FORMATION

The most difficult aspect in studying thinking is concepts. One reason is that the formation and use of concepts bear important relationship to many other psychological problems, notably the nature and development of language, the development and functions of perception, and the phenomenon of social interaction. Further, concepts involve 'higher' mental processes which are highly difficult to understand and investigate experimentally than other behavior. In speaking about concepts, we appear to be dealing with phenomenon almost without parallel in the scale of life, processes so complex and so closely associated with nervous activities that most of our conclusions require the extensive use of inference. To the experimental psychologist, this kind of process sometimes seems too intangible for scientific study. Apart from this, the psychologist has to necessarily discover the behavioral and genetic processes involved, which poses real problems.

Finally, the data obtained also poses a problem in understanding, because the situations and tasks utilized have typically been very narrow and the behavior observed

has largely been the simple, readily quantifiable response of the subject. This can be reduced by having a broader and deeper understanding of the concepts.

Some of the basic problems of concept formation are;

1. Ability to conceptualize – this ability is not independent of the other general intellectual abilities like memory, perceptual, speed, etc, and hence it has not been conclusively demonstrated to be relatively independent of other functions.

2. Acquisition of concepts and repertory- the problem here is that this ability is not independent of age, i.e. it depends upon increasing experience with age. Thus, two persons of the same ability to conceptualize may nevertheless, at the same age, have different repertories of concepts; or children of different conceptual abilities may still acquire, generally, the same kinds of concepts at about the same age.

3. Achieving a specific concept – the problem is evidently more atomistic than the first two, arising in a specifically defined situation rather than in the continuing development of mental organization and function.

A part from these problems, there is a fourth major problem area that which pertains to the function of concepts in the thought processes of the individual. Here, a concept may be regarded as a kind of selective system in the mental organization of a person which links previous experience and current states with stimulus objects.

Current research indicates that concepts should be viewed in a broader, more dynamic way than has therefore been the case; none of the conventional definitions of concept or of concept formation is satisfactory. One of their greatest weaknesses is the unfortunate tendency to regard words as concepts rather than to recognize that a verbal response is merely a label for the internal cognitive system, which, from the psychological standpoint, is actually the concept.

Thus, instead of attempting the present time to offer a self contained definition of concept, it is preferable simply to suggest the characteristics which should be taken into consideration.

The characteristics of concepts may be summarized as follows:

- They are not direct sensory data, but something resulting from the elaboration, combination thereof.
- Concepts depend on the previous experience of the organism.
- Concepts are the systems within the mental organization which tie together or link or combine discrete sensory experiences. This condition by be demonstrated by proving that an individual responds to different stimuli in the same way.
- Such ties or links are symbolic in nature, which is the same concept may be invoked by a variety of stimuli.
- On the side of the internal processes of the organism, concepts represent selective factors. An external stimulus arouses a symbolic response and guides perceptual activity, whichever comes first.
- Concepts have both extensional or denotative and intentional or connotative meanings. The extensional meaning is something that cannot be expressed in words because it is that which it stands for. The intentional meaning is that which is suggested inside one's hand.
- Concepts vary in the consistency or correctness of their organization.
- Concepts have both horizontal and vertical organization. The same object or relation has different points of reference, depending upon the other objects with which it is compared. Horizontally, objects may be classified into different, categories, all of them equally inclusive. At the same time, objects may be classified into groups of varying complexity or into more and more inclusive categories. In a given situation the horizontal classification is less fixed and more dynamic than the vertical.
- Generalization and differentiation play an important role in concept formation as they do in conditioning. The child's concept often shows crude generality which has to be overcome by taking note of differences. A little girl on seeing a squirrel for the first time called it a 'funny kit'. She was generalizing by assimilating the new to the old, but as she noticed that the new kitty was funny, she was ready to learn a new name and differentiate a fresh concept.
- A focuing on wholist strategy.
- A scanning or part strategy.

In the 'focusing strategy' the subject takes the first positive instance from a series of cards depicting colored circles and it is his initial hypothesis that is four red circles with single border. Succeeding presentation of cards are then used to rule out systematically the attributes which are not relevant to the correct concept. (e.g. : redness or single border)

In the 'scanning strategy' the subject begins with the part of the first positive instance as his hypothesis (e.g red circles) and tests this out with succeeding cards. As soon as he meets a positive but informing instance, he must change his hypothesis and test a new one (r.g. : red figures with a single border). Burner argues that the focusing strategy is the better one as it involves less cognitive strain for the subject. At any point of the focuser has to remember less than the 'scanner'. The result of his experiments were :-

- More subjects use a 'focusing' than a 'scanning' strategy.
- Subjects are markedly consistent in the strategies they employ from one task to another.
- The complexity of the task in terms of the number of attributes in the array does not affect either the preference for the 'focusing' strategy or the consistency of the subject.
- Failures occur with both strategies mainly because subjects are unable to adhere strictly to the rules of the two ideal stratigies.
- However, adherence to the strategy rules was far in excess of what would be expected if the subjects were behaving in a purely random fashion.

DEDUCTIVE REASONING AND INDUCTIVE REASONING

Reasoning is a process that involves interference. It is used in logical thinking and problem solving. It is goal-directed, and the conclusions (judgements) are drawn from a set of facts. In reaasoning, information from the environment and the stored information in brain are used following certain rules. We can classify reaoning into two main types : Inductive and Deductive.

DEDUCTIVE REASONING

Deductive reasoning is reasoning which use deductive arguments to move from given statements (premises), which are assumed to be true, to conclusions, which must be

true if the premises are true. An example of deductive reasoning, given by Aristotle is

- All men are mortal .(major premise)
- Socrates is a man. (minor premise)
- Socrates is mortal. (conclusion)

Deductive reasoning is often contrasted with inductive reasoning, which reasons from a large number of particular examples to general rule.

Deductive Logic

Deductive reasoning is supported by deductive logic.

For example :

All apples are fruit.

Some apples are red.

Therefore some fruits are red.

Or

All apples are fruit.

Some apples are red.

Therefore some fruits are red.

The first premise may be false yet anyone accepting the premises is compelled to accept the conclusion.

Inductive Reasoning

Induction or Inductive Reasoning, sometimes called inductive logic, is the process of reasoning in which the premises of an argument are believed to support the conclusion but do not entail it ; i.e. they do not ensure its truth. Induction is a form of reasoning that makes generalization based on individual instances. It is used to ascribe properties or relations to types based on an observation instance (i.e. on a number of observations or

experiences); or to formulate laws based on limited observations of recurring phenominal patterns. Induction is employed, for example, in using specific propositions such as :

This ice is cold. (Or : All ice I have ever touched was cold)

This billiard ball moves when struck with a cue. (Or : Of one hundred billiard balls struck with a cue, all of them moved.)

...to infer general propositions such as :

All ice is cold.

All billiards balls move when struck with a cue.

Inductive reasoning has been attacked several times. Historically, David Hume denied its logical admissibility. Sextus Empiricus questioned how the truth of the universals can be established by examining some of the particulars. Examining all the particulars is difficult as they are infinite in number. During the twentieth century, thinkers such as Karl Popper and David Miller has disputed the existance, necessity and validity of any inductive reasoning, including prophabilistic (Bayesian) reasoning. Scientists still rely on induction nevertheless.

Types of Inductive Reasoning

Generalization - Generalization more accuratey, an inductive generalization) proceeds from a premise about a sample to conclusion about the population.

The proportion Q of the sample has attribute A.

Therefore :

The proportion Q of the population has attributed A.

How great the support which the premises provide for the conclusion is dependent on (a) the number of individuals in the sample group compared to the number in the population; and (b) the randomnes of the sample. The hasty generalization and biased sample are fallacies related to generalization.

Statistical Syllogism

A statistical syllogism proceeds from a generalization to a conclusion about an individual.

A proportion Q of population of P has attribute A.

An individual I is a member of P.

Therefore :

There is a probability which corresponds to Q that I has A.

The proportion in the first premise would be something like "3/5ths of", "all", "Few" etc. Two dicto simpliciter fallacies can occur the statistical syllogism : "accident" and conversse accident".

Simple Induction

Simnple Induction proceeds from a premise about a simple group to a conclusion about another individual.

Proprtion Q of the known instances of population P has attribute A.

Individual I is another member of P.

Therefore :

There is a probability corresponding to Q that I has A.

This is a combination of a generalization and a statistical syllogism, where the conclusion of the generalization about an additional attribute common to both things.

P is similar to Q.

P has attribute A.

Therefore :

Q has attribute A.

A analogy relies on the inference that the properties known to be shared (the similarities) imply that A is also a shred property. The support which the premises provide for the conclusion is dependent upon the relevance and number of the similarities between the P and Q. The fallacy related to this process is false analogy.

Causal inference

A causal inference draws a conclusion about a causal connection based on the conditions of the occurance of an effect. Premises about the correlation of two things can indicate a causal relationship between them, but additional factors must be confirmed to establish the exact form of the causal relationship.

Prediction

A prediction draws a conclusion about a future individual from a past sample.

Proportion Q of observed members of group G have had attribute A.

Therefore :

There is a probability corresponding to Q that other member of Group G will have attribue A when next observed.

SUMMARY

Concepts are the mental categories for objects, events, or experiences that are similar to one another in one or more respects.

Reasoning is process that involves inference. It is used in logical thinking and problem solving. It is goal-directed, and a conclusions are drawn from aset of facts.

Deductive reasoning is reasoning which uses deductive arguments to move from given statements, which are assumed to be true, to conclusions, which must be true if the premises are true.

Induction or Inductive Reasoning, sometimes called inductive logic, is the process of reasoning in which the premises of an argument are believed to support the conclusion but do not entail it ; i.e. they do not ensure its truth.

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REVIEW QUESTIONS

1. What is Thinking ?
2. Explain Concept Formation with a suitable example.
3. What is Deductive Reasoning ?
4. Explain different types of Deductive Reasoning ?
5. Exaplain Inductive Reasoning with suitable example ?

PROBLEM SOLVING

B.A. SEM - II **Unit - IV**

Course No. : PY-201 **Lesson : 11**

STRUCTURE

OBJECTIVES

After going through this lesson, the student will be able to:

- Understand Problem solving
- Understand the seven stages of problem solving cycle
- Understanding decision making

INTRODUCTION

Every individual faces problems which come in all shapes and sizes, and he has to discover what to do 'in order to achieve a goal -whether searching for needed object or a friend's house in an unfamiliar neighborhood. In addition to the problems presented by

everyday living or the demands of occupation, people often seek out problems to solve. Furthermore, they spend much time in trying to solve the problems varying in difficulty and importance during their lifetime. To understand this, the theoretical background is considered.

A Gestalt Interpretation of Problem Solving

Gestalt writings are typically phenomenological in character. This does not mean that the Gestalt psychologists have no theory but they use general principles. Kohler's study on apes will cite the essence of his theory of problem solving.

The Double Stick Problem

This situation was one of. the most difficult that Kohler used, and illustrates many important mechanisms. The 'path' to a desired goal in this case can only be covered by an implement, but the implement itself must first be constructed. Sultan (the ape so named) is the subject. Two hollow sticks, one so much thinner than the other that it can be pushed in at either end of the other quite .easily, are used. The ape is put inside the cage with the two sticks and a box. The objective (goal) lies beyond the bars, just so far away that the animal cannot reach it with either rod. The ape tries to reach the goal with one stiek first and when it is futile the ape commits a "bad error". Later it tries to use the box to reach the goal; in spite of being futile, it is referred as a "good error" because it is a step forward to achieve the goal. In working with the sticks, the animal inserts one stick into the other and throws it off. Suddenly, something strikes the animal (insight) and the animal uses the stick in the present form (inserted into each other) and achieves the objectives.

Kohler in his interpretation states:

a) Organism tends to approach a goal by the most direct path, the initial tendency in solving; a problem is always a direct lo.comotors or reaching movement. Le. the ape tries to reach the goal with its hand in the initial stage of the experiment.

b) Tension is geperated in the psychological field whenever an obstruction intervenes between an organism and a goal in the geographical field -the physical objects and events are referred to as the geographical field, whereas the psychological field refers to the fluid patterns of perceptual processes wherein psychological dynamics transpire. The geographical field help determine the momentary state of the psychological field and hence tension is created when the direct path to the goal is

obstructed. In the experiment the animal showed increased agitation when the usual approaches to a goal failed. Tension in the psychological field varies with the need for the goal and with the figure quality of the goal-object.

c) Unresolved tension in the psychological field distributes itself in a pattern, the form of which is determined simultaneously by the conductive force of the goal and the restraining characteristics of the geographical field. There are two variables, at least, while Kohler associates with the functioning of this principle: 1. the conductive force of the goal-object increases with the psychological nearness of the organism to the goal, and 2. the entire pattern of conductive and restraining forces varies with the position of the organism in the geographical field.

d) The unstable, fluctuating pattern of tension in the psychological field tends to be minimized through sudden reorganizations, involving the perception of new paths to the goal -the sudden reorganization or insights are based on several variables.

1) Insight is more likely to occur if the goal tension is more moderate than it is excessive;

2) The extent to which the animal varies its position in the geographical field, facilitates, the process of reorganization;

3) The likelihood of new paths or new tools being utilized in insightful reorganization varies with the degree to which they fit into the momentary existing pattern of forces in the field;

4) The loss distance between the goal and a tool, or the more direct a path toward the goal in the psychological field; the more likely is insightful reorganization; and

5) The greater the figure quality of a tool or a path, the more likely it is to be utilized in insightful reorganization.

Whenever a given reorganization of the psychological field occurs, it exerts cohesive force over its parts and resists modification.

The Characteristics of Insight as a Mode of Problem Solving

The Gestalt psychologist utilizes insight as an emergent principle of behavior. Some of the characteristics which determine that insight does or does not occur are:

Suddenness

. Perhaps the most obvious criterion of an insightful solution is the suddenness with which it occurs. Ordinary learning, in either the trial- or -error or conditioning mode, insightful solutions, on the other hand, occur with dramatic suddenness, and once the insight has occurred, it usually persists as a permanent acquisition.

Smoothness

The Gestalt explanation of smoothness is that since the organism is in a field of continuously varying forces, any change of position in the field results in a concomitant change in the direction of the forces, yielding a smooth and continuous course of movement. This characteristic by itself does not serve to index the occurrence of an insight. A given sequence of activity in trial and error may also be executed smoothly, as a well learned skill. Similarly, a succession of partial insights may display the jerky character more typical of ordinary trial and error.

Point in behavior sequence where .S'olution occur.S'

In an insightful solution, the problem is mentally solved before it initiates the actual behavior. This is perhaps the essential characteristic of insight; implicit recognition and understanding of the solution precedes its execution. Of course, we can only infer the previous occurrence of the solution from overt behavior of the animal or from introspective reports of human objects.

Novelty of the situation

In a situation iQ which a sudden smooth solution occurs it can be presumed that the animal has had considerable previous experience, and we can attribute it to mere habit or the effects of previous learning. If, on the other hand, the situation is a novel one, we are likely to attribute a sudden, smooth solution to insight. But, the illustration given or any other experimental conducted in this area will have completely novel; situations or responses. The ape was familiar with handling- stick like objects, strings, and the like; the novelty lay in the selection necessary for the particular situation:

Behavioristic Interpretation of Problem Solving

The Behaviorist subs'cribes the trial-and-error learning is a more subtle process of selection,

with many mechanisms contributing to the overt product and not pure chance alone. The mechanisms contributing are:

The goal-gradient

Animals will tend to choose the shorter of two paths to the same goal. Since the ratio favoring the short over the long path increases with the nearness to the goal, "the nearer the goal-object to the organism and the stronger its motivation, the more difficult will be selection of the longer path (solution).

The habit-family hierarchy

1. The position in the hierarchy, and hence the probability of occurrence of a given response will vary with the degree to which it has previously been reinforced in similar situations. 2. An organism's structure will determine in part the locus of specific responses in the hierarchy and hence its normal mode of problem solving. 3. Behavior will become more varied and random as the problem situation persists unsolved. 4. The relative strengths of responses within any hierarchy vary with successive presentations of the situation.

Implicit trial and error

Judging from the introspection of the human subjects much trial- and -error exploration within the habit-family hierarchy is implicit in nature. For example, if a student wants to have the best out of preparing for exams or having a date with a girl, he will not try randomly and then decide the best, rather, he works out his past experiences implicitly and decides.

Generalization

An individual is' facing a problem in a new situation can solve it by generalizing the behavior to a similar situation. For example, in repairing a radio a person the person drops the small screw and he cannot find it on the table. He recollects a similar situation, wherein he used to lift the screws with some paste on a stick in his childhood. Now he tries the same thing for the present problem and identifies the screw; in this incident he has generalized the situation to the childhood situation reducing trial and error.

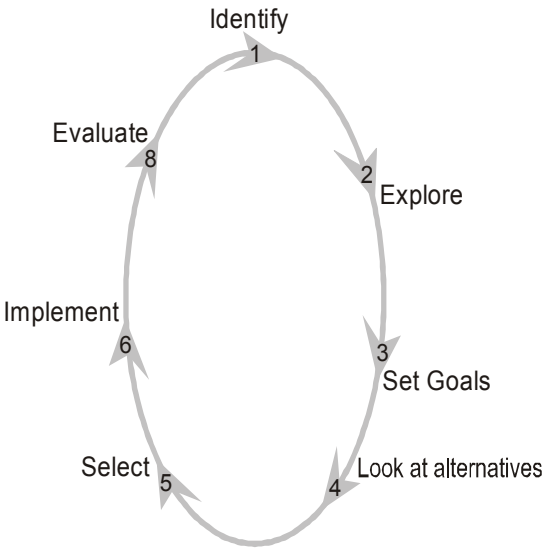
11.4 A Seven-Step Problem Solving Cycle

There are a variety of problem solving processes but each process consists of a series of

series of steps, including identifying an issue, searching for options and putting a possible solution into action. It is useful to view problem solving as a cycle because, sometimes, a problem needs several attempts to solve it, or the problem changes. Figure 1 shows a seven-step problem solving cycle.

To solve a problem, take the steps, one at a time.

Step 1. *Identify the problem*



The first step you need to take is to identify and name the problem so that you can find an appropriate solution. Sometimes you might be unsure about what the problem is: you might just feel general anxiety or be confused about what is getting in the way of your goals. If it is a personal problem you can ask yourself, your friends or a counselor, 'What is the problem which is getting in the way of me achieving my goal'? If it is an academic issue you can ask yourself, 'What is hindering me from completing this task', and you can consult with your tutor, supervisor or a Learning Adviser to clarify the issue.

Step 2. *Explore the problem*

When you are clear about what the problem is you need to think about it in different ways. You can ask yourself questions such as:

- How is this problem affecting me?'
- How is it affecting others?'
- Who else experiences this problem?'
- What do they do about it?' .

Seeing the problem in different ways is likely to help you find an effective solution.

Step 3. *Set goals* .

Once you have thought about the problem from different angles you can identify your goals. What is it that you want to achieve? Sometimes you might get so frustrated by a problem that you forget to think about what you want. For example, you might become ill, struggle to complete a number of assignments on time and feel so unmotivated that you let due dates pass. It is important at this time to consider the question, 'What is my immediate, goal?'. Do you want to?

- Improve your health?
- Increase your time management skills?
- Complete the assignments to the best of your ability?
- Finish the assignments as soon as possible?

If you decide your goal is to improve your health that will lead to sQlutions which are different from those linked to the goal of completing your assignments as soon as possible. One goal may lead you to a doctor and/or to take leave of absence from university; the other goal may lead you to apply for extensions for your assignments. So working out your goals is a vital part of the problem solving process.

Step 4. *Look at Alternatives*

When you have decided what your goal is you need to look for possible solutions. The more possible solutions you find the more likely it is that you will be able to discover an effective solution. You can *brain-storm* for ideas. The purpose of brain-storming is to collect together a long list of possibilities. It does not matter whether the ideas are useful or practical or manageable: just writ~ down the ideas as they come into your head. Some of the best solutions arise from creative thinking during brain-storming. You can also seek ideas about possible solutions from friends, family, a partner, a counselor, a lecturer, books or the internet. The.aim is to collect as many alternative solutions as possible.

Step 5. *Select a possible solution*

From the list of possible solutions you can sort out which are most relevant to your situation and which are realistic and manageable. You can do this by predicting outcomes for possible solutions and also checking with other people what they think outcomes might be.

For example, if a possible solution is withdrawing from a course and it seems realistic and manageable to you, you can check with university staff how withdrawing will affect your grade for that course, your future enrolment and you're Higher Education Contributions. And if you are receiving a Centrelink Allowance you will need to check with Centrelink whether or not withdrawal from a course will affect your payment. When you have explored the c~nsequences, you can use this information to identify the solution which is most relevant to you and is likely to have the best outcomes for your situation.

Step 6. *Implement a possible solution*

Once you have selected a possible solution you are ready to put it into action. You will need to have energy and motivation to do this because implementing the solution may take some time and effort. (If the solution had been easy to find and do, you would have probably already done it.) You can prepare yourself to implement the solution by planning when and how you will do it, whether you talk with others about it, and what rewards you will give yourself when you have done it.

Step 7. *Evaluate*

Just because you have worked your way through the problem solving process it does not_mean that, by implementing the possible solution, you automatically ~olve your problem. So evaluating the effectiveness. of your solution is very important. You can ask yourself (and others) :

- How effective was that solution?'
- Did it achieve what I wanted?'
- What consequences did it have on my situation?'

If the solution was successful in helping you solve your problem and reach your goal, then you know that you have effectively solved your problem. If you feel dissatisfied with the result, then you can begin the steps again. Viewing problem solving as a cycle may help you recognize that problem solving is a way of searching for a solution which will lead to different possible solutions, which you can evaluate. If you have solved the problem you have found an effective solution. If you judge the problem has not been solved you can look for, and try, alternative possibilities by beginning the problem solving cycle again.

When to use problem solving

You can solve problem anytime, you have a problem to solve or a goal to achieve. You can use the problem solving model to look for solutions to issues connected with your study, relationships, work or sport. You can take the problem solving steps by yourself, with a friend, or in a group. Problem solving with others is often very effective because you have access to a wide variety of viewpoints and potential solutions. The problem solving model is .a useful resource for you to utilize in your personal, academic and professional lives.

Conclusion

Problem solving is a skill and a process which you can learn. You can implement the process to help you solve a problem by following the seven steps outlined in this Learning Guide. Once you have learned the steps and begun to implement the process, *problem solving* will be a new. skill which you have acquired and can be used at university, home and in the workplace.

11.5 DECISION MAKING

Decision making can be regarded as an outcome of mental processes (cognitive process) leading to the selection of a course of action among several alternative. Every decision making process produces a final choice (James, 1990). The output can be an action or an opinion of choice.

Human performance in decision making terms has been subject of active research from several perspectives. From a psychological perspective, it is necessary to examine indivIdual decisions in the context of a set *or* needs, preferences an individual has and values he/she seeks. From a cognitive perspective, the decision making process must be regarded as a continuous process integrated in the interaction with the environment. From a normative perspective, the analysis of individual decisions is concerned with the logic of decisIon making and rationality and the invariant choice it leads to (Kahneman & Tversky, 2000).

Yet, at another level, it might be regarded as a problem solving activity which is terminated when a satisfactory solution is found. Therefore, decision making is a reasoning or emotional process which can be rational or irrational, can be based on explicit assumptions or tacit assumptions.

Logical decision making is an important part of all science-based professions, where specialists apply their knowledge in a given area to making informed decisions. For example, medical decision making often involves making a diagnosis and selecting an appropriate treatment. Some research using naturalistic methods shows, however, that in situations with higher time pressure, higher stakes, or increased ambiguities, experts use intuitive decision making rather than structured approaches, following a recognition primed decision approach to fit a set of indicators into the expert's experience and immediately arrive at a satisfactory; course of action without weighing alternatives. Also, recent robust decision efforts have formally integrated uncertainty into the decision making process.

Some of the decision making techniques that we use in everyday life include:

- Listing the advantages and disadvantages of each option, popularized by Plato and Benjamin Franklin.
- Flipping a coin, cutting a deck of playing cards, and other random or coincidence methods.
- Accepting the first option that seems like it might achieve the desired result.
- Prayer, tarot cards, astrology, augurs, revelation, or other forms of divination
- Acquiesce to a person in authority or an "expert"
- Calculating the expected value or utility for each option.

SUMMARY

Problem Solving involves efforts to develop or choose among various respqnses in order to attain desired goals.

Decision Making is a process of choosing among various courses of action or alternatives.

REFERENCES

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REVIEW QUESTIONS

Explain Problem solving and Decision making?

HEURISTICS AND ALGORITMS

B.A. SEM - II **Unit - IV**

Coiurse No. : PY-201 **Lesson : 12**

STRUCTURE

OBJECTIVES

After going through the lesson the student will be able:

- To understand Heuristics
- To understand Algorithms

INTRODUCTION

A *'heuristic* (hyu-'ris-tik)' is a method to help solve a problem, commonly informal. It is particularly used for a method that often rapidly leads to a solution that is usually reasonably close to the best possible answer. Heuristics are "rules of thumb", educated guesses, intuitive judgments or simply *common SenSe.*

In more precise terms, heuristics stand for strategies using readily accessible, though

loosely applicable, information to control problem-solving in human beings and machines (Judea, 1983).

Example

Perhaps the most fundamental heuristic is "trial and error", which can be used in everything from matching bolts to bicycles to finding the values of variables in algebra problems.

Here are a few other commonly used heuristics, from Polya's classic How to Solve It : (George, 1945).

- Look to the unknown.
- If you are having difficulty understanding a problem, try drawing a picture.
- If you carl't find a solution, try assuming that you have a solution and seeing what you can derive from that ("working backward").
- If the problem is abstract, try examining a concrete example.
- Try solving a more general problem first (the "inventor's paradox": the more ambitious plan may have more chances of success).

In psychology, heuristics are simple, efficient rules, hard-coded by evolutionary processes or learned, which have been proposed to explain how people make decisions, come to judgments, and solve problems, typically when facing complex problems or incomplete information. These rules work well under most circumstances, but in certain cases lead to systematic cognitive biases.

For instance, people may tend to. perceive more expensive beers as tasting better than inexpensive ones (providing the two beers are of similar initial quality or lack of quality and of similar style). This finding holds true even when prices and brands are switched; putting the high price on the normally relatively inexpensive brand is enough to lead subjects to perceive it as tasting better than the beer that is normally more expensive. One might call this "price implies quality" bias. (Cf. Veblen good.)

While much of the work of discovering heuristics in human decision-makers has been done by Amos Tversky and Daniel Kahneman, the concept was originally introduced

by Nobel laureate Herbert Simon (Kahneman, Tversky & Slovic, 1982). Gerd Gigerenzer focuses on how heuristics can be used to make judgments that are in principle accurate, rather than producing cognitive biases -heuristics that are "fast and frugal"(Gigerenzer & Todd, 1999).

Where cognition is concerned, human beings often follow the path of least resistance. Making decisions is hard work, so it is only reasonable to expect people to take shortcuts in performing this activity. Heuristics are extracted from past experience and serve as simple guidelines for making reasonably good choices quickly and efficiently. We'll focus on the three heuristics that tend to be used most frequently.

Availability: What comes to Mind First?

Let's start with the availability heuristic: the tendency to make judgments about the frequency or likelihood of events in terms of how readily examples of them can be brought to mind. This short-cut tends to work fairly well, because the more readily we can bring events to mind, the more frequent they generally are; but it can lead us into error as well. A good example of the availability heuristic in operation is provided by a study conducted by Tversky and Kahneman (1974). These researchers presented participants with lists of names, and then asked them whether the lists contained more men's or women's names. Although the numbers of male and female names were about equal, nearly 80 percent of the participants reported that women's names appeared more frequently. Why? Because the women named in the lists were more famous, so their names were not readily remembered and brought to mind. The availability heuristic also influences many persons to overestimate their chances of being a victim of violent crime, being involved in the airplane crash, or winning the lottery. Because such events are given extensive coverage in the mass media, people can readily bring vivid examples of them to mind. The result: they conclude that such outcomes are much more frequent than they really are (Tyler & Cook, 1984).

Representativeness: Assuming that what's typical is *also likely*

Imagine that you have just met your next-door neighbor for the first time. *On* the basis of a brief controversy, you determine that he is neat in his appearance, has a good vocabulary, seems very well read, is somewhat shy, and dresses conservatively. Later, you realize that he never mentioned what he does for a living. Is he more likely to be a business executive, a dentist, a librarian, or a waiter? One quick way of making a guess is to

compare him with your idea of typical members of each of these occupations. If you proceeded in this fashion, you might conclude that be is a librarian, because his traits might seem to resemble those of your image of the prototypical librarian more closely than those of waiters, dentists or executives. If you reasoned in this manner, you would be using the representativeness heuristic. In other words, you would be making your decision on the basis of a relatively simple rule: the more closely an item- or event, object, or person - resembles the most typical examples of some concept or category, the more likely it is to belong to that concept or category.

Unfortunately, the use of this heuristic sometimes causes us to ignore forms of information that could potentially prove very helpful. The most important of these is information relating to *base rates* -the relative frequency of various items or events in the external world. Returning to your new neighbor, there are many more businessman than male librarians. Thus, of the choices given, the most rational guess might be that your neighbor is a business executive. Yet because of the representativeness heuristic, you might falsely conclude; that he is a librarian (Tversky & Kahneman, 1974).

Anchoring and Adjustment: Reference points that may lead us astray

The day I receive my driver's license, I began to shop for my first car. After a long search, I found the car of my dreams. The major question, of course, was "How much it will cost?" A totally rational person would have located this information in the *Blue Book,* which lists the average prices paid for various used cars in recent months. But did I proceed in this fashion? Absolutely not. I asked the seller what he wanted for the car, and then proceeded to bargain from there. At first glance, this may seem like a reasonable strategy. But think again. If you adopt it, as I did when I purchased that car, you have allowed the seller to set a reference point- a figure from which your negotiations will proceed. In the case of a used car, if the reference point is close to the *Blue Book* price, all well and good. If it is much higher, though, you may end up paying more for the car than it is really worth -as I did.

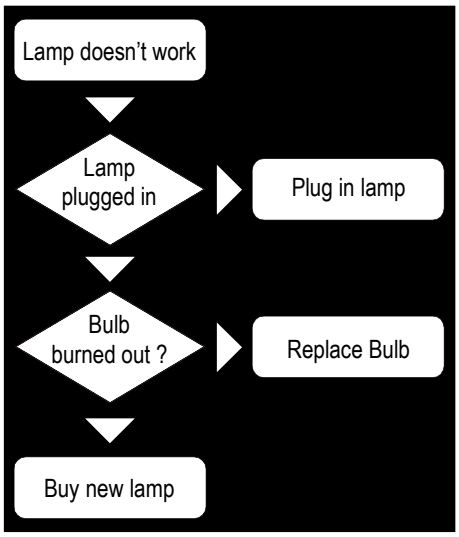
In such cases, decisions are influenced by what is known as anchoring and adjustment heuristic: a mental rul~ of thumb for reaching decisions by making adjustments in information that is already available. The basic problem with the anchoring-and-adjustment heuristic is that the adjustments are often insufficient in magnitude to offset the impact of the original reference point. In this case, the reference point was the original asking price. In other

contexts, it might be a performance rating assigned to an employee, a grade given to a term paper, or a suggested asking price for a new home (Diekmann et al., 1996; North craft & Neale, 1987).

ALGORITHMS

Algorithms are the rules for a particular kind of a problem that will, if followed, yield a solution. For example, imagine that you are supposed to meet a friend at a restaurant. Try as you may, you can't remember the name of the place. What can you do? One approach to get out the yellow pages and see if this refreshes your memory. If it doesn't, you can try calling all the restaurants listed to ask if your friend made a reservation (which you know she was planning to do). Following this algorithm - "Call every restaurant in the book" - will eventually work; but it is time consuming and inefficient.

In mathematics, computing, linguistics and related subjects, an **algorithm** is a sequence of finite instructions, often used for calculation and data processing. It is formally a type of effective method in which a list of well-defined instructions for completing a task will, when given an initial state, proceed through a well-defined series of successive states, eventually terminating in an end-state. The transition from one state to the next is not necessarily deterministic; some algorithms, known as probabilistic algorithms, incorporate randomness.



A partial formalization of the concept began with attempts to solve the Entscheidungs problem (the "decision problem") posed by David Hilbert in 1928. Subsequent formalizations were framed as attempts to define "effective calculability" (Kleene 1943:274) or "effective method" (Rosser 1939:225); those formalizations included the Godel-Herbrand-Kleene recursive functions of 1930, 1934 and 1935, Alonzo Church's lambda calculus of 1936, Emil Post's "Formulation I" of 1936, and Alan Turing's Turing machines of 1936-7 and'1939.

Representations of algorithms are generally classed into three accepted levels of Turing machine description (Sipser 2006: 157):

1 High-level description:

"...prose to describe an algorithm, ignoring the implementation details. At this level we do not need to mention how the machine manages its tape or head"

2 Implementation description :

"...prose used to define the way the Turing machine uses its head and the way that it stores data on its tape. At this level we do not give details of states or transition function"

3 Formal description:

Most detailed, "lowest level", gives the Turing machine's "state table".

Example

One of the simplest algorithms is to find the largest number in an (unsorted) list of numbers. The solution necessarily requires looking at every number in the list, but only once at each. From this follows a simple algorithm, which can be stated in a high-level description English prose, as:

High-level description:

1. Assume the first item is largest.
2. Look at each of the remaining items in the list and if it is larger than the largest item so far, make a note of it.
3. The last noted item is the largest in the list when the process is complete.

SUMMARY

- Heuristics are mental rules of thumb that reduce the cognitive effort required for decision making. We often employ heuristics rather than carefully calculating the probability and the subjective value or utility of each possible outcome.
- Algorithms are the rules for a particular kind of a problem that will, if followed, yield a solution.

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REVIEW QUESTIO,NS

1. Explain Heuristics and algorithms.

2. Algorithm is a sequence of finite instructions. Explain.

PSYCHOPHYSICS : NATURE & METHODS ; METHOD OF AVERAGE ERROR, METHOD OF LIMITS, METHOD OF CONSTANT STIMULI.

B.A. SEM - II **Unit - V**

Course No. : PY-201 **Lesson : 13**

Structure

13.0 OBJECTIVES :

After going through this lesson the student should be able to :

— define psychophysics and know its nature.

— understand different methods in Psychophysics.

— know the application, advantages and disadvantages of method of average error, limits and constant stimuli.

13.1 NATURE OF PSYCHOPHYSICS

The term psychophysics refers to the study of the relationships between the properties of stimuli as measured by a physical scale and the psychological or subjective impressions of those stimuli. **Fechner 1860** introduced the word psychophysics to cover all kinds of psychophysical relations that could be studied scientifically. The physical and psychological dimentions are closely related, e.g. the sensation of colour is related to the length of the light wave (i.e. red), the sensation of loudness is related to the intensity of the sound stimulus. Such relationships between the physical properties of the stimulus and the attributes of sensations are noticeable in respect of all kinds of sensations. The study of the relationships, its description and interpretation is called the science of psychophysics.

According the Guilford :

"Psychophysics has been regarded as the science that investigates the quantitative relationships between physical events and corresponding psychological events".

The close relationship between the physical and the psychological properties led the psychophysicist to think that it may be possible to measure the characteristics of the psychological events just as it is possible to measure the properties of an object. To measure the characteristics of physical objects, we use a scale of measurement for measuring length, weight, density etc. The scale beings with a zero value which implies absence of the measured characteristic. The zero value of a scale which measures the psychophysical processes would be at the point where the mental process first occurs. Inspite of the close relationship between the physical and psychological, the zero value of the psychological scale is not the same as the origin of the physical scale. There is no mental response to the very low values of the physical stimulus. The physical value of the stimulus should reach a particular level beyond zero before it can elicit a mental response i.e. the intensity of the light should be a little above zero for the sensation of light to occur. Similarly the intensity of the stimulus should further increase before one can experience the sensation of colour. The study of such sensations and their magnitudes are related to the intensities of the initiating physical stimuli.

Certain specific questions arise when the relation between the characteristics of the stimulus and the attributes of experience are studied. These include :

(a) Detection of minimal Stimuli :

The minimum amount of stimulation required will vary with the conditions of testing. A tone has to be less intense in a sound treated room than in a noisy one, and similarly a weaker light is needed in a dark room than in a well lit one. Each condition of testing and for each subject, such a minimum value of a given stimulus can be estimated.

(b) Detection of minimal Stimuli differences :

A minimal difference qualitative or quantitative is needed between two stimuli so that they can be reliably recognized as different by a subject. The minimum value of the difference will vary from one testing situation to another and from one subject to another.

(c) Judgement of relations among Stimuli :

The judgement of stimuli well above the minimum needed for discrimination defines another important area of investigation e.g. two stimuli judged to be equal or as standing in a certain relation to one another. The extent of error when subjects attempt to equate two stimuli with respect to quality or quantity varies.

Basic concepts of psychophysics :

(a) Sensitivity :

The organism is equipped with a number of receptor organs specialized to respond to particular energy changes in the environment. The receptors of the eye are responsive to light within a certain range of wave lengths, the receptors of the ear to sound waves within a certain range of frequencies and so on. The capacity of the receptor organs and other reaction systems in the organism to respond selectively and differentially to physical stimulation are called as sensitivity.

(b) Terminal Limen (T.L.) :

These are weak stimuli which fail to arouse response. These are stimuli of

of too great quantity to be receivable by receptors e.g. if the intensity of a sound stimulus is increased beyond a certain level, the resulting sensation will be pain in the ear which is not a normal accompaniment of a sound stimulus.

(c) Stimulus Limen :

Stimuli of any particular variety fail to evoke a response unless they have a minimum intensity. This minimum intensity of stimulus required to evoke a response is known as the limen or the threshold or the stimulus limen or the absolute limen. For every class of stimuli there is stimulus limen.

The minimum value of the stimulus above zero at which a sensation takes place and below which one experiences no sensation is called stimulus threshold or (Reis Limen). R. L. is the abbreviation for Reis Limen which stands for the least noticeable stimulus. It was found that the least noticeable value of stimulus is not identical in all observations as it changes from trial to trial. R. L. was, therefore, defined to be that value of a stimulus which was noticeable in 50% of observations and not noticeable in remaining 50%. The R. L. varies from person to person. Some persons are less and some are more sensitive to a particular class of stimuli.

Thus the R. L. provides the zero for the psychological scale.

(d) Difference Limen (D.L.) :

Differential limen is a stimulus difference which establishes a point at which the two stimuli presented should appear to be different from each other. Here the main concern is with perceived difference between two stimuli i.e., the two stimuli appear differently in an experimental situation.

Differential limen may be defined as the smallest stimulus difference that is determined by an observer 50 percent of the time when presented. In certain experimental procedures the percentage is 75 percent. The D. L. is determined by the method of minimal changes and also by the method of constant stimuli. The difference limen is intended to determine the point at which the two stimuli appear with some difference. In some case the D. L. is equal to half of the difference between the upper and lower threshold values, i.e.

$$DL = \frac{UT \ \Omega \ LT}{2}$$

Thus, the DL is calculated by averaging the upper and lower limen values.

CHECK YOUR PROGRESS EXERCISE NO. 1

Note : Use the space give below for your answer. Use separate sheet if required.

1. Define Psychophysics.

_____

_____

_____

2. Discuss the nature of Psychophysics.

_____

_____

_____

3. Explain the basic concepts of Psychophysics.

_____

_____

_____

4. What is meant by Threshold ?

_____

_____

_____

5. Explain in brief :

(a) Stimulus Limen

_____

_____

_____

(b) Difference Limen

_____

_____

_____

13.2 METHODS :

The Psychophysical methods are of critical importance and form the basis of the methodological procedures in studies of sensation and perception in experimental psychology. They stand for the quantification of the relations between physical attributes of stimuli and reported sensory experiences of the organism. With the help of psychophysical methods, the ways of variation of sensory experience in correspondence with the variations in objectively measurable stimuli. The methods involve the statistical treatment of the data. The relationship between the physical and the psychological dimensions, the psychophysicists developed three different methods of collection and treatment of data. Each one of these methods is explained below briefly :

13.2.1 The Method of Mean or Average Error :

It is also called the Method of Adjustment or the method of reproduction because the subject attempt to reproduce the standard stimulus ; method of adjustemnt because the subject adjusts the value of SV equivalent to the SS and 'Method of equivalent stimuli' because the experimenter wants to study the subjects phenomenal equivalence of a standard stimulus.

The method is used to determine the average magnitude of error in one's perception of the value of a stimulus. In using this method, the experimenter repeatedly presents to the subject a stimulus of a fixed or constant value, called the standard

stimulus, together with a variable stimulus, that is, a stimulus whose value can be changed, also called the comparison stimulus. The subject can increase or decrease the magnitude of the variable stimulus until it appears to him to be equal to the standard stimulus; the subject is required to adjust the variable stimulus to equality to the standard stimulus. The difference between the value of the standard stimulus and the value of the variable stimulus which S makes equal to the standard stimulus gives an estimate of the magnitude of the error S makes in perceiving the standard stimulus. The mean of differences obtained from several observations provides the Average Error or Mean Error in perception. Since 'S' adjusts the variable stimulus to equality to the standard stimulus, the method is also called the Method of Adjustment. Sometimes, the constant stimulus is alone presented to S and he is asked to reproduce the stimulus. For example, he may be shown a line of a fixed length and he may be required to draw other lines of the same length. A comparison of the length of the line presented with the average length of the lines drawn by S gives an estimate of S's error of perception of the constant line.

In collecting data by the method of average error, several important precautions must be observed :

(a) The direction of adjustment should be varied. On some trials the variable stimulus should be set at a value considerably larger than the standard ; on other trials it should be made considerably smaller. The subject has to begin his adjustment toward equality on successive trials from both above and below the standard. The subject typically overshoots his mark and may be allowed to attain equality by successive approximation.

(b) Account should be taken of "constant errors". The spatial arrangement of the standard and stimulus and the temporal sequence of the stimuli may give rise to systematic judgement tendencies such as the space error and the time error. In arriving at an estimate of the point of subjective equality, such tendencies must be taken in to consideration.

(c) Care must be exercised to prevent the subject from using – consciously or unconsciously – extraneous cues. For example, if the initial value of the variable comparison stimulus were always the same, the subject might learn a specific movement by which to adjust it to the point of equality. He might learn to turn an

intensity control Knob through a certain angle.

The method is widely used in the measurement of perceptual illusions. Let us consider the use of this method when the experimenter wants to determine the extent of illusion in the Muller-Lyer experiment.

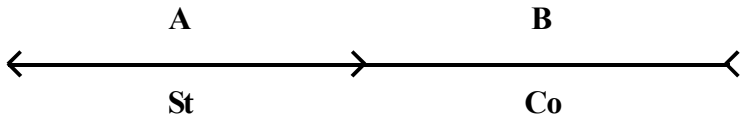


Fig. Muller Lyer Illusion

The illusion consists of segments A and B; and it is observed that though both the lines are of equal length, the line B is universally perceived as longer than the line A. An arrangement is made to vary the lengths of both the segments. On the reverse side of the apparatus, a scale is marked so that the actual lengths of the line can be easily recorded/measured.

In the experimental procedure, the experimenter first sets the standard. The standard set in the experiment is 150 mm. The experimenter sets Co shorter than St and in this situation the subject is instructed to push Co slowly 'out' until he perceives the two segments to be exactly equal. This is an ascending series. In the descending series the experimenter sets Co longer than St and the subject is instructed to push Co segment 'in' until he judges it to be equal to St.

Determination of PSE and CE by the Method of Average Error

Trial	Desending (Out)	(In)	Ascending (In)	(Out)	Ascending	Descending
1.	140	122	123	127		
2.	146	131	129	122		
3.	138	136	128	132		
4.	125	133	135	137		
5.	139	131	130	140		
			Standard = 150 mm			
M	137.6	130.6	129	131.6		

$$\overline{X}_D = \frac{137.6+131.6}{2} = \frac{269.2}{2} = 134.6 \text{ mm}$$

$$\overline{X}_A = \frac{130.6+129}{2} = \frac{259.2}{2} = 129.8 \text{ mm}$$

$$\text{PSE mm} = \frac{\overline{X}_D + \overline{X}_A}{2} = \frac{134.6+129.8}{2} = \frac{264.4}{2} \quad 132.6$$

CE = PSE - St = 32.2 - 150+= –17.8 mm

where

$\overline{X}_D$ = Average of descending trials;

$\overline{X}_A$ = Average of ascending trials;

PSE = Point of subjective Equality;

CE = Constant Error

In the experiment, the subject is given 20 trials. The subject is asked to move Co 'out' for first 5 trials, then 'in' in the next 10 trials and again 'out' in the last five trials. This procedure is followed to balance out the effects of practice and fatigue. This is known as counterbalanced design. Let L and R represent the position of Co in the left and right visual fields respectively and let O and I stand for the subjects moving Co out when Co is shorter and in when Co is longer. The distribution of 16 such settings would be as under :-

L (4 Trials)	R (4 Trials)	R (4 Trials)	L (4 Trials)
OIIO	OIIO	OIIO	OIIO

The method yields PSE directly and is mainly used to determine it. PSE obtained from the data is 132.2 mm and the value of CE is - 17.8 mm. The minus sign indicates that the subject underestimates St. The method can be used to determine DL, though it does not directly lead to its measurement. The DL can be calculated by first

calculating the probable error (PE) by using the formula PE = 0.6745 SD. This PE corresponds, though not exactly, to the genuine DL of the method of limits.

Advantages :-

There are certain advantages in using this method :-

(a) The procedure is simple and natural, and as the subject actively takes part in the experiment, his interest is sustained throughout.

(b) Secondly, the judgements given by the subject yield PSE directly.

Disadvantages :-

(a) Firstly, we do not get the direct estimate of DL. Though we can calculate DL by using SD, the procedure does not yield as reliable value of DL as in the methods of limits.

(b) Secondly, as the subject manipulates the stimulus, it becomes difficult for the experimenter to maintain constant experimental conditions as is possible in the other two basic psychophysical methods.

(c) Lastly, the use of the method is restricted to situation wherein it is possible to vary stimuli continuously or in small/discrete steps.

13.2.2 METHODS OF LIMITS

The Method of Limits is another important psychophysical method. It is also called the method of Just Noticeable Stimulus Difference, or the method of Minimal Change, or the Method Successive of Serial Exploration. This method has been principally used for the determination of the RL or the DL.

Determination of Absolute Thresh hold (RL) :—

RL is the lower or upper limit of a stimulus value. The subject is asked to report the presence or absence each stimulus. In this experiment, the experimenter has collected the data on one subject for determining the lower limit of audible pitch. Since hearing is limited to a frequency range between 16Hz and 20,000 Hz. the experimenter has used the frequency range of 12Hz and 28Hz. Since the lower limit used in this experiment is 12Hz and the upper limit used is 28 Hz the experiment

expects that he can get the lower limit of the audible pitch - i.e., around 16Hz - in the trial. The experiment is carried out till the experimenter is satisfied.

Determination of Stimulus Threshold by the Method of Limits:

Lower Limit for Audible Pitch

Frequency (Hz)		Ascending or Descending Series									
	D	A	D	A	D	A	D	A	D	A	
28	Y										
27	Y						Y				
26	Y		Y				Y				
25	Y		Y		Y		Y				
24	Y		Y		Y		Y				
23	Y		Y		Y		Y		Y		
22	Y		Y		Y		Y	Y	Y		
21	N		Y		Y	Y	Y	N	Y		
20		Y	N	Y	N	N	N	N	Y		
19		N		N		N		N	Y		
18		N		N		N		N	Y		
17		N		N		N		N	N	Y	
16		N		N		N				N	
15		N		N						N	
14		N		N		N				N	
13				N		N				N	
12				N							

(1) T = 21.5 19.5 20.5 18.5 19.5 19.5 19.5 21.5 17.5 17.5

M = 19.5 S.D = 1.34

(2) AvT = 20.5 19.5 19.5 20.5 17.5

M = 19.5 S.D = 1.1

(3) TD = 21.5 20.5 19.5 19.5 17.5 AUTA= 19.7

TA = 19.5 18.5 19.5 21.5 AUTA = 19.3

M = 19.5

The subject is given the stimulus of 28Hz and the subject responds by saying 'Yes' as hears the tone. The frequency of the tone is lowered by 1Hz. in each of the

successive trials and the subject keeps on reporting 'Yes' till the tone reaches the value of 22 Hz. Then he is administered the tone of 21Hz and the subject reports 'No' as he does not hear the tone. This change in judgement from 'yes' to 'No' reveals that the absolute threshold lies between 21 Hz and 22 Hz for our subject in that particular trial.

In this trial, the experimenter started with a tone of 28Hz, and the frequencies of the tone go on decreasing and is therefore called a trial in the descending series. In ascending series, the frequencies of the tone go on increasing. The experimenter starts with a tone of 14Hz, which is lower than the established lower limit of the audible pitch. The subject keeps on reporting 'No' till the tone reaches the value of the 19Hz. At 20Hz, the subject reports 'Yes' as he hears the tone. The threshold value, is therefore, 19.5Hz, and is subsequently entered in column T. In this experiment, the experimenter has arranged alternate ascending and descending series. Another important procedural point to be noted is that the starting points of both the ascending and descending series are different for each trial/vary with each trial. RL can be calculated in three ways :

(a) All the T values of the entire series are added and averaged. The mean value of T obtained in this experiment is 19.5 Hz.

(b) For each ascending and descending, we calculate the average T for each pair of ascending and descending series. These values are then averaged and the mean value of T.

(c) Lastly, we calculate the average T for all the ascending as well as descending series separately. The two average values thus obtained are averaged and the mean value of T is thus calculated.

The ascending and descending values are not the same and this difference is attributed to certain "constant errors" (CE) which influence the subject's decision. There is first an error of habituation, the subject keeps on reporting 'Yes' in the descending series and 'No' in the ascending series. The value of RL will thus be lowered in a descending series and will shoot up in the ascending series. The error of anticipation is exactly the opposite. This is demonstrated in descending series by changing the judgement from 'Yes' to 'No' and in ascending series from 'No' to 'Yes'.

In this averaging process, the introduction of ascending and descending series

is very useful. The methods of limits is particularly subject to both these errors and these can be avoided, at least partially, by instructing and training the subject not to consider his responses of the earlier trials, and to respond to the stimulus presented independently each time.

Determination of Difference Threshold (DL) :

In the determination of DL, we use two stimuli, one St and the other Co. In determining the DL, the subject is first given St and Co. He was asked to Judge whether he perceived Co to be greater than St, equal to St or smaller than St. The subject was to make one response out of the three available categories. When the subject first changes his judgement from greater (+) to equal (=) we locate the T value to be midway between these two judgements. This is regarded as upper threshold (+). We get another value of T, at a point, when the first shift in judgement is made from equal (=) to smaller (–). This is the lower threshold (T–). The value of St is 20 Hz. The ascending and descending series are used as in determining the RL. In the first column, the records of the descending series are made. The experimenter starts with the value of Co well above St. It is 25 Hz. Then with the minimal change in the value of Co, the subject.

Determination of Difference Threshold by the Method of Limits.

Co (Hz)	Value of Ascending or Descending Series										
	D	A	D	A	D	A	D	A	D	A	
25	+						+				
24	+				+		+				
23	+	+	+		+		+				
22	+	=	+		=		+		+		
21	=	=	=	+	=	+	=	+	+	+	
St = 20	=	–	=	=	–	=	=	=	+	=	
19	–	–	–	–		=	–	=	=	–	

18		–		–		–		–	–	–		
17		–		–				–		–		
16				–								

T (+) Upper
Threshold 21.5 22.5 21.5 20.5 22.5 20.5 21.5 20.5 19.5 20.5

T (–) Lower
Threshold 19.5 20.5 19.5 19.5 20.5 18.5 19.5 18.5 18.5 19.5

Mean T (+) = 22.1

Mean T (–) = 19.4

IU = Interval of uncertainty = [T(+) – T(–)] = 22.1–19.4 = 2.7

DL = Difference Threshold = ½ IU = 1.35

PSE = Point of Subjective Equality =

$$\frac{T(+) + (T-)}{2} = \frac{22.1 + 19.3}{2} = \frac{41.6}{2} = 20.75$$

CE = Constant Error = PSE – St = 20.75–20 = 0.75.

subject reports Co to be greater than St up to 22 Hz. At 21 Hz, the subject reports the change in judgement. Hence, the upper threshold (T+) for the series is 21.5 Hz. In ascending series, we start with the value of Co much below St. We first obtain the lower threshold (T–) and proceed to obtain the upper threshold (T+) for that particular series.

If we had used only two categories of responses, plus and minus, we would have obtained only one value of the threshold. But the advantage in using the three categories of responses is that we get an interval of uncertainty, where in, neither plus nor minus judgements occur. The IU is calculated by subtracting the average values of (T–) from the average values of (T+). The IU constitutes 2 DLs, hence

DL=IU/2, which is 1.35. The PSE where the subject perceives Co to be equal to St. In this experiment, therefore, it will be [T(+) – T(–)]/2 – and it is 20.75 Hz. The constant error (CE) is obtained by calculating the difference between the PSE and St. It may be positive or negative depending upon whether the PSE is greater or smaller than St. If it is positive, then it means that the subject over estiamtes St, and if it is negative it means that the subject underestimates St. In our experiment it is + 0.75.

Between the above two psychophysical methods, the method of average error has certain advantages over the method of limits. Chief among them are :—

(a) The subject is actively involved in the experiment when method of average is employed.

(b) It is easy to change the variable stimulus.

Continuous as in the case of method of average error rather than changing the SV in equal and small steps in the method of limits.

Constant Stimuli

The constant stimuli methods are generally regarded as the most accurate of all the psychophysical experiments but they are too cumbersome for the experiments as well as the subject. If the experimenter and the subject can put up with its procedural wrangles, then this method yields the best possible estimates and controls almost all the errors that enter in to the experiment while the methods of average error and limits are employed. The possible errors that might enter the constant methods are the time error and the errors caused by the fatigue on the part of the subject and also possible on the part of the experimenter. The chief purpose of this method too is to determine the RL and DL. This method is very similar to the method of limits.

Determination of Absolute Threshold (RL)

To determine RL, S has to report whether he notices the stimulus or fails to notice it. A stimulus that is perceived just above zero percent of the trial and the one that is perceived below hundred percent of the trials constitute the range to be employed by the experimenter. The experimenter selects a few stimuli in

the range and usually the number of stimuli selected varies between 4 and 10. These stimuli are spaced in equal steps along the stimulus continuum. The stimuli are presented to the subject in random order and each stimulus is presented to the subject for a large number of times.

The experimenter wants to determine the absolute threshold for pressure on the tip of the subject's finger. With the use of Von Bagh's tactical stimulator the experimenter is able to vary the amount of pressure exerted on the subject's finger tip and this is measured in grams per square mm. After a few tryouts, the experimenter selects a range consisting of various pressures, say from 1 to 6 gms/sq. mm. The range is selected that the lowest pressure yields favourable response approximately on 5% of the trials and the highest one yields it approximately on 95% of trials. The experimenter then conducts the experiment in which the selected stimuli are used randomly and each stimulus is administered 20 times.

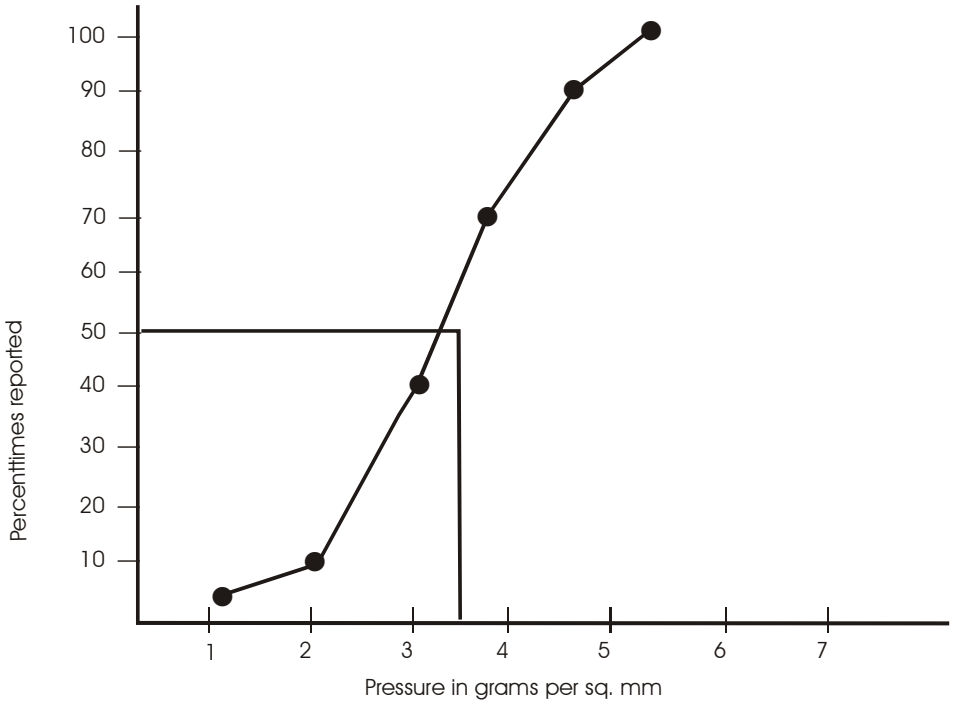
The subject reports the presence of 3 gms/sq. mm pressure for 35 percent of the times, while 4 gms/sq. mm pressure is felt by the subject on 65 percent of the times. It is, therefore, obvious that the absolute threshold lies between these two pressures.

Determination of Absolute Threshold by the Method of Constant Stimuli

	Stimulus Value (gm/mm^2)	Percentage of times reported present
1	5	
2	16	
3	35	
4	65	
5	80	
6	95	

The absolute threshold can be obtained by employing one of these two simple methods. First Method – We can draw an s – p graph. The stimulus values (s) are plotted on the abscissa and the proportion or relative frequency (p) have been converted in to percentages and plotted along the ordinate. A horizontal line is drawn from the 50 percent point on the ordinate and where it touches the graph, a vertical line from that point is dropped on the abscissa. This value on the abscissa gives us value of the absolute threshold. In the graph, it is shown in dotted line and the value of the absolute threshold thus obtained is 3.5 gms/sq. mm.

Another method to calculate the RL is the method of linear interpolation. It is clear from our data that the 50 percent point will lie between 35 percent and 65 percent points. Since 50 percent is exactly halfway between 35 percent and 65 percent points, by the method of linear interpolation, we fix the RL, at a corresponding position on the stimulus scale which comes out to be 3.5 gms./sq. mm.



Determination of the Difference Threshold (DL) :

In determining the DL by the method of constant stimulus differences, two stimuli-one standard and other variable are used. The subject is presented with St

and then Co on first half of the trials and in the reverse order in the other half of the trials. The subject is instructed to judge whether the first or the second member of the pair of stimuli was "greater than" (+) or "less than" (–) the other. Occasionally, a third category of "equal" (=) judgements is used. Generally, two category judgements are used in an experiment to determine DL, because it has been well established that if the observer is instructed not to use equal category and use only "greater than" and "less than" judgements, the observer guesses right more often than wrong (Fullerton and Cattell, 1892). Another advantage is that it is easier to analyse the data with the two category judgements as compared with the three category judgements. The classical laboratory experiment of Judging the differences in weights first with two category judgements and later with three category judgements in determining the DL.

Two Category Judgement

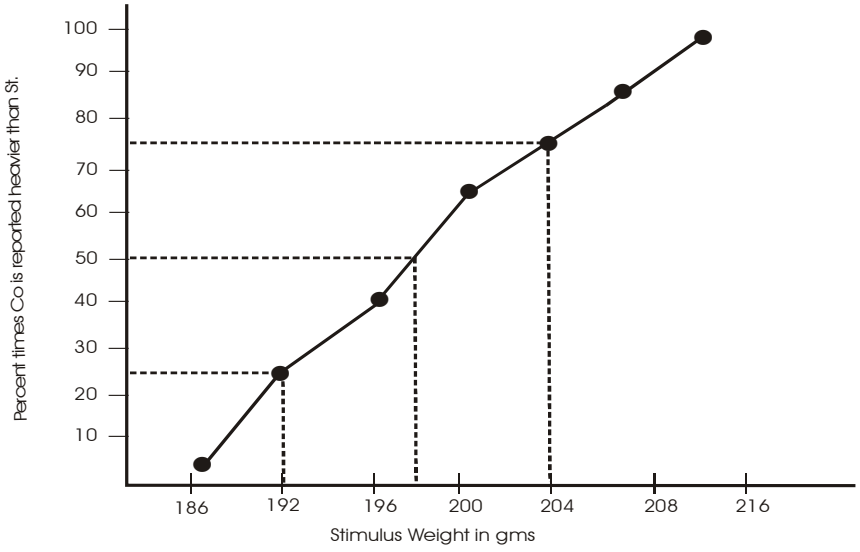
In the two category judgement experiment, the experimenter has employed the judgements of "greater than" and "less than". The standard weight is of 200 gms and the series comprises of seven weights with the difference in the successive weights being of 4 gms, as under.

188, 192, 196, 200, 204, 208, 212 each weight is administered 20 times in random order. Co precedes St in the first 10 trials and it follows St in the remaining trials. The subject is blindfolded and is instructed to lift the weight through the same height.

To analyse the data obtained in the laboratory experiment on a single subject. Since PSE is the judgement of equality, in this particular case, it is the value of Co that is judged heavier/lighter than St on 50% of the trials. From the data, it is clear that PSE lies between 196 and 200. The value of PSE can be obtained either by using the method of linear interpolation or graphically.

Value of Co	Percentage of times Co reported heavier than St.
188	7
192	22
196	39
200	61
204	75
208	88
212	95

The abscissa represents the stimulus values while the ordinate represents the percentage of times Co is reported heavier than St. A horizontal line is drawn from the 50 percent point on the ordinate and where it touches the graph, a vertical line from that point is dropped on the abscissa. The value on abscissa denotes PSE



In the determination of DL, the upper DL is conventionally defined as the difference from St which yield 75 percent heavier judgements and the lower DL is

the value of the difference from St which yields 25 percent heavier judgements. Since 75 percent and 25 percent both lie midway between zero discrimination (50%) and perfect discrimination (100% point and zero % point), they are regarded as reasonable estimates of UL and LL. As in the methods of limits, DL is one half the difference between UL and LL. Thus,

$DL = \frac{UL - LL}{2}$. The values of the UL and LL is 204 and 192.71 and hence the DL as 5.65. For determining the DL from the graph, we drop two verticals at 25 percent and 75 percent points on the curve. The values of LL and UL to be 193 and 204 respectively. Finally, the DL to be 5.50.

Three Category Judgement

The experimenter makes use of three categories : Heavier, equal and lighter. As in the method of limits, the experimenter's purpose in using the three categories is to determine two inter-category thresholds. The one will be obtained where the minus separates from the equal and the other where equal separates from the plus. The experimenter may introduce the third category of equal or doubtful responses of those subjects who insists on giving these Judgements.

To Calculate the PSE and the DL, the general procedure followed is first to convert the three category judgements in to two category judgements and then to treat the data as in a two category judgements. There are two procedures followed in reducing the data in two categories. In the procedure followed by Fechner, he divided the equal judgements equally between plus and minus, at each separate value of Co. Suppose for a certain Co, the experimenter has obtained 30 Judgements of plus, 50 judgements of equal and 20 of minus. Now 50 Judgements of equal are to be divided in proportion of the plus and minus judgements obtained and finally added to them. The proportion of plus to minus judgements is 3:2 and when equal judgements are divided in this proportion and added to plus and minus Judgements, we have 60 judgements of plus and 40 of minus. Neither of these methods is regarded perfect and as already pointed out earlier the observer guesses right more often than wrong when two category Judgements are given.

Let us suppose that the experimenter wants to use the data obtained from three category Judgements. The experimenter will obtain two thresholds, as in the method of limits. One will be (T+) and the other will be (T–). Index of (T+) would be the mean for plus Judgements ; and the index of (T–) would be the mean for minus Judgements. The IU constitutes 2 DLs and hence DL = ½ IU. Midpoint of IU gives us PSE. Thus,

$$IU = T(+) - T(-)$$

$$DL = \tfrac{1}{2}[T(+) - T(-)]$$

$$PSE = \tfrac{1}{2}[T(+) + T(-)]$$

Since DL is defined as half the IU, its value will depend upon the ranges of IU. If IU is large, then DL will be large; and if IU is small, then DL will be small. If the observer is a very confident individual, he will confine to only two categories, plus and minus. Thus, the attitude of the observer will, at least partly, determine the value of the DL and cannot be taken at its face value as individual's perceptual ability to discriminate the stimuli. Experimental manipulation and measurement of such biases have been attempted.

Limitations

Following are the main limitations of the method of constant stimuli :

(a) The stimuli are presented to 'S' in a random order.

(b) The most intense stimulus employed in superthreshold on somewhat less than 100 percent of the trials presumably, and therefore cannot be particularly painful.

CHECK YOUR PROGRESS EXERCISE NO. 2

Note : Use the space give below for your answer. Use separate sheet if required.

1. Name three methods used by psychophysicsts

_____

_____

_____

2. Briefly describe the method of average error with suitable example.

_____

_____

_____

3. What is meant by the term threshold ?

_____

_____

_____

4. How difference threshold is determined ?

_____

_____

_____

5. What are the limitations of method of constant stimuli ?

_____

_____

_____

13.3 LET US SUM UP

Psychophysics refers to the study of the relationships between the properties of stimuli as measured by a physical scale and the psychological impressions of these stimuli. The relation between the characteristics of the stimulus and the attributes of experience are influenced by detection of minimal stimuli, minimal stimulus differences and judgement of relations among stimuli. Psychophysics is based on the basic concepts of sensitivity, terminal limen, stimulus limen and difference limen.

Psychophysical methods are of critical importance in experimental psychology. The methods involve statistical treatment of data. The method of average error also

The methods involve statistical treatment of data. The method of average error also known as method of mean, method of adjustment, method of reproduction and method of equivalent stimuli. This is used to determine the average magnitude of error in one's perception of the value of a stimulus. The method is widely used in measurement of perceptual illusions.

The method of limit is also called method of just noticeable difference or the method of minimal change or the method of successive or serial exploration. This method has been principally used for the determination of the RL (Absolute threshold) and DL (Difference threshold). Out of the above two average error method has certain advantages over the method of limits.

The constant stimuli methods are generally regarded as most accurate among the three methods. Two judgement category and three judgement category are used in this method.

SIGNAL DETECTION THEORY

B.A. SEM - II **Unit - V**

Course No. : PY-201 **Lesson : 14**

Signal Detection Theory

Signal detection theory is a popular model of sensory processing. The general approach of signal detection theory has direct application for us in terms of sensory experiments. But it also offers a way to analyze many different kinds of decision problems. Its applications can be seen in a variety of domains in our everyday life and often we are involved in decision making processes in which the concepts of signal detection come into play.

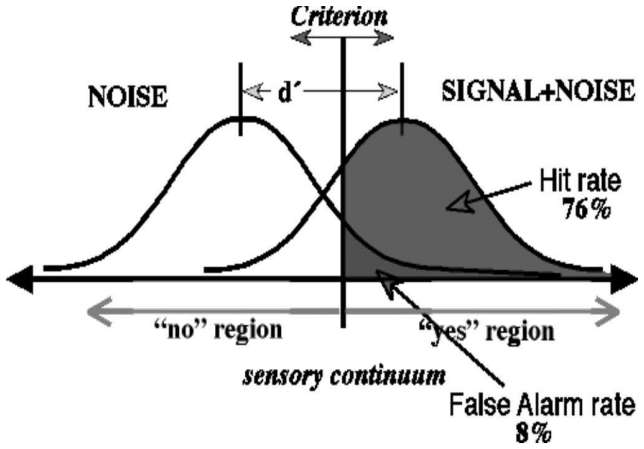
Consider the following everyday example:

Reading in the library, you see someone who looks familiar. Have you met him before? There is uncertainty about whether a signal is present or not. That is, whether you've met the person before. For the person who looks familiar, should you go and talk to him at the risk of embarrassment when you realize he's a stranger? Or should you pretend to ignore him at the risk of offending your friend? Both paths of action have potential costs and benefits and the correct decision is not clear. Furthermore, the decision you make might be biased by your own previous experience. For example, if in the past you accidentally waved 'hello' to a stranger, you might be less likely to wave to the person who looks familiar

The theory of signal detection was developed by mathematicians and engineers in the 1950's working in the fields of mathematical statistics and electronic communications. Signal detection deals with the detectability of signals and controlling the criterion that are used for the detection of signals. Early on, it became apparent that this theory has application to psychophysics because the observer's criterion affects the judgments they make. The

theory of signal detection allows for the ability to separate the effects of the stimulus detectability from the observer's criterion in sensory experiments.

The following figure will be used to explain the key concepts we will need for signal detection theory:



The subject's task is to detect a signal which is presented along some sensory continuum. For example, the sensory continuum in the case of the experiment of Hecht, Schlaer and Pirenne, is a visual continuum of flash intensity. Present in the observer's nervous system is noise that may come from a variety of sources such as spontaneous isomerizations and spontaneous neural discharge. When a signal, a flash in this case, is presented to the subject, in order to detect the flash, the subject must discriminate the signal which is added to the inherent noise from the noise alone. We think of the noise as having a distribution; at any point in time the noise has a value that varies from a mean level. We will assume here that the noise distribution is normal. When a signal is added to the noise, the distribution is shifted to the right along the sensory continuum. Again we will assume that the signal + noise distribution is normally distributed and that it has the same standard deviation as the noise distribution alone. We can normalize these distributions (to simplify and standardize the math involved) so that the mean of the noise distribution is zero and the standard deviations of both distributions are 1.

When a signal + noise distribution (SN) is detectably different (let's assume we know the detectible difference, for now) from the noise distribution (N) the two distributions

are separated by a distance called d' (d-prime). d' is a sensitivity index which is the distance of the mean of the SN distribution from the N distribution when the N distribution has a mean equal to zero and both distributions have a standard deviation of one.

When a subject is presented with the signal at any particular time, the signal will fall along the sensory continuum according to the SN distribution. The subject will base his judgment of detection of the signal according to some criterion along the sensory continuum. If no signal is presented during a trial the subject is still subject to an event at that time along the sensory continuum which has a probability associated with the N distribution. For any particular trial, the sensory event (which may be the result of a signal presentation or no signal presentation) is above the criterion level the subject will report seeing the flash. If the sensory event is below the criterion, he will report not seeing the flash.

Let's assume the subject's criterion is located at the point shown in the figure above. If you present the subject with multiple trials in which the signal is presented or not presented there will be a probability associated with the subject's response due to the distributions of the N and SN. These probabilities can be summarized in a conditional probability matrix. The rows of the matrix represent the presence or absence of a signal and the columns represent the subject's response.

If the subject says he saw the signal ("yes") when it was present, this is called a hit.

If the subject says he didn't see the signal ("no") when it was present, this is called a miss.

If the subject says he saw the signal ("yes") when it was absent, this is called a false alarm.

If the subject says he didn't see the signal ("no") when it was absent, this is called a correct rejection.

The notation P (Y|SN) means the probability of a yes response given the presentation of the signal and P (N|N) means the probability of a no response given that the signal was absent.

So in the example presented here the table would look like this:

		RESPONSE "Yes"	RESPONSE "No"
STIMULUS	Present SN	P(Y|SN) HIT	P(N|SN) MISS
	Absent N	P(Y|N) FALSE ALARM	P(N|N) CORRECT REJECTION

	"Yes"	"No"
SN	**.76**	**.24**
N	**.08**	**.92**

So for example, when the signal is not present, there will be a false alarm rate of 8%. Notice that the probability sums to 1.0 reading across the table.