CHALIMBANA UNIVERSITY

DIRECTORATE OF DISTANCE EDUCATION

PYS 3300: BASIC STRUCTURES AND PROCESSES

FIRST EDITION 2020

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.

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MODULE OVERVIEW

Introduction

This course provides a framework for understanding different. basic human structures and processes in Psychology.

Rationale

This course will give you the understanding of different basic human structures and processes in Psychology that will help you understand human behavior better.

Course aims

The course aims at familiarizing you with an overview of the basic human structures and processes in Psychology.

Learning Outcomes

By the end of the course, you are expected to;

- describe the basic neuro-psychological processes.
- explain sensory functioning, signal detection, and sensory adaptation.
- explain various states of consciousness and their impact on behaviour.
- apply learning principles to explain human behaviour.
- compare and contrast various cognitive processes.
- identify and apply basic motivational concepts to understand the behaviour of humans.

Summary

This module covers basic human structures and processes in Psychology.

Study skills

As an adult learner, your approach to learning will be different to that of your school days you will choose when you want to study. You will have professional and/or personal motivation for doing so and you will most likely be fitting your activities around other professional or domestic responsibilities.

Essentially you will be taking control of your learning environment. As a consequence, you will need to consider performance issues related to time management, goals setting, stress management, etc. perhaps you will also need to reacquaint yourself in areas such as essay planning, coping with examinations and using the internet as a learning source.

Your most significant considerations will be time and space i.e. the time you dedicate to your learning and the environment in which you engage in that learning. It is recommended that you take time now before starting your self-study to familiarise yourself with these issues. There are a number of excellent resources on the web. A few suggested links are: http://www.how-to-study.com/ and http://www.ucc.vt.edu/stdysk/stdyhlp.html

Time frame

You are expected to spend at least three terms of your time to study this module. In addition, there shall be arranged contact sessions with lecturers from the University during residential possibly in April, August and December. You are requested to spend your time carefully so that you reap maximum benefits from the course. Listed below are the components of the course, what you have to do and suggestions as to how you should allocate your time to each unit in order that you may complete the course successfully and no time.

Required resources

Text books and module.

Need help

In case you have difficulties in studying this module don't hesitate to get in touch with your lecturers. You can contact them during week days from 08:00 t0 17:00 hours. Mr Moono Maurice mmoono.75@gmail.com Tutorial Room 3,. You are also free to utilise the services of the University Library which opens from 08:00 hours to 20:00 hours every working day.

Assessment

Continuous Assessment	**50%**
One Assignment	25%
One Test	25%
Final Examination	**50%**
Total	**100**

REFERENCES

Required Readings

1. Goldstein E.B (2009). Sensation and Perception, 8th Ed. Wadson cenagage learning .Belmont.

2. Medin, D.L, Ross, B. H. & Markman, A. B. (2005). Cognitive Psychology, 4th Ed. John Wiley & Sons, Inc.

Recommended Readings

1. Sternberg R.J. (2009) Cognitive Psychology Harcourt Bruce College Publishers, Orlando.

2. Garrett B. (2009) Brain and Behaviour, 2nd Ed. Sage Publications, Los Angeles.

3. Wickens A (2005). Foundations of Biopsychology, 2nd Ed. Pearson Education Ltd Essex.

UNIT 1: BASIC STRUCTURE AND FUNCTION OF THE NERVOUS SYSTEM

1.1 Introduction

The picture you have in your mind of the nervous system probably includes the **brain**, the nervous tissue contained within the cranium, and the **spinal cord**, the extension of nervous tissue within the vertebral column. That suggests it is made of two organs—and you may not even think of the spinal cord as an organ—but the nervous system is a very complex structure. Within the brain, many different and separate regions are responsible for many different and separate functions. It is as if the nervous system is composed of many organs that all look similar and can only be differentiated using tools such as the microscope or electrophysiology. In comparison, it is easy to see that the stomach is different than the esophagus or the liver, so you can imagine the digestive system as a collection of specific organs.

1.2 Learning Outcomes

By the end of this unit, you are to;

- identify the anatomical and functional divisions of the nervous system.
- analyze the functional and structural differences between gray matter and white matter
- discuss the basic functions of the nervous system.

1.3 Time frame

You need about two (2) hours to interact with this material.

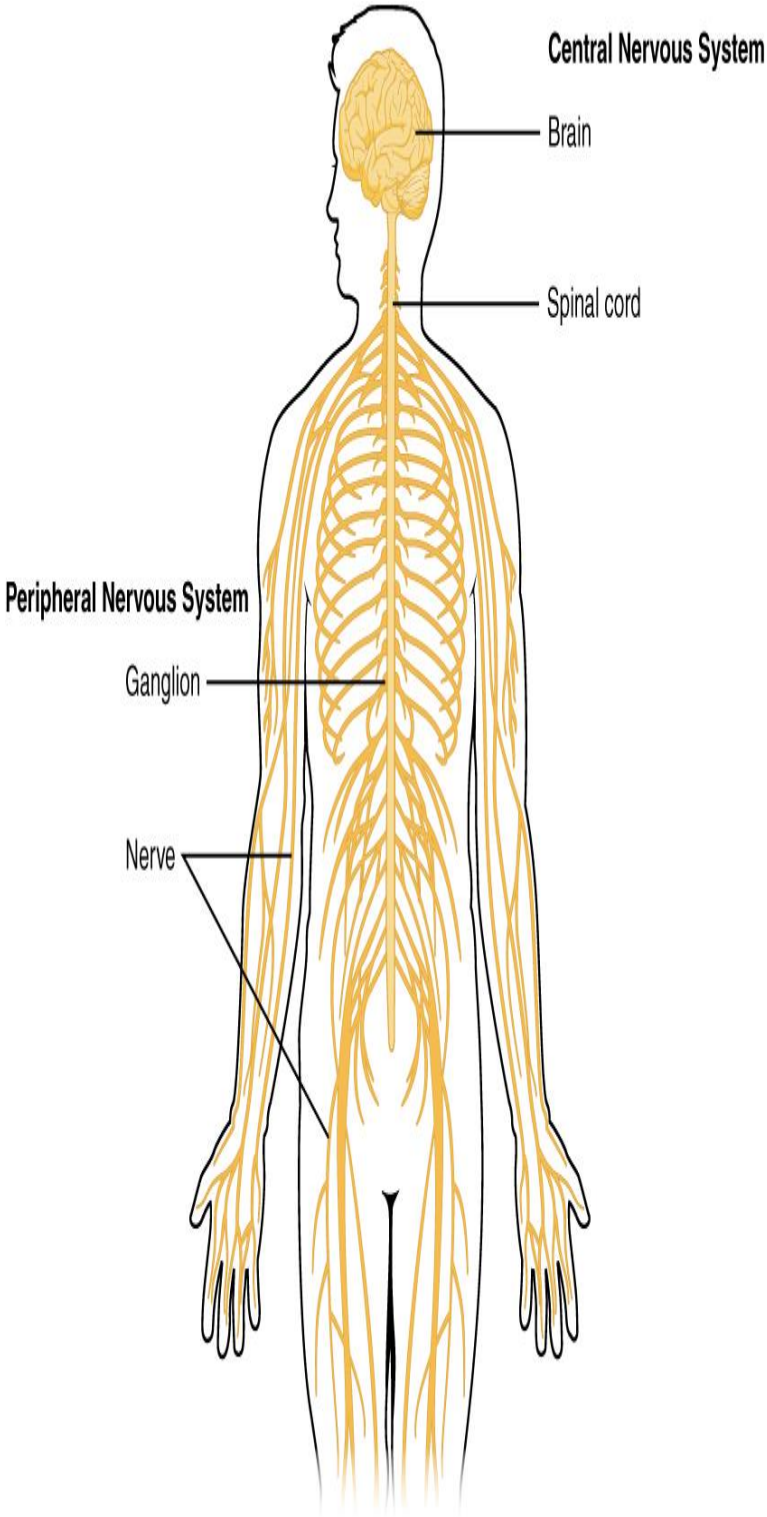
1.4 Content

- The Central and Peripheral Nervous Systems
- Functional Division of the Nervous System
- Autonomic nervous system (ANS)
- Peripheral nervous system (PNS)
- Understanding The Transmission of Nerve Impulses

1.5 The Central and Peripheral Nervous Systems

The nervous system can be divided into two major regions: the central and peripheral nervous systems. The **central nervous system (CNS)** is the brain and spinal cord, and the **peripheral nervous system (PNS)** is everything else (Figure 1). The brain is contained within the cranial cavity of the skull, and the spinal cord is contained within the vertebral cavity of the vertebral column. It is a bit of an oversimplification to say that the CNS is what is inside these two cavities and the peripheral nervous system is outside of them, but that is one way to start to think about it. In actuality, there are some elements of the peripheral nervous system that are within the cranial or vertebral cavities. The peripheral nervous system is so named because it is on the periphery—meaning beyond the brain and spinal cord. Depending on different aspects of the nervous system, the dividing line between central and peripheral is not necessarily universal.

Figure 1. **The Central and Peripheral Nervous System** (Source: Kandel 2012, Principles of neural Science)



The structures of the PNS are referred to as ganglia and nerves, which can be seen as distinct structures. The equivalent structures in the CNS are not obvious from this overall perspective and are best examined in prepared tissue under the microscope.

Nervous tissue, present in both the CNS and PNS, contains two basic types of cells: neurons and glial cells. A **glial cell** is one of a variety of cells that provide a framework of tissue that supports the neurons and their activities. The **neuron** is the more functionally important of the two, in terms of the communicative function of the nervous system. To describe the functional divisions of the nervous system, it is important to understand the structure of a neuron. Neurons are cells and therefore have a **soma**, or cell body, but they also have extensions of the cell; each extension is generally referred to as a **process**. There is one important process that every neuron has called an **axon**, which is the fiber that connects a neuron with its target. Another type of process that branches off from the soma is the **dendrite**. Dendrites are responsible for receiving most of the input from other neurons.

Looking at nervous tissue, there are regions that predominantly contain cell bodies and regions that are largely composed of just axons. These two regions within nervous system structures are often referred to as **gray matter** (the regions with many cell bodies and dendrites) or **white matter** (the regions with many axons). The colors ascribed to these regions are what would be seen in "fresh," or unstained, nervous tissue. Gray matter is not necessarily gray. It can be pinkish because of blood content, or even slightly tan, depending on how long the tissue has been preserved. But white matter is white because axons are insulated by a lipid-rich substance called **myelin**. Lipids can appear as white ("fatty") material, much like the fat on a raw piece of chicken or beef. Actually, gray matter may have that color ascribed to it because next to the white matter, it is just darker—hence, gray.

The distinction between gray matter and white matter is most often applied to central nervous tissue, which has large regions that can be seen with the unaided eye. When looking at peripheral structures, often a microscope is used and the tissue is stained with artificial colors. That is not to say that central nervous tissue cannot be stained and viewed under a microscope, but unstained tissue is most likely from the CNS—for example, a frontal section of the brain or cross section of the spinal cord.

A brain removed during an autopsy, with a partial section removed, shows white matter surrounded by gray matter. Gray matter makes up the outer cortex of the brain.

Regardless of the appearance of stained or unstained tissue, the cell bodies of neurons or axons can be located in discrete anatomical structures that need to be named. Those names are specific to whether the structure is central or peripheral. A localized collection of neuron cell bodies in the CNS is referred to as a **nucleus**. In the PNS, a cluster of neuron cell bodies is referred to as a **ganglion**. It is the center of an atom, where protons and neutrons are found; it is the center of a cell, where the DNA is found; and it is a center of some function in the CNS. There is also a potentially confusing use of the word ganglion (plural = ganglia) that has a historical explanation. In the central nervous system, there is a group of nuclei that are connected together and were once called the basal ganglia before "ganglion" became accepted as a description for a peripheral structure. Some sources refer to this group of nuclei as the "basal nuclei" to avoid confusions

(a) The nucleus of an atom contains its protons and neutrons. (b) The nucleus of a cell is the organelle that contains DNA. (c) A nucleus in the CNS is a localized center of function with the cell bodies of several neurons, shown here circled in red. (credit c: "Was a bee"/Wikimedia Commons)

Terminology applied to bundles of axons also differs depending on location. A bundle of axons, or fibers, found in the CNS is called a **tract** whereas the same thing in the PNS would be called a **nerve**. There is an important point to make about these terms, which is that they can both be used to refer to the same bundle of axons. When those axons are in the PNS, the term is nerve, but if they are CNS, the term is tract. The most obvious example of this is the axons that project from the retina into the brain. Those axons are called the optic nerve as they leave the eye, but when they are inside the cranium, they are referred to as the optic tract. There is a specific place where the name changes, which is the optic chiasm, but they are still the same axons (Figure 4). A similar situation outside of science can be described for some roads. Imagine a road called "Broad Street" in a town called "Anyville." The road leaves Anyville and goes to the next town over, called "Hometown." When the road crosses the line between the two towns and is in Hometown, its name changes to "Main Street." That is the idea behind the naming of the retinal axons. In the PNS, they are called the optic nerve, and in the CNS, they are the optic tract. Table 1 helps to clarify which of these terms apply to the central or peripheral nervous systems.

The axons extend from the eye to the brain through these two bundles of fibers, but the chiasm represents the border between peripheral and central.

1.6 Functional Division of the Nervous System

The nervous system can also be divided on the basis of its functions, but anatomical divisions and functional divisions are different. The CNS and the PNS both contribute to the same functions, but those functions can be attributed to different regions of the brain (such as the cerebral cortex or the hypothalamus) or to different ganglia in the periphery. The problem with trying to fit functional differences into anatomical divisions is that sometimes the same structure can be part of several functions. For example, the optic nerve carries signal from the retina that are either used for the conscious perception of visual stimuli, which takes place in the cerebral cortex, or for the reflexive responses of smooth muscle tissue that are processed through the hypothalamus.

There are two ways to consider how the nervous system is divided functionally. First, the basic functions of the nervous system are sensation, integration, and response. Secondly, control of the body can be somatic or autonomic—divisions that are largely defined by the structures that are involved in the response. There is also a region of the peripheral nervous system that is called the enteric nervous system that is responsible for a specific set of the functions within the realm of autonomic control related to gastrointestinal functions.

1.7 Basic Functions

The nervous system is involved in receiving information about the environment around us (sensation) and generating responses to that information (motor responses). The nervous system can be divided into regions that are responsible for **sensation** (sensory functions) and for the **response** (motor functions). But there is a third function that needs to be included. Sensory input needs to be integrated with other sensations, as well as with memories, emotional state, or learning (cognition). Some regions of the nervous system are termed **integration** or association areas. The process of integration combines sensory perceptions and higher cognitive functions such as memories, learning, and emotion to produce a response.

Sensation. The first major function of the nervous system is sensation—receiving information about the environment to gain input about what is happening outside the body (or, sometimes,

within the body). The sensory functions of the nervous system register the presence of a change from homeostasis or a particular event in the environment, known as a **stimulus**. The senses we think of most are the "big five": taste, smell, touch, sight, and hearing. The stimuli for taste and smell are both chemical substances (molecules, compounds, ions, etc.), touch is physical or mechanical stimuli that interact with the skin, sight is light stimuli, and hearing is the perception of sound, which is a physical stimulus similar to some aspects of touch. There are actually more senses than just those, but that list represents the major senses. Those five are all senses that receive stimuli from the outside world, and of which there is conscious perception. Additional sensory stimuli might be from the internal environment (inside the body), such as the stretch of an organ wall or the concentration of certain ions in the blood.

Response. The nervous system produces a response on the basis of the stimuli perceived by sensory structures. An obvious response would be the movement of muscles, such as withdrawing a hand from a hot stove, but there are broader uses of the term. The nervous system can cause the contraction of all three types of muscle tissue. For example, skeletal muscle contracts to move the skeleton, cardiac muscle is influenced as heart rate increases during exercise, and smooth muscle contracts as the digestive system moves food along the digestive tract. Responses also include the neural control of glands in the body as well, such as the production and secretion of sweat by the eccrine and merocrine sweat glands found in the skin to lower body temperature.

Responses can be divided into those that are voluntary or conscious (contraction of skeletal muscle) and those that are involuntary (contraction of smooth muscles, regulation of cardiac muscle, activation of glands). Voluntary responses are governed by the somatic nervous system and involuntary responses are governed by the autonomic nervous system, which are discussed in the next section.

Integration. Stimuli that are received by sensory structures are communicated to the nervous system where that information is processed. This is called integration. Stimuli are compared with, or integrated with, other stimuli, memories of previous stimuli, or the state of a person at a particular time. This leads to the specific response that will be generated. Seeing a baseball pitched to a batter will not automatically cause the batter to swing. The trajectory of the ball and its speed will need to be considered. Maybe the count is three balls and one strike, and the batter wants to let this pitch go by in the hope of getting a walk to first base. Or maybe the batter's team is so far ahead, it would be fun to just swing away.

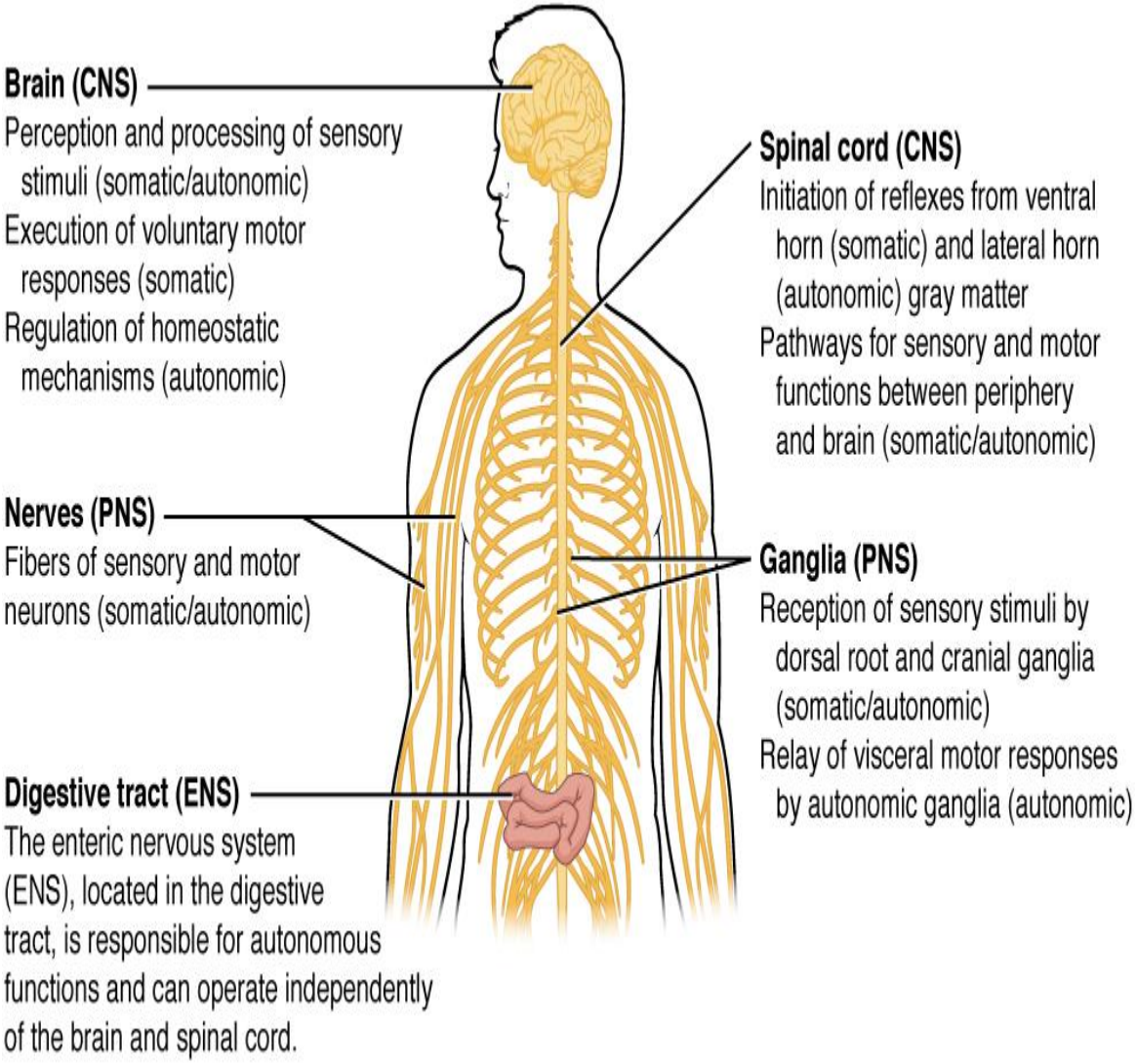
Controlling The Body

The nervous system can be divided into two parts mostly on the basis of a functional difference in responses. The **somatic nervous system (SNS)** is responsible for conscious perception and voluntary motor responses. Voluntary motor response means the contraction of skeletal muscle, but those contractions are not always voluntary in the sense that you have to want to perform them. Some somatic motor responses are reflexes, and often happen without a conscious decision to perform them. If your friend jumps out from behind a corner and yells "Boo!" you will be startled and you might scream or leap back. You didn't decide to do that, and you may not have wanted to give your friend a reason to laugh at your expense, but it is a reflex involving skeletal muscle contractions. Other motor responses become automatic (in other words, unconscious) as a person learns motor skills (referred to as "habit learning" or "procedural memory").

The **autonomic nervous system (ANS)** is responsible for involuntary control of the body, usually for the sake of homeostasis (regulation of the internal environment). Sensory input for autonomic functions can be from sensory structures tuned to external or internal environmental stimuli. The motor output extends to smooth and cardiac muscle as well as glandular tissue. The role of the autonomic system is to regulate the organ systems of the body, which usually means to control homeostasis. Sweat glands, for example, are controlled by the autonomic system. When you are hot, sweating helps cool your body down. That is a homeostatic mechanism. But when you are nervous, you might start sweating also. That is not homeostatic, it is the physiological response to an emotional state.

There is another division of the nervous system that describes functional responses. The **enteric nervous system (ENS)** is responsible for controlling the smooth muscle and glandular tissue in your digestive system. It is a large part of the PNS, and is not dependent on the CNS. It is sometimes valid, however, to consider the enteric system to be a part of the autonomic system because the neural structures that make up the enteric system are a component of the autonomic output that regulates digestion. There are some differences between the two, but for our purposes here there will be a good bit of overlap. See Figure 5 for examples of where these divisions of the nervous system can be found.

Figure 2. **Somatic, Autonomic, and Enteric Structures of the Nervous System**. (Source wright, 1993, Human Biology and Health)



Somatic structures include the spinal nerves, both motor and sensory fibers, as well as the sensory ganglia (posterior root ganglia and cranial nerve ganglia). Autonomic structures are found in the nerves also, but include the sympathetic and parasympathetic ganglia. The enteric nervous system includes the nervous tissue within the organs of the digestive tract.

How Much of Your Brain Do You Use?

Have you ever heard the claim that humans only use 10 percent of their brains? Maybe you have seen an advertisement on a website saying that there is a secret to unlocking the full potential of your mind—as if there were 90 percent of your brain sitting idle, just waiting for you to use it. If you see an ad like that, don't click. It isn't true.

An easy way to see how much of the brain a person uses is to take measurements of brain activity while performing a task. An example of this kind of measurement is functional

magnetic resonance imaging (fMRI), which generates a map of the most active areas and can be generated and presented in three dimensions (Figure 6).

The underlying assumption is that active nervous tissue will have greater blood flow. By having the subject perform a visual task, activity all over the brain can be measured. Consider this possible experiment: the subject is told to look at a screen with a black dot in the middle (a fixation point). A photograph of a face is projected on the screen away from the center. The subject has to look at the photograph and decipher what it is. The subject has been instructed to push a button if the photograph is of someone they recognize. The photograph might be of a celebrity, so the subject would press the button, or it might be of a random person unknown to the subject, so the subject would not press the button.

In this task, visual sensory areas would be active, integrating areas would be active, motor areas responsible for moving the eyes would be active, and motor areas for pressing the button with a finger would be active. Those areas are distributed all around the brain and the fMRI images would show activity in more than just 10 percent of the brain (some evidence suggests that about 80 percent of the brain is using energy—based on blood flow to the tissue—during well-defined tasks similar to the one suggested above). This task does not even include all of the functions the brain performs. There is no language response, the body is mostly lying still in the MRI machine, and it does not consider the autonomic functions that would be ongoing in the background.

1.8 Important terms to note

Autonomic nervous system (ANS): functional division of the nervous system that is responsible for homeostatic reflexes that coordinate control of cardiac and smooth muscle, as well as glandular tissue.

Axon: single process of the neuron that carries an electrical signal (action potential) away from the cell body toward a target cell.
Brain: the large organ of the central nervous system composed of white and gray matter, contained within the cranium and continuous with the spinal cord.
Central nervous system (CNS): anatomical division of the nervous system located within the cranial and vertebral cavities, namely the brain and spinal cord.
Dendrite: one of many branchlike processes that extends from the neuron cell body and functions as a contact for incoming signals (synapses) from other neurons or sensory cells.

Centric nervous system (ENS): neural tissue associated with the digestive system that is responsible for nervous control through autonomic connections.

Ganglion: localized collection of neuron cell bodies in the peripheral nervous system.

Glial cell: one of the various types of neural tissue cells responsible for maintenance of the tissue, and largely responsible for supporting neurons.

Gray matter: regions of the nervous system containing cell bodies of neurons with few or no myelinated axons; actually may be more pink or tan in color, but called gray in contrast to white matter.

Integration: nervous system function that combines sensory perceptions and higher cognitive functions (memories, learning, emotion, etc.) to produce a response.

Myelin: lipid-rich insulating substance surrounding the axons of many neurons, allowing for faster transmission of electrical signals.

Nerve: cord-like bundle of axons located in the peripheral nervous system that transmits sensory input and response output to and from the central nervous system.

Neuron: neural tissue cell that is primarily responsible for generating and propagating electrical signals into, within, and out of the nervous system

Nucleus: in the nervous system, a localized collection of neuron cell bodies that are functionally related; a "center" of neural function

Peripheral nervous system (PNS): anatomical division of the nervous system that is largely outside the cranial and vertebral cavities, namely all parts except the brain and spinal cord

Process: in cells, an extension of a cell body; in the case of neurons, this includes the axon and dendrites

Response: nervous system function that causes a target tissue (muscle or gland) to produce an event as a consequence to stimuli

Sensation: nervous system function that receives information from the environment and t

ranslates it into the electrical signals of nervous tissue

Soma: in neurons, that portion of the cell that contains the nucleus; the cell body, as opposed to the cell processes (axons and dendrites)

Somatic nervous system (SNS): functional division of the nervous system that is concerned with conscious perception, voluntary movement, and skeletal muscle reflexes

Spinal cord: organ of the central nervous system found within the vertebral cavity and connected with the periphery through spinal nerves; mediates reflex behaviors

Stimulus: an event in the external or internal environment that registers as activity in a sensory neuron

Tract: bundle of axons in the central nervous system having the same function and point of origin

White matter: regions of the nervous system containing mostly myelinated axons, making the tissue appear white because of the high lipid content of myelin

1.9 Understanding The Transmission of Nerve Impulses

Nerve impulses have a domino effect. Each neuron receives an impulse and must pass it on to the next neuron and make sure the correct impulse continues on its path. Through a chain of chemical events, the dendrites (part of a neuron) pick up an impulse that's shuttled through the axon and transmitted to the next neuron. The entire impulse passes through a neuron in about seven milliseconds — faster than a lightning strike. Here's what happens in just six easy steps:

1. Polarization of the neuron's membrane: Sodium is on the outside, and potassium is on the inside.

   Cell membranes surround neurons just as any other cell in the body has a membrane. When a neuron is not stimulated — it's just sitting with no impulse to carry or transmit — its membrane is polarized. Not paralyzed. Polarized. Being polarized means that the electrical charge on the outside of the membrane is positive while the electrical charge on the inside of the membrane is negative. The outside of the cell contains excess sodium ions (Na+); the inside of the cell contains excess potassium ions (K+). (Ions are atoms of an element with a positive or negative charge.)

   You're probably wondering: How can the charge inside the cell be negative if the cell contains positive ions? Good question. The answer is that in addition to the K+, negatively charged protein and nucleic acid molecules also inhabit the cell; therefore, the inside is negative as compared to the outside.

   Then, if cell membranes allow ions to cross, how does the Na+ stay outside and the K+ stay inside? If this thought crossed your mind, you deserve a huge gold star! The answer is that the Na+ and K+ do, in fact, move back and forth across the membrane. However, Mother Nature thought of everything. There are Na+/K+ pumps on the membrane that pump the Na+ back outside and the K+ back inside. The charge of an

ion inhibits membrane permeability (that is, makes it difficult for other things to cross the membrane).

2. Resting potential gives the neuron a break.

   When the neuron is inactive and polarized, it's said to be at its resting potential. It remains this way until a stimulus comes along.

3. Action potential: Sodium ions move inside the membrane.

   When a stimulus reaches a resting neuron, the gated ion channels on the resting neuron's membrane open suddenly and allow the Na+ that was on the outside of the membrane to go rushing into the cell. As this happens, the neuron goes from being polarized to being depolarized.

   Remember that when the neuron was polarized, the outside of the membrane was positive, and the inside of the membrane was negative. Well, after more positive ions go charging inside the membrane, the inside becomes positive, as well; polarization is removed and the threshold is reached.

   Each neuron has a threshold level — the point at which there's no holding back. After the stimulus goes above the threshold level, more gated ion channels open and allow more Na+ inside the cell. This causes complete depolarization of the neuron and an action potential is created. In this state, the neuron continues to open Na+ channels all along the membrane. When this occurs, it's an all-or-none phenomenon. "All-or-none" means that if a stimulus doesn't exceed the threshold level and cause all the gates to open, no action potential results; however, after the threshold is crossed, there's no turning back: Complete depolarization occurs and the stimulus will be transmitted.

   When an impulse travel down an axon covered by a myelin sheath, the impulse must move between the uninsulated gaps called nodes of Ranvier that exist between each Schwann cell.

4. Repolarization: Potassium ions move outside, and sodium ions stay inside the membrane.

   After the inside of the cell becomes flooded with Na+, the gated ion channels on the inside of the membrane open to allow the K+ to move to the outside of the membrane.

With K+ moving to the outside, the membrane's repolarization restores electrical balance, although it's opposite of the initial polarized membrane that had Na+ on the outside and K+ on the inside. Just after the K+ gates open, the Na+ gates close; otherwise, the membrane couldn't repolarize.

5. Hyperpolarization: More potassium ions are on the outside than there are sodium ions on the inside.

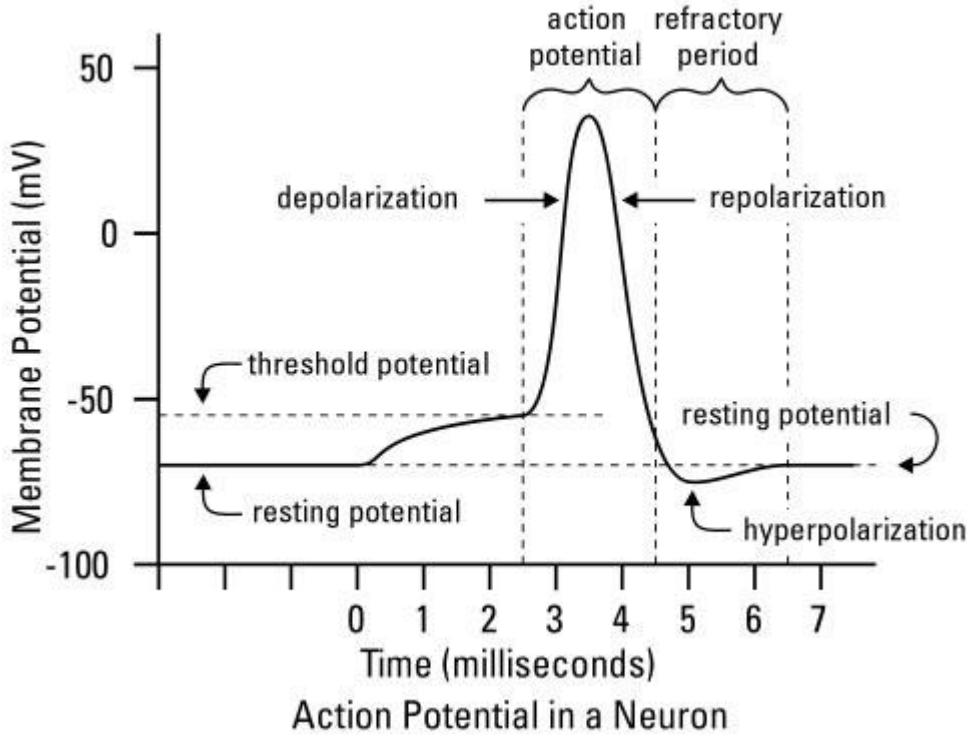
   When the K+ gates finally close, the neuron has slightly more K+ on the outside than it has Na+ on the inside. This causes the membrane potential to drop slightly lower than the resting potential, and the membrane is said to be hyperpolarized because it has a greater potential. (Because the membrane's potential is lower, it has more room to "grow."). This period doesn't last long, though (well, none of these steps take long!). After the impulse has traveled through the neuron, the action potential is over, and the cell membrane returns to normal (that is, the resting potential).

6. Refractory period puts everything back to normal: Potassium returns inside, sodium returns outside.

   The refractory period is when the Na+ and K+ are returned to their original sides: Na+ on the outside and K+ on the inside. While the neuron is busy returning everything to normal, it doesn't respond to any incoming stimuli. It's kind of like letting your answering machine pick up the phone call that makes your phone ring just as you walk in the door with your hands full. After the Na+/K+ pumps return the ions to their rightful side of the neuron's cell membrane, the neuron is back to its normal polarized state and stays in the resting potential until another impulse comes along.

   The following figure shows transmission of an impulse. (Source Kandel 2012, principles of neural science)

Figure 3: **Action potentialmof neurons** (Source wright, 1993, Human Biology and Health)



Transmission of a nerve impulse: Resting potential and action potential.

Like the gaps between the Schwann cells on an insulated axon, a gap called a *synapse* or *synaptic cleft* separates the axon of one neuron and the dendrites of the next neuron. Neurons don't touch. The signal must traverse the synapse to continue on its path through the nervous system. Electrical conduction carries an impulse across synapses in the brain, but in other parts of the body, impulses are carried across synapses as the following chemical changes occur:

1. Calcium gates open.

   At the end of the axon from which the impulse is coming, the membrane depolarizes, gated ion channels open, and calcium ions (Ca2+) are allowed to enter the cell.

2. Releasing a neurotransmitter.

   When the calcium ions rush in, a chemical called a neurotransmitter is released into the synapse.

3. The neurotransmitter binds with receptors on the neuron.

The chemical that serves as the neurotransmitter moves across the synapse and binds to proteins on the neuron membrane that's about to receive the impulse. The proteins serve as the receptors, and different proteins serve as receptors for different neurotransmitters — that is, neurotransmitters have specific receptors.

4. Excitation or inhibition of the membrane occurs.

   Whether excitation or inhibition occurs depends on what chemical served as the neurotransmitter and the result that it had. For example, if the neurotransmitter causes the Na+ channels to open, the neuron membrane becomes depolarized, and the impulse is carried through that neuron. If the K+ channels open, the neuron membrane becomes hyperpolarized, and inhibition occurs. The impulse is stopped dead if an action potential cannot be generated.

   If you're wondering what happens to the neurotransmitter after it binds to the receptor, you're really getting good at this anatomy and physiology stuff. Here's the story: After the neurotransmitter produces its effect, whether it's excitation or inhibition, the receptor releases it and the neurotransmitter goes back into the synapse. In the synapse, the cell "recycles" the degraded neurotransmitter. The chemicals go back into the membrane so that during the next impulse, when the synaptic vesicles bind to the membrane, the complete neurotransmitter can again be released.

1.10 Terminologies

1. The central nervous system: is made of the brain and the spinal code and the peripheral nervous system.
2. Nucleus: is a realized collection of neuro cell bodies in the CNS.

1.11 Activity

1. Explain the function of the central nervous system.

1.12 Reflection

Explain the function of enteric nervous system (ENS).

1.13 Summary

The nervous system can be separated into divisions on the basis of anatomy and physiology. The anatomical divisions are the central and peripheral nervous systems. The CNS is the brain and spinal cord. The PNS is everything else. Functionally, the nervous system can be divided into those regions that are responsible for sensation, those that are responsible for integration, and those that are responsible for generating responses. All of these functional areas are found in both the central and peripheral anatomy.

Considering the anatomical regions of the nervous system, there are specific names for the structures within each division. A localized collection of neuron cell bodies is referred to as a nucleus in the CNS and as a ganglion in the PNS. A bundle of axons is referred to as a tract in the CNS and as a nerve in the PNS. Whereas nuclei and ganglia are specifically in the central or peripheral divisions, axons can cross the boundary between the two. A single axon can be part of a nerve and a tract. The name for that specific structure depends on its location.

Nervous tissue can also be described as gray matter and white matter on the basis of its appearance in unstained tissue. These descriptions are more often used in the CNS. Gray matter is where nuclei are found and white matter is where tracts are found. In the PNS, ganglia are basically gray matter and nerves are white matter.

The nervous system can also be divided on the basis of how it controls the body. The somatic nervous system (SNS) is responsible for functions that result in moving skeletal muscles. Any sensory or integrative functions that result in the movement of skeletal muscle would be considered somatic. The autonomic nervous system (ANS) is responsible for functions that affect cardiac or smooth muscle tissue, or that cause glands to produce their secretions. Autonomic functions are distributed between central and peripheral regions of the nervous system. The sensations that lead to autonomic functions can be the same sensations that are part of initiating somatic responses. Somatic and autonomic integrative functions may overlap as well.

A special division of the nervous system is the enteric nervous system, which is responsible for controlling the digestive organs. Parts of the autonomic nervous system overlap with the enteric nervous system. The enteric nervous system is exclusively found in the periphery because it is the nervous tissue in the organs of the digestive system.

UNIT 2: ENDOCRINE SYSTEM

2.1 Introduction

The endocrine system is a network of glands and organs located throughout the body. It's similar to the nervous system in that it plays a vital role in controlling and regulating many of the body's functions.

However, while the nervous system uses nerve impulses and neurotransmitters for communication, the endocrine system uses chemical messengers called hormones.

Keep reading to discover more about the endocrine system, what it does, and the hormones it produces.

2.2 Learning Outcomes

By the end of this unit, you are expected to;

- discuss the function of the endocrine system.
- analyses the composition of endocrine system.
- discuss the conditions that can affect the endocrine system.
- examine common symptoms of Cushing syndrome.

2.3 Time Frame

You need about two (2) hours to interact with this material.

2.4 Content

- Endocrine system function
- Endocrine System Organs
- Endocrine system hormones
- Conditions that can affect the endocrine system
- Hyperthyroidism

- Hypothyroidism
- Cushing syndrome
- Addison disease
- Diabetes

2.5 Endocrine system function

The endocrine system is responsible for regulating a range of bodily functions through the release of hormones.

Hormones are secreted by the glands of the endocrine system, traveling through the bloodstream to various organs and tissues in the body. The hormones then tell these organs and tissues what to do or how to function.

Some examples of bodily functions that are controlled by the endocrine system include:

- metabolism
- growth and development
- sexual function and reproduction
- heart rate
- blood pressure
- appetite
- sleeping and waking cycles
- body temperature

2.6 Endocrine System Organs

The endocrine system is made up of a complex network of glands, which are organs that secrete substances.

The glands of the endocrine system are where hormones are produced, stored, and released. Each gland produces one or more hormones, which go on to target specific organs and tissues in the body.

The glands of the endocrine system include:

Hypothalamus. While some people don't consider it a gland, the hypothalamus produces multiple hormones that control the pituitary gland. It's also involved in regulating many functions, including sleep-wake cycles, body temperature, and appetite. It can also regulate the function of other endocrine glands.

Pituitary. The pituitary gland is located below the hypothalamus. The hormones it produces affect growth and reproduction. They can also control the function of other endocrine glands.

Pineal. This gland is found in the middle of your brain. It's important for your sleep-wake cycles.

Thyroid. The thyroid gland is located in the front part of your neck. It's very important for metabolism.

Parathyroid. Also located in the front of your neck, the parathyroid gland is important for maintaining control of calcium levels in your bones and blood.

Thymus. Located in the upper torso, the thymus is active until puberty and produces hormones important for the development of a type of white blood cell called a T cell.

Adrenal. One adrenal gland can be found on top of each kidney. These glands produce hormones important for regulating functions such as blood pressure, heart rate, and stress response.

Pancreas. The pancreas is located in your abdomen behind your stomach. Its endocrine function involves controlling blood sugar levels.

Some endocrine glands also have non-endocrine functions. For example, the ovaries and testes produce hormones, but they also have the non-endocrine function of producing eggs and sperm, respectively.

2.7 Endocrine system hormones

Hormones are the chemicals the endocrine system uses to send messages to organs and tissue throughout the body. Once released into the bloodstream, they travel to their target organ or tissue, which has receptors that recognize and react to the hormone.

Below are some examples of hormones that are produced by the endocrine system.

Hormone	**Secreting gland(s)**	**Function**
Adrenaline	adrenal	increases blood pressure, heart rate, and metabolism in reaction to stress
Aldosterone	adrenal	controls the body's salt and water balance
Cortisol	adrenal	plays a role in stress response
dehydroepiandrosterone sulfate (DHEA)	adrenal	aids in production of body odour and growth of body hair during puberty
Estrogen	ovary	works to regulate menstrual cycle, maintain pregnancy, and develop female sex characteristics; aids in sperm production
follicle stimulating hormone (FSH)	pituitary	controls the production of eggs and sperm
Glucagon	pancreas	helps to increase levels of blood glucose
Insulin	pancreas	helps to reduce your blood glucose levels
luteinizing hormone (LH)	pituitary	controls estrogen and testosterone production as well as ovulation
Melatonin	pituitary	controls sleep and wake cycles
Oxytocin	pituitary	helps with lactation, childbirth, and mother-child bonding
parathyroid hormone	parathyroid	controls calcium levels in bones and blood
Progesterone	ovary	helps to prepare the body for pregnancy when an egg is fertilized
Prolactin	pituitary	promotes breast-milk production

Testosterone	ovary, teste, adrenal	contributes to sex drive and body density in males and females as well as development of male sex characteristics
thyroid hormone	thyroid	help to control several body functions, including the rate of metabolism and energy levels

2.8 Conditions that can affect the endocrine system

Sometimes, hormone levels can be too high or too low. When this happens, it can have a number of effects on your health. The signs and symptoms depend on the hormone that's out of balance.

Here's a look at some conditions that can affect the endocrine system and alter your hormone levels.

Hyperthyroidism

Hyperthyroidism happens when your thyroid gland makes more thyroid hormone than necessary. This can be caused by a range of things, including autoimmune conditions.

Some common symptoms of hyperthyroidism include:

- fatigue
- nervousness
- weight loss
- diarrhea
- issues tolerating heat
- fast heart rate
- trouble sleeping

Treatment depends on how severe the condition is, as well as its underlying cause. Options include medications, radioiodine therapy, or surgery.

Graves disease is an autoimmune disorder and common form of hyperthyroidism. In people with Graves disease, the immune system attacks the thyroid, which causes it to produce more thyroid hormone than normal.

2.8.1 Hypothyroidism

Hypothyroidism occurs when your thyroid doesn't produce enough thyroid hormone. Like hyperthyroidism, it has many potential causes.

Some common symptoms of hypothyroidism include:

- fatigue
- weight gain
- constipation
- issues tolerating the cold
- dry skin and hair
- slow heart rate
- irregular periods
- fertility issues

Treatment of hypothyroidism involves supplementing your thyroid hormone with medication.

2.8.2 Cushing syndrome

Cushing syndrome happens due to high levels of the hormone cortisol.

Common symptoms of Cushing syndrome include:

- weight gain
- fatty deposits in the face, midsection, or shoulders
- stretch marks, particularly on the arms, thighs, and abdomen
- slow healing of cuts, scrapes, and insect bites

- thin skin that bruises easily
- irregular periods
- decreased sex drive and fertility in males

Treatment depends on the cause of the condition and can include medications, radiation therapy, or surgery.

2.8.3 Addison disease

Addison disease happens when your adrenal glands don't produce enough cortisol or aldosterone. Some symptoms of Addison disease include:

- fatigue
- weight loss
- abdominal pain
- low blood sugar
- nausea or vomiting
- diarrhea
- irritability
- a craving for salt or salty foods
- irregular periods

Treatment of Addison disease involves taking medications that help to replace the hormones that your body isn't producing enough of.

2.8.4 Diabetes

Diabetes refers to a condition in which your blood sugar levels aren't regulated properly.

People with diabetes have too much glucose in their blood (high blood sugar). There are two types of diabetes: type 1 diabetes and type 2 diabetes.

Some common symptoms of diabetes include:

- fatigue
- weight loss
- increased hunger or thirst
- frequent urge to urinate
- irritability
- frequent infections

Treatment for diabetes can include blood sugar monitoring, insulin therapy, and medications. Lifestyle changes, such as getting regular exercise and eating a balanced diet, can also help.

The bottom line

The endocrine system is a complex collection of glands and organs that helps to regulate various bodily functions. This is accomplished through the release of hormones, or chemical messengers produced by the endocrine system.

2.9 Terminology

1. The endocrine system: is a complex collection of glands and organs that helps to regulate various bodily functions**.**

UNIT 3: SENSATION AND PERCEPTION

3.1 Introduction

Humans have five basic senses: touch, sight, hearing, smell and taste. The sensing organs associated with each sense send information to the brain to help us understand and perceive the world around us. People also have other senses in addition to the basic five. In this unit, you will learn how they work.

3.2 Learning Outcomes

By the end of this unit, you are expected to;

- discuss five basic senses.
- examine perceptual organisation.
- analyse perceptual constancy.
- analyse pattern recognition theories.

3.3 Time frame

You need to about two (2) hours to interact with this material.

3.4 Content

- Five human senses
- The sense of space
- Additional senses & variations
- Perceptual Organization
- Perception of Distance and Depth
- Perceptual Constancy
- Pattern Recognition
- Theories of pattern recognition
- Template matching
- Multiple discrimination scaling
- Recognition by components theory
- Top-down and bottom-up processing

- Top-down processing
- Bottom-up processing
- Seriation
- Piaget's work on seriation
- Development of problem-solving skills
- Application of seriation in schools
- Facial pattern recognition
- Neural mechanisms
- Facial recognition development
- Language development
- Pattern recognition in language
- Acquisition Phonological development
- Grammar development
- Music pattern recognition
- Cognitive mechanisms
- Developmental issues
- False pattern recognition
- Perceptual Constancy

3.5 Five human senses

3.5.1 Touch

Touch is thought to be the first sense that humans develop, according to the Stanford Encyclopaedia of Philosophy. Touch consists of several distinct sensations communicated to the brain through specialized neurons in the skin. Pressure, temperature, light touch, vibration, pain and other sensations are all part of the touch sense and are all attributed to different receptors in the skin.

Touch isn't just a sense used to interact with the world; it also seems to be very important to a human's well-being. For example, touch has been found to convey compassion from one human to another.

Touch can also influence how humans make decisions. Texture can be associated with abstract concepts, and touching something with a texture can influence the decisions a person

makes, according to six studies by psychologists at Harvard University and Yale University, published in the June 24, 2010, issue of the journal Science.

"Those tactile sensations are not just changing general orientation or putting people in a good mood," said Joshua Ackerman, an assistant professor of marketing at the Massachusetts Institute of Technology. "They have a specific tie to certain abstract meanings." [Just a Touch Can Influence Thoughts and Decisions]

3.5.2 Sight

Sight, or perceiving things through the eyes, is a complex process. First, light reflects off an object to the eye. The transparent outer layer of the eye called the cornea bends the light that passes through the hole of the pupil. The iris (which is the colored part of the eye) works like the shutter of a camera, retracting to shut out light or opening wider to let in more light.

"The cornea focuses most of the light. Then, it [the light] passes through the lens, which continues to focus the light," explained Dr. Mark Fromer, an ophthalmologist and retina specialist at Lenox Hill Hospital in New York City. [How the Human Eye Works]

The lens of the eye then bends the light and focuses it on the retina, which is full of nerve cells. These cells are shaped like rods and cones and are named for their shapes, according to the American Optometric Association. Cones translate light into colors, central vision and details. The rods translate light into peripheral vision and motion. Rods also give humans vision when there is limited light available, like at night. The information translated from the light is sent as electrical impulses to the brain through the optic nerve.

People without sight may compensate with enhanced hearing, taste, touch and smell, according to a March 2017 study published in the journal PLOS One. Their memory and language skills may be better than those born with sight, as well.

"Even in the case of being profoundly blind, the brain rewires itself in a manner to use the information at its disposal so that it can interact with the environment in a more effective manner," Dr. Lotfi Merabet, senior author on that 2017 study and the director of the Laboratory for Visual Neuroplasticity at Schepens Eye Research Institute of Massachusetts Eye and Ear, said in a statement.

3.5.3 Hearing

This sense works via the complex labyrinth that is the human ear. Sound is funneled through the external ear and piped into the external auditory canal. Then, sound waves reach the tympanic membrane, or eardrum. This is a thin sheet of connective tissue that vibrates when sound waves strike it.

The vibrations travel to the middle ear. There, the auditory ossicles — three tiny bones called the malleus (hammer), incus (anvil) and stapes (stirrup) — vibrate. The stapes bone, in turn, pushes a structure called the oval window in and out, sending vibrations to the organ of Corti, according to the National Library of Medicine (NLM). This spiral organ is the receptor organ for hearing. Tiny hair cells in the organ of Corti translate the vibrations into electrical impulses. The impulses then travel to the brain via sensory nerves.

People retain their sense of balance because the Eustachian tube, or pharyngotympanic tube, in the middle ear equalizes the air pressure in the middle ear with the air pressure in the atmosphere. The vestibular complex, in the inner ear, is also important for balance, because it contains receptors that regulate a sense of equilibrium. The inner ear is connected to the vestibulocochlear nerve, which carries sound and equilibrium information to the brain.

3.5.4 Smell

Humans may be able to smell over 1 trillion scents, according to researchers. They do this with the olfactory cleft, which is found on the roof of the nasal cavity, next to the "smelling" part of the brain, the olfactory bulb and fossa. Nerve endings in the olfactory cleft transmit smells to the brain, according to the American Rhinologic Society.

Dogs are known as great smellers, but research suggests that humans are just as good as man's best friend. Research published in the May 11, 2017, issue of the journal Science suggests that humans can discriminate among 1 trillion different odors; it was once believed that humans could take in only 10,000 different smells.

"The fact is the sense of smell is just as good in humans as in other mammals, like rodents and dogs," John McGann, a neuroscientist at Rutgers University-New Brunswick in New Jersey and the author of the new review, said in a statement. The Rutgers study backs up a previous study at the Rockefeller University in New York, whose findings were published in the March 2014 issue of the journal Science. [People Smell Great! Human Sniffers Sensitive as Dogs']

Humans have 400 smelling receptors. While this isn't as many as animals that are super smellers have, the much more complicated human brain makes up for the difference, McGann said.

In fact, poor smelling ability in people may be a symptom of a medical condition or aging. For example, the distorted or decreased ability to smell is a symptom of schizophrenia and depression. Old age can also lessen the ability to smell properly. More than 75 percent of people over the age of 80 years may have major olfactory impairment, according to a 2006 paper published by the National Institutes of Health.

3.5.5. Taste

The gustatory sense is usually broken down into the perception of four different tastes: salty, sweet, sour and bitter. There is also a fifth taste, defined as umami or savory. There may be many other flavors that have not yet been discovered. Also, spicy is not a taste. It is actually a pain signal, according to the National Library of Medicine (NLM).

The sense of taste aided in human evolution, according to the NLM, because taste helped people test the food they ate. A bitter or sour taste indicated that a plant might be poisonous or rotten. Something salty or sweet, however, often meant the food was rich in nutrients.

Taste is sensed in the taste buds. Adults have 2,000 to 4,000 taste buds. Most of them are on the tongue, but they also line the back of the throat, the epiglottis, the nasal cavity and the esophagus. Sensory cells on the buds form capsules shaped like flower buds or oranges, according to the NLM. The tips of these capsules have pores that work like funnels with tiny taste hairs. Proteins on the hairs bind chemicals to the cells for tasting.

It is a myth that the tongue has specific zones for each flavor. The five tastes can be sensed on all parts of the tongue, although the sides are more sensitive than the middle. About half of the sensory cells in taste buds react to several of the five basic tastes. The cells differ in their level of sensitivity, according to the NLM. Each has a specific palette of tastes with a fixed ranking, so some cells may be more sensitive to sweet, followed by bitter, sour and salty, while others have their own rankings. The full experience of a flavor is produced only after all of the information from the different parts of the tongue is combined.

The other half of the sensory cells are specialized to react to only one taste. It's their job to transmit information about the intensity — how salty or sweet something tastes.

Other factors help build the perception of taste in the brain. For example, the smell of the food greatly affects how the brain perceives the taste. Smells are sent to the mouth in a process called olfactory referral. This is why someone with a stuffy nose may have trouble tasting food properly. Texture, translated by the sense of touch, also contributes to taste.

3.6 The sense of space

In addition to the traditional big five, there is another sense that deals with how your brain understands where your body is in space. This sense is called proprioception.

Proprioception includes the sense of movement and position of our limbs and muscles. For example, proprioception enables a person to touch their finger to the tip of their nose, even with their eyes closed. It enables a person to climb steps without looking at each one. People with poor proprioception may be clumsy and uncoordinated.

Researchers at the National Institutes of Health (NIH) found that people who have particularly poor proprioception through mechanosensation — the ability to sense force, such as feeling when someone presses down on your skin — may have a mutated gene that is passed down from generation to generation. That comes from a September 2016 study in the New England Journal of Medicine. "The patient's version of [the gene] PIEZO2 may not work, so their neurons cannot detect touch or limb movements," Alexander Chesler, a principal investigator at the National Center for Complementary and Integrative Health and the lead author of the study, said in a statement.

3.7 Additional senses & variations

There are more-subtle senses that most people never really perceive. For example, there are neuron sensors that sense movement to control balance and the tilt of the head. Specific kinesthetic receptors exist for detecting stretching in muscles and tendons, helping people to keep track of their limbs. Other receptors detect levels of oxygen in certain arteries of the bloodstream.

Sometimes, people don't even perceive senses the same way. People with synesthesia can see sounds as colors or associate certain sights with smells, for example.

3.8 Perceptual Organization

So far we have talked a lot about sensation, now we shift to perception. Our senses provide us with raw data about the external world but it must then be interpreted. Perception involves deciphering meaningful patterns in the jumble of sensory information and is the brain's process of organizing and making sense of sensory information. Perception begins with a real world object which activates our sensory system. We never experience the stimulus directly but our perception is usually very accurate.

In the early 20th century a group of German psychologists calling themselves Gestalt psychologists set out to discover the principles through which we interpret sensory information. Gestalt roughly translates to mean "whole" "form" or "pattern". They believed that our brains create a coherent perceptual experience that is more than simply the sum of the available sensory information and that it does so in predictable ways. One example of this is **Figure-Ground**. Sometimes when we look at an image, there aren't enough cues to allow us to distinguish the figure from the ground; they blend into each other in a sort of camouflage. We alternate back and forth between the two images because of the ambiguity of clues. Another example of Gestalt principles is the idea of **Grouping** or the perceptual tendency to organize stimuli into coherent groups. There are four principles of perceptual organization/grouping: 1) Proximity, 2) Similarity, 3) Closure/Connectedness, and 4) Continuity. These principles usually broaden our understanding of the world; our brain tries to fill in missing information rather than seeing things as random bits and pieces of raw data.

3.9 Perception of Distance and Depth

We are constantly judging the distance between ourselves and other objects along in a process known as depth perception. Depth perception can be accomplished with one eye (monocular cues) or two eyes (binocular cues). Binocular Cues which again are visual cues to gauge depth and distance requiring the use of both eyes. Two examples of these cues are:

1. Retinal Disparity: Our eyes are set roughly 2 ½ inches apart which means that each eye has a slightly different view of things. Binocular distance cues are based on the difference between the images cast on the two retinas when both eyes are focused on the same object.

2. Convergence: a visual depth cue that comes from muscles controlling eye movement as the eyes turn inward to view a nearby stimulus (no convergence if far away and can't converge if too close).

Monocular Cues again are visual cues requiring the use of one eye. There are several monocular cues that we use to gauge distance or depth.

1. **Relative Size**: If two objects are similar in size, we perceive the one that casts a smaller retinal image to be farther away.

2. **Interposition**: monocular distance cue in which one object, by partly blocking a second object, is perceived as being closer

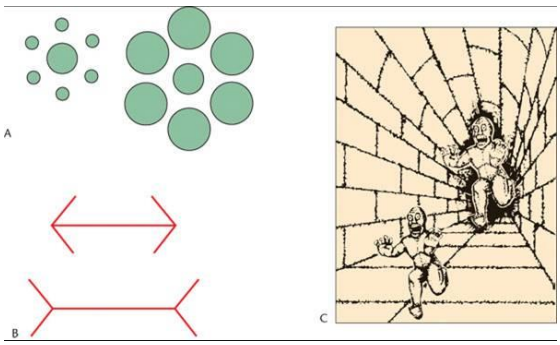
3. Relative Height: We perceive objects that are higher in our field of vision to be farther away than those that are lower.

4. **Relative Motion (Motion Parallax):** monocular cue to distance in which objects closer than the point of visual focus seem to move in the direction opposite to the viewer's moving head, and objects beyond the focus point appear to move in the same direction as the viewer's head (example of being on a train)

5. Linear Perspective: monocular cue to distance and depth based on the fact that the two parallel lines seem to come together on the horizon

6. Light and Shadowing: monocular cue to distance and depth based on the fact that shadows often appear on the parts of objects that are more distant

Figure 3 **Illusions** (Source, Wayn, 2010, Themes and Variations)



Sometimes our visual cues can lead us astray and result in **Visual Illusions** (result from false and misleading depth cues). There are two main types of visual illusions; the first is Physical Illusions where the cause of the illusion is in the behavior of the light before it reaches the eye causing us to see something

that isn't physically there. The second is Perceptual Illusions which occur because the stimulus contains misleading cues that give rise to inaccurate or impossible perceptions. An example of a physical illusion might be seeing water on the road such as a mirage and perceptual illusions can be seen in the images on the left. On a side note, many perceptual illusions were employed to help make the recent Lord of the Rings films! More examples of illusions can be seen if you click here!

3.10 Perceptual Constancy

We have a tendency to perceive objects as stable and unchanging despite changes in sensory stimulation which is called Perceptual Constancy. Once we have found a stable perception of an object, we can recognize it at almost any distance, from most any position, and under most any illumination. Without this ability, the world would be really confusing. There are a few different types of perceptual constancies that we possess. The first is Size Constancy or the perception of an object as the same size regardless of the distance from which it is viewed (wouldn't think that a woman 100's of feet away was only a few inches tall; experience tells us otherwise). The second type is **Shape Constancy** which is a tendency to see an object as the same shape no matter what angle it is viewed from (door remains a rectangle even though it is moved and viewed from other angles). Third is Color Constancy or an inclination to perceive familiar objects as retaining their color despite changes in sensory information (see our red car as red no matter if it is in bright light or in the dark). Finally we have **Brightness Constancy** which involves the perception of brightness being the same, even though the amount of light reaching the retina changes (compare objects with surrounding objects – know a white piece of paper is brighter than a piece of coal).

3.11 Pattern Recognition

In psychology and cognitive neuroscience, **pattern recognition** describes a cognitive process that matches information from a stimulus with information retrieved from memory.[1]

Pattern recognition occurs when information from the environment is received and entered into short-term memory, causing automatic activation of a specific content of long-term memory. An early example of this is learning the alphabet in order. When a carer repeats ‘A, B, C’ multiple times to a child, utilizing the pattern recognition, the child says ‘C’ after he/she hears ‘A, B’ in order. Recognizing patterns allow us to predict and expect what is

coming. The process of pattern recognition involves matching the information received with the information already stored in the brain. Making the connection between memories and information perceived is a step of pattern recognition called identification. Pattern recognition requires repetition of experience. Semantic memory, which is used implicitly and subconsciously is the main type of memory involved with recognition.[2]

Pattern recognition is not only crucial to humans, but to other animals as well. Even koalas, who possess less-developed thinking abilities, use pattern recognition to find and consume eucalyptus leaves. The human brain has developed more, but holds similarities to the brains of birds and lower mammals. The development of neural networks in the outer layer of the brain in humans has allowed for better processing of visual and auditory patterns. Spatial positioning in the environment, remembering findings, and detecting hazards and resources to increase chances of survival are examples of the application of pattern recognition for humans and animals.[3]

There are six main theories of pattern recognition: template matching, prototype-matching, feature analysis, recognition-by-components theory, bottom-up and top-down processing, and Fourier analysis. The application of these theories in everyday life is not mutually exclusive. Pattern recognition allows us to read words, understand language, recognize friends, and even appreciate music. Each of the theories applies to various activities and domains where pattern recognition is observed. Facial, music and language recognition, and seriation are a few of such domains. Facial recognition and seriation occur through encoding visual patterns, while music and language recognition use the encoding of auditory patterns.

3.12 Theories of pattern recognition

3.12.1 Template matching

Template matching theory describes the most basic approach to human pattern recognition. It is a theory that assumes every perceived object is stored as a "template" into long-term memory.[4] Incoming information is compared to these templates to find an exact match.[5] In other words, all sensory input is compared to multiple representations of an object to form one single conceptual understanding. The theory defines perception as a fundamentally recognition-based process. It assumes that everything we see, we understand only through past exposure, which then informs our future perception of the external world.] For example,

A, **A**, and *A* are all recognized as the letter A, but not B. This viewpoint is limited, however, in explaining how new experiences can be understood without being compared to an internal memory template

3.12.2 Prototype matching

Unlike the exact, one-to-one, template matching theory, prototype matching instead compares incoming sensory input to one average prototype This theory proposes that exposure to a series of related stimuli leads to the creation of a "typical" prototype based on their shared features It reduces the number of stored templates by standardizing them into a single representation.[4] The prototype supports perceptual flexibility, because unlike in template matching, it allows for variability in the recognition of novel stimuliFor instance, if a child had never seen a lawn chair before, they would still be able to recognize it as a chair because of their understanding of its essential characteristics as having four legs and a seat. This idea, however, limits the conceptualization of objects that cannot necessarily be "averaged" into one, like types of canines, for instance. Even though dogs, wolves, and foxes are all typically furry, four-legged, moderately sized animals with ears and a tail, they are not all the same, and thus cannot be strictly perceived with respect to the prototype matching theory.

3.12.3 Feature analysis

Multiple theories try to explain how humans are able to recognize patterns in their environment. Feature detection theory proposes that the nervous system sorts and filters incoming stimuli to allow the human (or animal) to make sense of the information. In the organism, this system is made up of feature detectors, which are individual neurons, or groups of neurons, that encode specific perceptual features. The theory proposes an increasing complexity in the relationship between detectors and the perceptual feature. The most basic feature detectors respond to simple properties of the stimuli. Further along the perceptual pathway, higher organized feature detectors are able to respond to more complex and specific stimuli properties. When features repeat or occur in a meaningful sequence, we are able to identify these patterns because of our feature detection system.

3.12.4 Multiple discrimination scaling

Template and feature analysis approaches to recognition of objects (and situations) have been merged / reconciled / overtaken by multiple discrimination theory. This states that the amounts in a test stimulus of each salient feature of a template are recognized in any perceptual judgment as being at a distance in the universal unit of 50% discrimination (the objective performance 'JND'[f]) from the amount of that feature in the template.

3.21.5 Recognition by components theory

Figure **4 Recognition by components (**Source, Wayn , 2010 Themes and Variation**)**

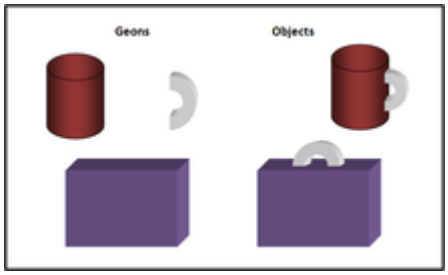


Image showing the breakdown of common geometric shapes (geons).

Similar to feature detection theory, recognition by components (RBC) focuses on the bottom-up features of the stimuli being processed. First proposed by Irving Biederman (1987), this theory states that humans recognize objects by breaking them down into their basic 3D geometric shapes called geons (i.e. cylinders, cubes, cones, etc.). An example is how we break down a common item like a coffee cup: we recognize the hollow cylinder that holds the liquid and a curved handle off the side that allows us to hold it. Even though not every coffee cup is exactly the same, these basic components helps us to recognize the consistency across examples (or pattern). RBC suggests that there are fewer than 36 unique geons that when combined can form a virtually unlimited number of objects. To parse and dissect an object, RBC proposes we attend to two specific features: edges and concavities. Edges enable the observer to maintain a consistent representation of the object regardless of the viewing angle and lighting conditions. Concavities are where two edges meet and enable the observer to perceive where one geon ends and another begins.

The RBC principles of visual object recognition can be applied to auditory language recognition as well. In place of geons, language researchers propose that spoken language can be broken down into basic components called phonemes. For example, there are 44 phonemes in the English language.

3.12.6 Top-down and bottom-up processing

Top-down processing

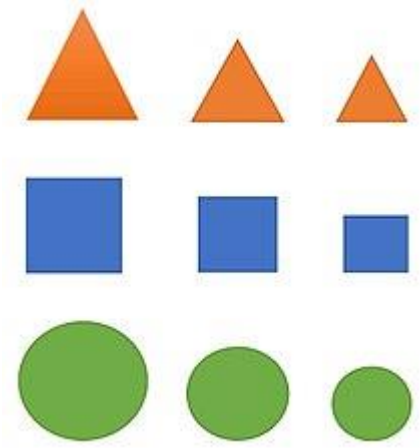
Top-down processing refers to the use of background information in pattern recognition. It always begins with a person's previous knowledge, and makes predictions due to this already acquired knowledge. Psychologist Richard Gregory estimated that about 90% of the information is lost between the time it takes to go from the eye to the brain, which is why the brain must guess what the person sees based on past experiences. In other words, we construct our perception of reality, and these perceptions are hypotheses or propositions based on past experiences and stored information. The formation of incorrect propositions will lead to errors of perception such as visual illusions. Given a paragraph written with difficult handwriting, it is easier to understand what the writer wants to convey if one reads the whole paragraph rather than reading the words in separate terms. The brain may be able to perceive and understand the gist of the paragraph due to the context supplied by the surrounding words.

Bottom-up processing

Bottom-up processing is also known as data-driven processing, because it originates with the stimulation of the sensory receptors.[10] Psychologist James Gibson opposed the top-down model and argued that perception is direct, and not subject to hypothesis testing as Gregory proposed. He stated that sensation is perception and there is no need for extra interpretation, as there is enough information in our environment to make sense of the world in a direct way. His theory is sometimes known as the "ecological theory" because of the claim that perception can be explained solely in terms of the environment. An example of bottom up-processing involves presenting a flower at the center of a person's field. The sight of the flower and all the information about the stimulus are carried from the retina to the visual cortex in the brain. The signal travels in one direction.

3.12.7 Seriation

Figure 5 Seriation (Source, Wayne , 2010 Themes and Variation)



A simple seriation task involving arranging shapes by size

In psychologist Jean Piaget's theory of cognitive development, the third stage is called the Concrete Operational State. It is during this stage that the abstract principle of thinking called "seriation" is naturally developed in a child. Seriation is the ability to arrange items in a logical order along a quantitative dimension such as length, weight, age, etc It is a general cognitive skill which is not fully mastered until after the nursery years .] To seriate means to understand that objects can be ordered along a dimension, and to effectively do so, the child needs to be able to answer the question "What comes next?" Seriation skills also help to develop problem-solving skills, which are useful in recognizing and completing patterning tasks.

3.12.8 Piaget's work on seriation

Piaget studied the development of seriation along with Szeminska in an experiment where they used rods of varying lengths to test children's skills They found that there were three distinct stages of development of the skill. In the first stage, children around the age of 4 could not arrange the first ten rods in order. They could make smaller groups of 2-4, but could not put all the elements together. In the second stage where the children were 5–6 years of age, they could succeed in the seriation task with the first ten rods through the process of trial and error. They could insert the other set of rods into order through trial and error. In the third stage, the 7-8-year-old children could arrange all the rods in order without much trial

and error. The children used the systematic method of first looking for the smallest rod first and the smallest among the rest

3.12.9 Development of problem-solving skills

To develop the skill of seriation, which then helps advance problem-solving skills, children should be provided with opportunities to arrange things in order using the appropriate language, such as "big" and "bigger" when working with size relationships. They should also be given the chance to arrange objects in order based on the texture, sound, flavor and color. Along with specific tasks of seriation, children should be given the chance to compare the different materials and toys they use during play. Through activities like these, the true understanding of characteristics of objects will develop. To aid them at a young age, the differences between the objects should be obvious. Lastly, a more complicated task of arranging two different sets of objects and seeing the relationship between the two different sets should also be provided. A common example of this is having children attempt to fit saucepan lids to saucepans of different sizes, or fitting together different sizes of nuts and bolts.

3.10 Application of seriation in schools

To help build up math skills in children, teachers and parents can help them learn seriation and patterning. Young children who understand seriation can put numbers in order from lowest to highest. Eventually, they will come to understand that 6 is higher than 5, and 20 is higher than 10. Similarly, having children copy patterns or create patterns of their own, like ABAB patterns, is a great way to help them recognize order and prepare for later math skills, such as multiplication. Child care providers can begin exposing children to patterns at a very young age by having them make groups and count the total number of objects.

3.11 Facial pattern recognition

Recognizing faces is one of the most common forms of pattern recognition. Humans are incredibly effective at remembering faces, but this ease and automaticity belies a very challenging problem All faces are physically similar. Faces have two eyes, one mouth, and one nose all in predictable locations, yet humans can recognize a face from several different angles and in various lighting conditions. Neuroscientists posit that recognizing faces takes

place in three phases. The first phase starts with visually focusing on of the physical features. The facial recognition system then needs to reconstruct the identity of the person from previous experiences. This provides us with the signal that this might be a person we know. The final phase of recognition completes when the face elicits the name of the person. Although humans are great at recognizing faces under normal viewing angles, upside-down faces are tremendously difficult to recognize. This demonstrates not only the challenges of facial recognition but also how humans have specialized procedures and capacities for recognizing faces under normal upright viewing conditions.

3.12 Neural mechanisms

Brain animation highlighting the fusiform face area, thought to be where facial processing and recognition takes place

Scientists agree that there is a certain area in the brain specifically devoted to processing faces. This structure is called the fusiform gyrus, and brain imaging studies have shown that it becomes highly active when a subject is viewing a face. Several case studies have reported that patients with lesions or tissue damage localized to this area have tremendous difficulty recognizing faces, even their own. Although most of this research is circumstantial, a study at Stanford University provided conclusive evidence for the fusiform gyrus' role in facial recognition. In a unique case study, researchers were able to send direct signals to a patient's fusiform gyrus. The patient reported that the faces of the doctors and nurses changed and morphed in front of him during this electrical stimulation. Researchers agree this demonstrates a convincing causal link between this neural structure and the human ability to recognize faces

12.13 Facial recognition development

Although in adults, facial recognition is fast and automatic, children do not reach adult levels of performance (in laboratory tasks) until adolescence. Two general theories have been put forth to explain how facial recognition normally develops. The first, general cognitive development theory, proposes that the perceptual ability to encode faces is fully developed early in childhood, and that the continued improvement of facial recognition into adulthood is attributed to other general factors. These general factors include improved attentional focus, deliberate task strategies, and metacognition. Research supports the argument that these other

general factors improve dramatically into adulthood. Face-specific perceptual development theory argues that the improved facial recognition between children and adults is due to a precise development of facial perception. The cause for this continuing development is proposed to be an ongoing experience with faces.

3.14 Developmental issues

Several developmental issues manifest as a decreased capacity for facial recognition. Using what is known about the role of the fusiform gyrus, research has shown that impaired social development along the autism spectrum is accompanied by a behavioral marker where these individuals tend to look away from faces, and a neurological marker characterized by decreased neural activity in the fusiform gyrus. Similarly, those with developmental prosopagnosia (DP) struggle with facial recognition to the extent they are often unable to identify even their own faces. Many studies report that around 2% of the world's population have developmental prosopagnosia, and that individuals with DP have a family history of the trait.] Individuals with DP are behaviorally indistinguishable from those with physical damage or lesions on the fusiform gyrus, again implicating its importance to facial recognition. Despite those with DP or neurological damage, there remains a large variability in facial recognition ability in the total population. It is unknown what accounts for the differences in facial recognition ability, whether it is a biological or environmental disposition. Recent research analyzing identical and fraternal twins showed that facial recognition was significantly higher correlated in identical twins, suggesting a strong genetic component to individual differences in facial recognition ability

3.15 Language development

Pattern recognition in language acquisition]

Recent research reveals that infant language acquisition is linked to cognitive pattern recognition. Unlike classical nativist and behavioral theories of language development, scientists now believe that language is a learned skill.[22] Studies at the Hebrew University and the University of Sydney both show a strong correlation between the ability to identify visual patterns and to learn a new language. Children with high shape recognition showed better grammar knowledge, even when controlling for the effects of intelligence and memory capacity This is supported by the theory that language learning is based on statistical

learning,] the process by which infants perceive common combinations of sounds and words in language and use them to inform future speech production.

3.16 Phonological development

The first step in infant language acquisition is to decipher between the most basic sound units of their native language. This includes every consonant, every short and long vowel sound, and any additional letter combinations like "th" and "ph" in English. These units, called phonemes, are detected through exposure and pattern recognition. Infants use their "innate feature detector" capabilities to distinguish between the sounds of words. They split them into phonemes through a mechanism of categorical perception. Then they extract statistical information by recognizing which combinations of sounds are most likely to occur together, like "qu" or "h" plus a vowel. In this way, their ability to learn words is based directly on the accuracy of their earlier phonetic patterning.

3.17 Grammar development

The transition from phonemic differentiation into higher-order word production is only the first step in the hierarchical acquisition of language. Pattern recognition is furthermore utilized in the detection of prosody cues, the stress and intonation patterns among words. Then it is applied to sentence structure and the understanding of typical clause boundaries. This entire process is reflected in reading as well. First, a child recognizes patterns of individual letters, then words, then groups of words together, then paragraphs, and finally entire chapters in books. Learning to read and learning to speak a language are based on the "stepwise refinement of patterns in perceptual pattern recognition.

3.18 Music pattern recognition

Music provides deep and emotional experiences for the listener. These experiences become contents in long-term memory, and every time we hear the same tunes, those contents are activated. Recognizing the content by the pattern of the music affects our emotion. The mechanism that forms the pattern recognition of music and the experience has been studied by multiple researchers. The sensation felt when listening to our favorite music is evident by the dilation of the pupils, the increase in pulse and blood pressure, the streaming of blood to the leg muscles, and the activation of the cerebellum, the brain region associated with

physical movement. While retrieving the memory of a tune demonstrates general recognition of musical pattern, pattern recognition also occurs while listening to a tune for the first time. The recurring nature of the metre allows the listener to follow a tune, recognize the metre, expect its upcoming occurrence, and figure the rhythm. The excitement of following a familiar music pattern happens when the pattern breaks and becomes unpredictable. This following and breaking of a pattern creates a problem-solving opportunity for the mind that form the experience.] Psychologist Daniel Levitin argues that the repetitions, melodic nature and organization of this music create meaning for the brain. The brain stores information in an arrangement of neurons which retrieve the same information when activated by the environment. By constantly referencing information and additional stimulation from the environment, the brain constructs musical features into a perceptual whole.[27]

The medial prefrontal cortex – one of the last areas affected by Alzheimer's disease – is the region activated by music.

3.19 Cognitive mechanisms

To understand music pattern recognition, we need to understand the underlying cognitive systems that each handle a part of this process. Various activities are at work in this recognition of a piece of music and its patterns. Researchers have begun to unveil the reasons behind the stimulated reactions to music. Montreal-based researchers asked ten volunteers who got "chills" listening to music to listen to their favorite songs while their brain activity was being monitored. The results show the significant role of the nucleus accumbens (NAcc) region – involved with cognitive processes such as motivation, reward, addiction, etc. – creating the neural arrangements that make up the experience. A sense of reward prediction is created by anticipation before the climax of the tune, which comes to a sense of resolution when the climax is reached. The longer the listener is denied the expected pattern, the greater the emotional arousal when the pattern returns. Musicologist Leonard Meyer used fifty measures of Beethoven's 5th movement of the String Quartet in C-sharp minor, Op. 131 to examine this notion. The stronger this experience is, the more vivid memory it will create and store. This strength affects the speed and accuracy of retrieval and recognition of the musical pattern. The brain not only recognizes specific tunes, it distinguishes standard acoustic features, speech and music.

MIT researchers conducted a study to examine this notion. The results showed six neural clusters in the auditory cortex responding to the sounds. Four were triggered when hearing standard acoustic features, one specifically responded to speech, and the last exclusively responded to music. Researchers who studied the correlation between temporal evolution of timbral, tonal and rhythmic features of music, came to the conclusion that music engages the brain regions connected to motor actions, emotions and creativity. The research indicates that the whole brain "lights up" when listening to music.] This amount of activity boosts memory preservation, hence pattern recognition.

Recognizing patterns of music is different for a musician and a listener. Although a musician may play the same notes every time, the details of the frequency will always be different. The listener will recognize the musical pattern and their types despite the variations. These musical types are conceptual and learned, meaning they might vary culturally. While listeners are involved with recognizing (implicit) musical material, musicians are involved with recalling them (explicit).

A UCLA study found that when watching or hearing music being played, neurons associated with the muscles needed for playing the instrument fire. Mirror neurons light up when musicians and non-musicians listen to a piece.

Developmental issues

Pattern recognition of music can build and strengthen other skills, such as musical synchrony and attentional performance and musical notation and brain engagement. Even a few years of musical training enhances memory and attention levels. Scientists at University of Newcastle conducted a study on patients with severe acquired brain injuries (ABIs) and healthy participants, using popular music to examine music-evoked autobiographical memories (MEAMs). The participants were asked to record their familiarity with the songs, whether they liked them and what memories they evoked. The results showed that the ABI patients had the highest MEAMs, and all the participants had MEAMs of a person, people or life period that were generally positive. The participants completed the task by utilizing pattern recognition skills. Memory evocation caused the songs to sound more familiar and well-liked. This research can be beneficial to rehabilitating patients of autobiographical amnesia who do not have fundamental deficiency in autobiographical recall memory and intact pitch perception.

In a study at University of California, Davis mapped the brain of participants while they listened to music. The results showed links between brain regions to autobiographical memories and emotions activated by familiar music. This study can explain the strong response of patients with Alzheimer's disease to music. This research can help such patients with pattern recognition-enhancing tasks.

False pattern recognition

The human tendency to see patterns that do not actually exist is called apophenia. Examples include the Man in the Moon, faces or figures in shadows, in clouds, and in patterns with no deliberate design, such as the swirls on a baked confection, and the perception of causal relationships between events which are, in fact, unrelated. Apophenia figures prominently in conspiracy theories, gambling, misinterpretation of statistics and scientific data, and some kinds of religious and paranormal experiences. Misperception of patterns in random data is called pareidolia.

3.20 What Is Perceptual Constancy?

Perceptual constancy refers to a person or animal's ability to see different sizes, shapes or brightness without having to re-evaluate or re-interpret the properties of the image **or object.** For example, even though buildings may be different sizes, perceptions maintain constant regardless of the distance.

Perceptual constancy affects sizes, shapes and brightness within sight. Size constancy allows individuals to perceive a person or object as the same size even though distance may make them appear smaller or larger. Senses are also affected by perceptual constancy as the volume may fade, yet the sound is still perceived as loud when it is soft. With perceptual constancy, distance does not always affect what a person is sensing.

Shapes are also affected by perceptual constancy as an individual typically associates an object as a certain shape although it can transform when the angle is changed. For example, an object that is in the form of a circle may, in reality, look more like an ellipse from a distance, however, perceptual constancy allows an individual to still perceive the shape as a circle from a distance or different angle.

Perceptual constancy also refers to a person's ability to recognize and maintain sight of colors, regardless of how it looks under a different level of light or at a different angle. Even though a blue shirt may look black in darker levels of light, perceptual constancy allows the individual to still perceive the shirt as a blue color.

3.21 Terminologies

1. **Proprioception**: this is the sense that deals with how your brain understands where your body is in space.
2. **Retinal disparity**: our eyes are set roughly $2\frac{1}{2}$ inches which means that each eye has slightly different view of things.

3.22 Activity

1. Discuss the following concepts:
   (a) Relative size.
   (b) Interposition.
   (c) Relative motion.

3.23 Reflection

Do you think culture affects human perception?

3.24 Summary

In this unit, you have learnt about our five common senses and how they work. You have also learnt about perceptual organisation such as figure Ground, you have also learnt about perception of distance and depth, which includes: retina disparity and convergence. You have also learnt about perceptual constancy and pattern recognition.

UNIT 4: BASIC COGNITIVE PROCESSES

1.1 Introduction

In this unit, you will learn about cognitive process such as attention, learning: meaning, native, types and theories, and problem solving techniques.

1.2 Learning outcomes

By the end of this unit, you are expected to;

- analyse attention as a cognitive process.
- discuss theories of learning and their principles.
- discuss problem solving skill/techniques

1.3 Time frame

You need about two (2) hours interacting with this material.

1.4 Content

- Attention
- Early views on attention
- Meaning and Nature of learning
- Types of Learning
- Theories of Learning
- Trial and Error Learning Theory
- Learning by Conditioning
- Sub-principles of Classical Conditioning
- Learning by Insight
- Learning by Imitation
- Laws of Learning
- Techniques of Problem Solving?
- Introduction to Problem Solving Techniques
- Evaluating the Success of Your Solution

1.5 Attention

Attention, in psychology, the concentration of awareness on some phenomenon to the exclusion of other stimuli.

Attention is awareness of the here and now in a focal and perceptive way. For early psychologists, such as Edward Bradford Titchener, attention determined the content of consciousness and influenced the quality of conscious experience. In subsequent years less emphasis was placed on the subjective element of consciousness and more on the behaviour patterns by which attention could be recognized in others. Although human experience is determined by the way people direct their attention, it is evident that they do not have complete control over such direction. There are, for example, times when an individual has difficulty concentrating attention on a task, a conversation, or a set of events. At other times an individual's attention is "captured" by an unexpected event rather than voluntarily directed toward it.

Attention has to do with the immediate experience of the individual; it is a state of current awareness. There are, of course, myriad events taking place in the world all the time, each impinging upon a person's senses. There are also events taking place within the body that affect attention, just as there are representations of past events stored in one's memory but accessible to awareness under appropriate circumstances.

While it might be expected that current awareness is the totality of all those events at any given moment, clearly this is not the case. Within this vast field of potential experiences, an individual focus upon—or attends to—some limited subset of the whole. This subset constitutes the subjective field of awareness. It is possible to determine the reason for this limitation. Control and coordination of the many inputs and stored experiences and the organization of appropriate patterns of response are the province of the brain. The brain has impressive processing capabilities, but it has a limited capacity. A person cannot consciously experience all the events and information available at any one time. Likewise, it is impossible to initiate, simultaneously, an unlimited number of different actions. The question becomes one of how an appropriate subset of inputs, intermediate processes, and outputs are selected to command attention and engage available resources.

Attention, then, may be understood as a condition of selective awareness which governs the extent and quality of one's interactions with one's environment. It is not necessarily held under voluntary control. Some of the history of attention and the methods by which psychologists and others have come to characterize and understand it are presented in the discussion that follows.

Early views on attention

19th-century roots

Psychologists began to study attention in the latter part of the 19th century. Before this time, philosophers had typically considered attention within the context of apperception (the mechanism by which new ideas became associated with existing ideas). Thus Gottfried Wilhelm Leibniz suggested that one's loss of awareness of the constant sound of a waterfall illustrates how events can cease to be apperceived (that is, represented in consciousness) without specific attention. He suggested that attention determines what will and will not be apperceived. The term *apperception* was still employed in the 19th century by Wilhelm Wundt, one of the founders of modern psychology. Wundt, however, was among the first to point out the distinction between the focal and more general features of human awareness. He wrote of the wide field of awareness (which he called the *Blickfeld*) within which lay the more limited focus of attention (the *Blickpunkt*). He suggested that the range of the *Blickpunkt* was about six items or groups. He also speculated that attention is a function of the frontal lobes of the brain.

One of the most influential psychologists at the turn of the century was William James. In his major work, *The Principles of Psychology* (1890), he says:

Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others.

James held that attention made humans perceive, conceive, distinguish, and remember more effectively and sped their reactions.

In 1906 another prominent psychologist, W.B. Pillsbury, suggested three methods for measuring attention. The first relied upon tests that measured attention through performance

of a task judged to require a high degree of attention; the second measured diminished attention through decreased performance; and the third gauged the strength of attention by the stimulus level required to distract the individual.

As the 20th century progressed, psychology and the study of behaviour were subject to new influences that had far-reaching consequences for notions of attention. One such area of influence originated in the work of Russian physiologist Ivan Petrovich Pavlov, who reported what is now usually referred to as the orienting response. In dogs and other animals this includes such signs of attention as pricked-up ears, head turned toward the stimulus, increased muscular tension, and physiological changes detectable with instruments. Further influence came from work on reflexology by one of Pavlov's competitors, Russian Vladimir M. Bekhterev. Many psychologists came to regard the conditioned reflex (an involuntary response conditioned by reward) as the basic building block of all human learning.

Learning: Meaning, Nature, Types and Theories of Learning

Meaning and Nature:

Learning is a key process in human behaviour. All living is learning. If we compare the simple, crude ways in which a child feels and behaves, with the complex modes of adult behaviour, his skills, habits, thought, sentiments and the like- we will know what difference learning has made to the individual.

The individual is constantly interacting with and influenced by the environment. This experience makes him to change or modify his behaviour in order to deal effectively with it. Therefore, learning is a change in behaviour, influenced by previous behaviour. As stated above the skills, knowledge, habits, attitudes, interests and other personality characteristics are all the result of learning.

Learning is defined as "any relatively permanent change in behaviour that occurs as a result of practice and experience". This definition has three important elements.

a. Learning is a change in behaviour—better or worse.

b. It is a change that takes place through practice or experience, but changes due to growth or maturation are not learning.

c. This change in behaviour must be relatively permanent, and it must last a fairly long time.

All learning involves activities. These activities involve either physical or mental activities. They may be simple mental activities or complex, involving various muscles, bones, etc. So also the mental activities may be very simple involving one or two activities of mind or complex which involve higher mental activities.

What activities are learned by the individual refer to types of learning. For example, habits, skills, facts, etc. There are different types of learning. Some of the important and common learning activities are explained here.

1.6 Types of Learning:

1. Motor learning:

Most of our activities in our day-to-days life refer to motor activities. The individual has to learn them in order to maintain his regular life, for example walking, running, skating, driving, climbing, etc. All these activities involve the muscular coordination.

2. Verbal learning:

This type of learning involves the language we speak, the communication devices we use. Signs, pictures, symbols, words, figures, sounds, etc, are the tools used in such activities. We use words for communication.

3. Concept learning:

It is the form of learning which requires higher order mental processes like thinking, reasoning, intelligence, etc. we learn different concepts from childhood. For example, when we see a dog and attach the term ‘dog’, we learn that the word dog refers to a particular animal. Concept learning involves two processes, viz. abstraction and generalisation. This learning is very useful in recognising, identifying things.

4. Discrimination learning:

Learning to differentiate between stimuli and showing an appropriate response to these stimuli is called discrimination learning. Example, sound horns of different vehicles like bus, car, ambulance, etc.

5. Learning of principles:

Individuals learn certain principles related to science, mathematics, grammar, etc. in order to manage their work effectively. These principles always show the relationship between two or more concepts. Example: formulae, laws, associations, correlations, etc.

6. Problem solving:

This is a higher order learning process. This learning requires the use of cognitive abilities-such as thinking, reasoning, observation, imagination, generalization, etc. This is very useful to overcome difficult problems encountered by the people.

7. Attitude learning:

Attitude is a predisposition which determines and directs our behaviour. We develop different attitudes from our childhood about the people, objects and everything we know. Our behaviour may be positive or negative depending upon our attitudes. Example: attitudes of nurse towards her profession, patients, etc.

Theories of Learning:

Psychologists have tried to explain how people learn and why they learn. They have conducted many experiments on animals and children and come to certain definite conclusions which explain the modes of learning.

These are called as theories of learning. In many books, these explanations are treated as kinds of learning. In a sense it is true. But the term learning is very comprehensive. It covers a wide range of activities which cannot be explained within a limited framework. There are many theories explaining modes of learning. Important among them are:

Trial and Error Learning Theory:

This theory was developed by an American psychologist EL Thorndike (1874-1949). He argues that learning takes place through trial and error method. According to him learning is a gradual process where the individual will make many attempts to learn. The essence of this theory is-as the trials increase, the errors decrease.

This is possible because of association formed between sense impressions and impulses to action. Such an association comes to be known as a ‘bond’ or a ‘connection, because it is

these bonds or connections which become strengthened or weakened in making and breaking of habits. According to this theory when an individual is placed in a new situation, he makes a number of random movements. Among them, those which are unsuccessful are eliminated and the successful ones are fixed.

These random movements are not eliminated at once. In the first attempt their number is very large, in the second attempt the number of errors diminishes and the range of activity becomes narrower. Gradually the individual learns to avoid unnecessary movements and reaches the goal. Improvement takes place through repetition.

Thorndike studies the character of trial and error learning in a number of experiments on cats-using a box which he called 'puzzle box'. In one of the experiments a hungry cat was placed in the box and the door was closed which could be opened by pressing a Latch. A fish was placed outside the box in a plate.

The cat could see this fish. The cat was given 100 trials-ten in the morning and ten in each afternoon for five days. The cat was fed at the end of each experimental period and then was given nothing more to eat until after the next session. If, succeeded in opening the door in any trial by chance, he went to eat food (fish). A complete record was made of the cat's behaviour during each trial.

In the beginning the cat made a number of random movements like biting, clawing, dashing, etc. gradually in subsequent trials the cat reduced the incorrect responses (errors), as it was in a position to manipulate the latch as soon as it was put in the box.

This experiment revealed that the random movements were decreased gradually, that is-as the trials increased the errors decreased. As the trials increased the solution to open the door (pressing the latch) was discovered and at the end, the cat could open the door with zero error. The time taken in each trial was eventually reduced.

Thorndike conducted many experiments with maze and puzzle box learning in which cats and rats were used. He has demonstrated that through numerous trials the animal learns much and gradually improves his effort.

We all learn many skills like swimming, cycling, riding, etc., through this method. Children learn to sit, stand, walk, and run by this method only. However, this method involves considerable waste of time and effort.

Learning by Conditioning:

In literal sense, conditioning means 'getting used' to, or 'adjusted 'to a new situation, or a stimulus. It is a process of substituting the original stimulus by a new one and connecting the response with it. There are two types of conditioning theories:

1. Classical conditioning:

This method of conditioning got its name from the fact that, it is a kind of learning situation that existed in the early classical experiments of Ivan P Pavlov (1849-1936), Russian physiologist who was awarded Nobel Prize, in 1904 for his experiments.

Pavlov designed an apparatus to measure the quantity of saliva produced in response to food (meat power). At the beginning of his experiment Pavlov noted that no saliva flowed when he rang the bell. He then trained the dog by sounding the bell, and shortly afterwards presenting food.

After the sound of the bell had been paired with food a few times, he tested the effects of the training by measuring the amount of saliva that flowed when he rang the bell and did not present food. He found that some saliva was produced in response to the sound of the bell alone. He then resumed the training-paired presentation of bell and food a few times and then tested again with the bell alone.

As the training continued, the amount of saliva on tests with the bell alone increased. Thus, after training the dog's mouth watered-salivated- whenever the bell was sounded. This is what was learned; it is the conditioned response.

This theory states that CS (bell) becomes a substitute after pairing with UCS (food) and acquires the capacity to elicit a response. It is because the association (conditioning) is formed between CS and UCS. This may be symbolically presented as follows:

UCS<——————————à UCR

(Food) (Saliva)

↓ (Conditioning)

CS<————————————————-à CR

(Bell) (Saliva)

Sub-principles of Classical Conditioning:

There are certain sub-principles which explain the different phenomena of this experiment.

a. Extinction and spontaneous recovery:

Extinction means cessation of a response. The strength of the CS gradually decreases when it is presented alone and not followed by UCS for a number of trails. This process is called 'extinction'. In this experiment when only bell is presented without food for a number of trials, the dog stopped salivation gradually.

But when the CS (bell) was paired again with UCS (food) for some trials, the CR (salivation) recovered. This is known as 'spontaneous recovery'. In spontaneous recovery the dog required less number of trials than the first time, because the association between CS and UCS still existed in the brain of the animal.

b. Stimulus generalization:

A tendency to respond to a stimulus which is similar to original one is called stimulus generalization, the greater the similarity, the more the generalization. In this experiment, the dog started salivating even for the sound of a buzzer which was similar to bell.

c. Stimulus discrimination:

When there is much difference between two stimuli, the animal can discriminate between the two. For example, if the dog is conditioned to salivate at the signal of red light, it will not salivate when green light is presented.

d. Higher order conditioning:

If a 'light' is presented followed by bell and then by food for a number of trials, the dog will start salivating to light itself. This phenomenon is called higher order condition.

All these principles are very useful in behaviour therapy. Conditioning is not confined only to the laboratory.

In our day-to- day's life we come across many instances of such learning. For example, a small child who does not know, touches a burning candle, it gives him a painful experience and withdraws his hand. Later this experience will make him withdraw from burning objects and avoid them all together.

Conditioning is used as psychotherapeutic technique very effectively in the treatment of abnormal behaviours such as phobias, alcoholism, enuresis, etc. These are called behaviour modification techniques. Watson and others have conducted many experiments to prove the usefulness of this method.

2. Operant Conditioning:

This method of conditioning was developed by an American psychologist BF Skinner. This theory is also known as 'Instrumental conditioning', because the animals use certain operations or actions as instruments to find solution.

Skinner conducted his famous experiment by placing a hungry rat in a box called after his name 'Skinner box'. This box was containing a lever and a food tray in a corner of the box. It was so arranged, that the animal was free to move inside the box, but the pressing of the lever would get the animal a pallet of food in the tray as reinforcement.

Arrangement was also made to record the number of pressings of the lever by a mechanical device. It was found in the beginning that the rat pressed the lever occasionally and used to get food as reinforcement for each pressing.

Gradually, as the animal learnt the pressing of lever would give some food, it repeated the responses very rapidly. This rapid increase in pressing the lever is the indication of the animal conditioned to get food.

In day-to-day's life also, much learning takes place in animals as well as in human beings by this method. The reinforcement will be the motivating factor. It will make the organism to repeat its action.

It is on the basis of these experiments, Skinner made his famous statement "Rewarded behaviour is repeated". Instrumental conditioning involves more activity by the learner than classical conditioning. Skinner conducted his experiments on different animals like pigeons, rats, etc.

Reinforcement which is the most important aspect of this experiment is divided into two types: positive reinforcement is used in reward training. Negative reinforcement-like punishment is used to stop undesired responses or behaviours. Operant conditioning is useful in shaping undesirable behaviour and also in modification of behaviour.

This is also useful in training of mentally retarded children to learn dressing, eating and toilet training skills, treatment of phobias, drug and alcohol addictions, and psychotherapy and to teach needed behaviour in children. Further, these experiments have proved that intermittent reinforcement yields better results than continuous reinforcement.

Learning by Insight:

Many times learning proceeds by the more efficient process of trying those methods which are seem to have a relation to solution. This is possible by understanding or perception of the situation.

Learning by perceiving the relationship in the scene and understanding the situation is insightful learning. This theory was developed by a psychologist known as Wolf gang Kohler, who belonged to Gestalt school of psychology.

According to Gestalt theory—perception of a situation as a 'whole' gives better understanding than sum total of its parts. That is, the situation viewed as a whole will definitely look different from that, viewed through its parts.

Kohler conducted his most famous experiments on chimpanzee- called Sultan. In the experiment, Sultan was put in a cage and a banana was placed at some distance outside the cage. Then the chimpanzee was given two sticks, so constructed that one stick could be fitted into another and make the stick longer.

The hungry Sultan first attempted with its hands to get the banana. Then he took one of the sticks and tried to pull the banana nearer, then tried with other stick, but failed to reach it. By this effort, the chimpanzee became tired and left the attempts to reach banana and started playing with sticks.

While playing so, one of the sticks got fitted into the other and the stick became lengthier. Immediately Sultan became elated and pulled the banana with this long stick and ate it. This 'sudden flash of idea' to reach food with longer stick was called as 'Insight', by Kohler.

He conducted many experiments to prove that learning takes place also by insight and not only by trial and error. He concluded that the occurrence of insight to find solution to a problem is possible by perception of the whole situation.

Kohler conducted many experiments on this line of learning to prove that, just trial and error method is not enough to find solution for many complex problems.

Trial and error or association through connectionism and conditioning may account for simple acquisition of knowledge, skills, interests, habits and other personality characteristics. But it is absolutely insufficient for solving complex problems.

It is here the method of insightful learning is very useful. Because it involves many higher mental processes such as thinking, reasoning, intelligence, etc.

Insight occurs, when the individual sees in a flash, the solution to his problem or difficulty. It is not blind or stupid learning. It is an intelligent way of learning. In many occasions people try to size up the situation, things and arrive at a conclusion. With experience man is able to solve problems better and sooner.

He exercises his discrimination ability in solving problems, and learning becomes a matter of insight rather than of trial and error. Archimedes's example of' Aha' experience (eureka) explained in creative thinking is the appropriate example for occurrence of insight.

Learning by Imitation:

It is the simplest method of learning. Many of our day-to-day's activities are learnt by imitating others. For example, the way we eat, drink, walk, talk, dress, etc, are all learnt by

imitating others. We observe and watch what and how other people do certain activities and imitate them.

We observe the demonstrations given by an expert, imitate his movements and learn them. By copying the behaviour of others, people avoid waste of time and effort of trial and error method of learning. For example, a boy observes the way of holding a cricket bat, the movements of an expert player, imitates the same and learns.

Psychologists like Millar and Dollard have tried to show that the tendency to imitate is itself a learned response and if reinforced, the individual will be more likely to continue to imitate.

Many people believe that imitation is a lower form type of learning. Still others argue that imitation can never lead to novel responses and there will be no chance to use individual's creativity or originality. But at the same time many educationists believe that only the imitative individual can learn better. Whatever may be the opinion it is quite obvious that we learn many things by imitation.

Laws of Learning:

EL Thorndike has explained three laws of learning called Primary laws and in addition to these, he has also framed 5 subsidiary laws in connection with his trial and error learning theory.

Primary laws:

These are the most important laws, which explain the basic aspects of learning. They are:

1. Law of readiness:

By readiness means the organism is ready to respond or act. This is more essential prerequisite for learning.

This indicates that the animal or human being is motivated to learn. This condition of readiness has two effects— satisfaction and annoyance. When the animal is ready to act- if permitted- it gives pleasure. If it is not permitted, it feels annoyed.

In the same way when the animal is not ready to learn- if asked to learn- it is annoying. On the other hand, if it is prevented from learning it gives pleasure.

These points have been given below in the words of Thorndike:

a. For a conduction unit ready to conduct-to conduct is satisfying.

b. For a conduction unit ready to conduct-not to conduct is annoying.

c. For a conduction unit not ready to conduct- to conduct is annoying.

This law clearly shows that readiness of a person to learn is very important. Hence motivate him to learn.

2. Law of exercise:

This law is also known as law of frequency. Frequency refers to number of repetitions of learning. Thorndike believed that repeated exercising of a response strengthens its connection with stimulus.

This aspect refers to law of use and disuse, which explains that, anything not in use will perish. So also if the response is not repeated, its bond with stimulus gets weakened. This is also according to the statement that ‘practice makes man perfect’.

In Thorndike’s experiment the cat becomes perfect after repeating the response more number of times, i.e. it learnt to open the door without committing any error.

3. Law of effect:

This law states that when a connection is accomplished by satisfying effect- its strength is increased. By this, Thorndike meant that the probability of its occurrence is greater. In his experiment if the hungry cat succeeded in opening the door, would get its favourable dish to eat.

This had a positive effect on its response. Rewards always strengthen connections between stimuli and responses, and on the other hand, punishment weakens connections.

Secondary laws:

In addition to the three primary laws explained above, Thorndike has given five secondary or subsidiary laws also.

They are as follows:

a. Law of multiple response:

It means when a response fails to elicit a desired effect, the learner will try with new responses until the goal is reached.

b- Law of set or attitude:

Mental set or positive attitude is very important in any learning.

c. **Law of associative shifting:**

This is nothing but shifting of the response to a new situation which is similar to the earlier one. Because the fundamental notion is that, if a response can be kept intact through a series of changes in stimulating situation, it may finally be given to a new situation.

d. Law of prepotency of elements:

This law states that the learner is able to react in a selected way, only to the salient elements of the problem and not for other unimportant elements.

e. Law of response by analogy:

It means comparing a new situation to the previously learned one and thus giving a response by analogy.

As stated above, Thorndike formulated these laws on the basis of his experiments. According to the law of readiness, the cat was ready to learn, because it was hungry. This hunger motivated the cat to learn to open the door.

According to the second law, the cat was repeatedly given trials and exercise which strengthened its learning. Finally, on each trial the cat was given reinforcement in the form of fish.

This encouraged the cat to continue its effort to learn to open the door. The secondary laws given by him support these findings. These laws are highly relevant to the field of education. The teachers can make use of these laws in order to make their teaching more effect

How to Solve Problems - Techniques of Problem Solving?

As the owner of your own business you deal with problems on an almost daily basis. Being familiar with effective Problem Solving Techniques can dramatically affect the growth of your business.

Although you find solutions to your problems, many businessmen and women are not really skilled in the methods of problem solving, and when solutions fail, they fault themselves for misjudgment. The problem is typically not misjudgment but rather a lack of skill.

This guide instructs you in some problem solving techniques. Crucial to the success of a business faced with problems is your understanding of just what the problems are, defining them, finding solutions, and selecting the best solutions for the situations. This guide explains the following.

* How to identify a problem.
* How to respond to it.
* The different techniques and methods used in problem-solving.
* How to find alternative solutions. How to select the best solution for the situation.
* Designing a Plan of Action. How to implement the Plan of Action.
* How to assess the success of the solution and the Plan of Action.

4.7 Introduction to Problem Solving Techniques

What is a problem. A problem is a situation that presents difficulty or perplexity. Problems come in many shapes and sizes. For example, it can be:

Something did not work as it should and you don't know how or why. Something you need is unavailable, and something must be found to take its place. Employees are undermining a new program. The market is not buying. What do you do to survive? Customers are complaining. How do you handle their complaints?

Where do problems come from? Problems arise from every facet of human and mechanical functions as well as from nature. Some problems we cause ourselves (e.g., a hasty choice was made and the wrong person was selected for the job); other problems are caused by forces beyond our control (e.g., a warehouse is struck by lightning and burns down).

Problems are a natural, everyday occurrence of life, and in order to suffer less from the tensions and frustrations they cause, we must learn how to deal with them in a rational, logical fashion.

If we accept the fact that problems will arise on a regular basis, for a variety of reasons, and from a variety of sources, we can:

learn to approach problems from an objective point of view; learn how to anticipate some of them; and prevent some of them from becoming larger problems.

To accomplish this, you need to learn the process of problem solving.

Here, we will instruct you in the basic methods of problem-solving. It is a step by step guide which you can easily follow and practice. As you follow this guide, you will eventually develop some strategies of your own that work in concert with the problem-solving process described in this guide.

Keep in mind, though, as you read that this is not a comprehensive analysis of the art of problem-solving but rather a practical, systematic, and simplified, yet effective, way to approach problems considering the limited time and information most business owners and managers have. In addition, some problems are so complex that they require the additional help of experts in the field, so be prepared to accept the fact that some problems are beyond one person's ability, skill, and desire to succeed.

You are responsible for everything that happens in your life. Learn to accept total responsibility for yourself. If you don’t manage yourself, then you are letting others have control of your life. In this video you'll discover 90 powerful tips and strategies to better manage yourself for success.

1. Identifying The Problem

Before a problem can be solved, you must first recognize that a problem exists. Here is where your approach to problem-solving is crucial. You should not allow the problem to intimidate you. You should approach it rationally and remind yourself that every problem is solvable if it is tackled appropriately.

Fear can block your ability to think clearly, but if you:

1. Follow a workable procedure for finding solutions;
2. Accept the fact that you can't foresee everything;
3. Assume that the solution you select is your best option at the time; and
4. Accept the possibility that things may change and your solution fail;

you will then enter the problem-solving process rationally, You should try to view it as an intellectual exercise. Once you recognize that a problem exists, your next step is to identify

the problem. First, you need to discover how the problem occurred. Ask yourself the following questions:

1. Did something go wrong?
2. Did something breakdown?
3. Were there unexpected results or outcome?
4. Is something that once worked no longer working?

Second, you need to know the nature of the problem:

1. Is it people, operational, technical, etc.?
2. Is it with a particular department, product or service, etc.?
3. Is it something tangible or intangible?
4. Is it an external or internal problem?

Third, you need to decide how significant the problem is. Based on the level of significance, you may choose to deal with the problem or not to deal with it. Sometimes what you think is a small problem, when analyzed, proves to be a major problem. The reverse is also true. To determine this, you should ask yourself the following types of questions:

1. Is it disrupting operations?
2. Is it hampering sales?
3. Is it causing conflict among people?
4. Is it an everyday occurrence or is it infrequent?
5. Is it affecting personnel and their productivity?
6. Is it common or unusual?
7. Is it affecting goals, and if yes, which ones?
8. Is it affecting customers, vendors, and any other external people?

Fourth, you should narrow down the type of problem:

1. Is it basically a problem which occurred in the past and the main concern is to make certain that it doesn't occur again?
2. Is it a problem which currently exists and the main concern is to clear up the situation?
3. Is it a problem which might occur in the future and the basic concern is planning and taking action before the problem arises?

The answer to all of the above questions will help you focus on the true problem. You cannot effectively research the causes of a problem until you have a clear understanding of what the problem is. Sometimes, people spend many hours on what they perceive as a problem only to find out, after seeking the causes, that something else was really the problem.

In order to appropriately identify the problem and its causes, you must do some research. To do this, simply list all the previous questions in checklist form, and keeping the checklist handy, go about gathering as much information as you possibly can. Keep in mind the relative importance and urgency of the problem, as well as your own time limitations. Then interview the people involved with the problem, asking them the questions on your checklist.

After you've gathered the information and reviewed it, you will have a pretty clear understanding of the problem and what the major causes of the problem are. At this point, you can research the causes further through observation and additional interviewing. Now, you should summarize the problem as briefly as possible, list all the causes you have identified, and list all the areas the problem seems to be affecting.
Before proceeding to finding solutions, there is some additional research that could be done. If possible and if warranted, you might wish to find out:
1. What has previously been done in regards to this problem.
2. What have other companies done.
3. What formal knowledge might you need to acquire.
4. What has been learned from past experience.
5. What do experts say about the problem.

2. Roadblocks to Problem Solving

Many of us serve as our own roadblocks in solving problems. There are a variety of roadblocks to watch for in order to effectively use the technique of problem solving:
1. Watch out for old habits.
2. Check your perceptions.
3. Overcome your fears.
4. Be careful of assumptions.
5. Don't be tied to a problem; try to look at it with detachment.
6. Don't let yourself procrastinate.
7. Control your inclination for reactive solutions.
8. Control your inclination for rash solutions.
9. Avoid emotional responses and always attempt to be rational.
10. Be aware that the nature of a problem can change.
11. Do not skip steps in the problem solving process.

At this point, you are ready to check your understanding of the problem. You've already identified the problem, broken it all down into all its facets, narrowed it down, done research

on it, and you are avoiding typical roadblocks. On a large pad, write down the problem, including all of the factors, the areas it affects, and what the effects are. For a better visual understanding, you may also wish to diagram the problem showing cause and effect.
Study what you have written down and/or diagrammed. Call in your employees and discuss your analysis with them. Based on their feedback, you may decide to revise. Once you think you fully understand the causes and effects of the problem, summarize the problem as succinctly and as simply as possible.

3. How to Find Solutions

There are a number of methods for finding solutions. We will describe five thinking methods below, but we recommend that you use a number of them in finding solutions. The first four methods described are unconventional and more innovative. They allow you the possibility of arriving at a novel solution. The fifth method is a more typical and straightforward method.

1. Association: There are three types of associative thinking. This type of thinking is basically a linking process either through similarity, difference, or contiguity. For example, contiguity finds solutions from things that are connected through proximity, sequence, and cause and effect. The process works as follows: List as many parts of the problem you can think of. Then giving yourself a short time limit, list as many words or ideas that have either proximity, sequence, or related cause and effect to the ones you have listed. For example, a contiguous association might be "misplaced work - cluttered desk" (proximity); "misplaced work - rushing" (sequence); "misplaced work - irate customer" (cause and effect).
Associative thinking taps the resources of the mind. It brings into focus options you might not have considered if you stuck to ideas only directly related to the problem. As a result of associative thinking, you might find other relationships embedded in the problem that will lead to a better solution.

2. Analogy: This thinking method is a way of finding solutions through comparisons. The process is based on comparing the different facets of the problem with other problems that may or may not have similar facets. An analogy might go like this: "Employees have been coming in late to work quite often; how can I get them to be at work on time? This to me is like soldiers being late for a battle. Would soldiers come late to a battle? Why not?" By, comparing the situation of workers to the situation of soldiers, you may find a solution for a way to motivate employees to come to work on time.

3. Brainstorming: This thinking method is based on a free, non-threatening, anything goes atmosphere. You can brainstorm alone or with a group of people. Most often a group of people from diverse backgrounds is preferable. The process works like this: The problem is

explained to the group and each member is encouraged to throw out as many ideas for solutions as he or she can think of no matter how ridiculous or far-fetched they may sound. All the ideas are discussed among the group, revised, tossed out, expanded, etc. based on the group's analysis of them. Based on the group's grasp of the effectiveness of each idea, the best ones are selected for closer review. For example, the group of people might throw out for consideration any thoughts they might have on how to increase sales or improve profits.

4. Intuition: This mode of thinking is based on hunches. It is not, as some think, irrational. Intuition or hunches are built on a strong foundation of facts and experiences that are buried somewhere in the subconscious. All the things you know and have experienced can lead you to believe that something might be true although you've never actually experienced that reality. Use your intuition as much as possible but check it against the reality of the situation.

5. Analytical Thinking: This thinking method is based on analysis. It is the most conventional and logical of all the methods and follows a step by step pattern.

a. Examine each cause of the problem. Then for each cause, based on your direct knowledge and experience, list the solutions that logically would seem to solve the problem.

b. Check the possible solutions you arrive at with the research you have compiled on how the problem was solved by others.

Using each thinking technique, search for solutions. Keep a running list of all of them, even the ones that seem far out, too simple, or even impossible. The effect of this is to give you a rich pool of ideas that will lead you to the best solution.

4. Sorting Out the Best Solution

Go through your long list of solutions and cross-out those that obviously won't work. Those ideas are not wasted for they impact on those ideas that remain. In other words, the best ideas you select may be revised based on the ideas that wouldn't work. With the remaining solutions, use what is called the "Force Field Analysis Technique." This is basically an analysis technique which breaks the solution down into its positive effects and negative effects. To do this, write each solution you are considering on a separate piece of paper. Below the solution, draw a line vertically down the center of the paper. Label one column advantages and one column disadvantages.

Now, some more analytical thinking comes into play. Analyzing each facet of the solution and its effect on the problem, listing each of the advantages and disadvantages you can think of.

One way to help you think of the advantages and disadvantages is to role-play each solution. Call in a few of your employees and play out each solution. Ask them for their reactions.

Based on what you observe and on their feedback, you will have a better idea of the advantages and disadvantages of each solution you are considering.

After you complete this process for each solution, select those solutions which have the most advantages. At this point, you should be considering only two or three. In order to select the most appropriate solution, you should check each solution against the following criteria: Cost effectiveness; Time constraints; Availability of manpower, material, etc.; Your own intuition.

Before you actually implement the solution, you should evaluate it. Ask yourself these questions:

1. Are the objectives of the solution sound and clear and not complex?
2. Will the solution achieve the objectives?
3. What are the possibilities it will fail and in what way?

5. The Plan of Action

Finding the solution does not mean the problem is solved. Now, you need to design a plan of action so that the solution gets carried out properly. Designing and carrying out the plan of action is equally as important as the solution. The best solution can fail because it is not implemented correctly. When designing the plan of action, consider the following:

Who will be involved in the solution; Who will be affected by the solution; What course of action will be taken; How should the course of action be presented to company employees, customers, vendors, etc.; When will it happen - the time frame; Where will it happen; How will it happen; What is needed to make it happen.

Design a plan of action chart including all the details you need to consider to carry it out and when each phase should happen. Keep in mind, though, that the best plans have setbacks for any number of reasons - from a key person being out for illness to a supplier shipping material late. So remember that your dates are only target dates. Solutions and plans of action must be flexible. Expect some things to be revised.

6. Evaluating the Plan of Action

Before you implement the plan of action, you should analyze it to see if you've considered as many of the variables as possible. Some questions you might ask yourself are:

1. Is there adequate staff to carry it out?
2. Is the plan detailed yet simple enough for those affected to know what to expect and how to carry it out?
3. Will it embarrass anyone - manager, employee, customer, vendor, etc.?

4. Is the time frame realistic and feasible?

5. Are there special conditions which may have been overlooked?

6. Who should be informed?

7. Who should be involved?

8. Who should be responsible for each aspect and/or phase?

9. Is the plan of action cost effective?

10. Does the plan have a public relations component?

7. Obstacles You May Encounter

There are a number of obstacles you may encounter when you implement your plan of action. It is, therefore, advisable that you devise ways to overcome them. Try not to allow obstacles to prevent you from reaching your goals. Some obstacles to watch for are:

1. Not receiving material and/or equipment on time;

2. Other situations which might arise and deflect your attention from this problem;

3. Procrastination;

4. A power struggle among managers and/or employees;

5. Resistance to change - a natural human condition.

Resistance to change and company-wide acceptance is typically the biggest obstacle. The best way to overcome them is to build a public relations component into your plan of action. The key question to ask yourself is, "How will I get my people to support the solution and make it work?" Some effective methods for accomplishing this are:

1. Have as many managers and employees involved in the problem solving process as possible.

2. Advertise the problem and solution to your employees through memos, newsletters, and posters, showing the advantages and disadvantages of the solution but proving it is better than the conditions which currently exist.

3. Establish a schedule of meetings where different groups of employees can be exposed to the solution and ask them for their feedback.

4. If necessary, develop a training program so that managers and employees feel competent in carrying out the solution.

5. Involve key leaders who wield impact and influence others.

The key to a successful PR campaign is involving, as much as possible, the people who are affected by the problem. The benefits of doing so is that they will understand the problem better and why the solution is an effective one. The result will be that they will be more likely to not only support your solution but also make sure that it works. Many times the solutions

we select for problems don't work because employees sabotage them, not because they are not inherently good solutions. Employees may resist change, especially if they feel threatened. Involving employees will assuage their fears.

8. Simulating the Solution / Plan of Action

Before you implement the plan of action on a full scale, you should select a small group of managers and employees and role play the solution in the work setting. Observe the group as they carry out the solution and take note of:

1. How they carry out the solution;
2. Their reactions to the solution;
3. Their understanding of the solution;
4. The effectiveness of the tools they are using in carrying out the solution;
5. Their resistance to change and reverting back to the previous behaviors.

Based on what you observe, you may need to revise some of your plans.

9. Successful Implementation

To assure the successful implementation successful implementation of your solution and plan of action, remember the following:

1. Prepare your staff well in advance;
2. Train your staff well in advance;
3. Order equipment, material, etc., well in advance;
4. If necessary, hire new staff and do so well in advance;
5. Use PR at every meeting and in memos as much as possible;
6. Evaluate the effects of each phase as it is implemented and make the necessary adjustments;
7. Attempt to remain flexible and open-minded.

Evaluating the Success of Your Solution

As each phase of your plan of action is implemented, you should ask yourself whether your goals were achieved, how well they were achieved, and did it work smoothly. To check your own perceptions of the results, get as much feedback as possible from your managers and from your employees. What you may think is working may not be working well in the eyes of your people. Always remember that they are one of your most valuable tools in successfully carrying out your solution.

4.8 Terminologies

1. Verbal learning: involves the language we speak, the communication devices, we use. Signs, pictures, words, figures are tools, used in this activity.

2. Law of effect: this law states that when a connection is accomplished by satisfying effects it's strength is increased.

4.9 Activity

1. Discuss the following concepts:
   (a) Law of set or attitude
   (b) Law of associative shifting.
   (c) Stimulus discrimination.

4.10 Reflection

Do you think Thondike's law of exercise improves memory of learning?

4.11 Summary

In this unit, you have learnt about basic cognitive process such as attention, learning under leaving as a cognitive process you have analysed classical conditions and Thondeke's laws of learning. You have also looked at the problem solving techniques.

UNIT 5: STATES OF CONSCIOUSNESS

5.1 Introduction

Consciousness is a term used to describe the awareness of your physical and mental experience. As you might have already realized, not all forms of awareness are the same. There are a number of different states of human consciousness as well as a variety of things that can have an impact on these states of awareness.

Human consciousness is often compared to a stream, constantly changing but always flowing smoothly.

5.2 Learning Outcomes

By the end of this unit, you are expected to;

- discuss states of consciousness
- analyze effects of drugs on consciousness

5.3 Time Frame

You need about two (2) hours interacting with this material.

5.4 Content

- Understanding Consciousness
- Body Clocks
- Sleep and Consciousness
- Dreams and Consciousness
- Hypnosis and Consciousness
- Drugs and Consciousness

5.5 Understanding Consciousness

Have you ever wondered why you feel more energetic in the morning, tried to analyze your dreams or questioned how hypnosis works? All of these topics are related to human consciousness, which can be altered in a number of different ways (such as performing holotropic breath work).

How Conscience and Conscious Are Used in Psychology

Body Clocks

Many people begin the day full of energy but then start to feel run-down by mid-afternoon. Other people struggle to plod through the morning routine only to finally feel energetic in the evening. The daily fluctuations of energy levels are known as the circadian rhythm and play an important role in human consciousness. Sometimes referred to as the body's "clocks," these daily rhythms have a major impact on your consciousness as well as a wide number of physiological states. Understanding these biological and environmental rhythms can tell you a great deal about how body clocks can influence states of consciousness.

5.6 Sleep and Consciousness

Sleep has fascinated researchers, scientists and scholars for thousands of years. Technological innovations during the last century allowed scientists to study sleep in ways that simply weren't possible in the past, which has helped lead to a number of theories of sleep. Learn more about why we sleep and some of the most common sleep disorders:

- Why Do We Sleep?

5.7 Dreams and Consciousness

At some point in your life, you have probably had a truly baffling dream that left you wondering, "What did that *mean*?" Learn more about some of the research on dream characteristics, theories and interpretations:

- The Characteristics of Dreams
- Why Do We Dream?
- Dream Interpretations

5.8 Hypnosis and Consciousness

Hypnosis has been used to for a number of purposes including pain management and weight loss. Is hypnosis really an effective therapeutic tool?

5.9 Drugs and Consciousness

Psychoactive drugs can be used to treat serious medical conditions, but they can also lead to addictions and social problems. Learn more about how these drugs affect human consciousness in this overview of some of the most common psychoactive drugs.

Final Thoughts

States of conscious play an important role in our everyday experience. In order to see how consciousness works, it helps to understand how it can be influenced by the body's natural processes, sleep, disorders, and substances.

5.10 Terminologies

1. Consciousness: is a term used to describe the awareness of tour physical and mental experience.
2. Circadian: are daily fluctuation of energy leves.

5.11 Activity

1. What are body clocks?
2. What is the relationship between dreams and consciousness.

5.12 Reflection

What is the difference between hypnosis and consciousness?

5.13 Summary

In this unit, you have learnt about different states of consciousness such as sleep and consciousness, dreams and consciousness hypnosis and consciousness and drugs and consciousness. We hope at this point you have a clear understanding of state consciousness.

UNIT 6: MOTIVATION

6.1 Introduction

Motivation has been generally defined as an internal process that activates guides and maintains behaviour over time (Durojaiye, 1990). With respect to academic environments, you need to know that the general goal behind motivation strategies is to increase student academic performance by increasing their motivation to learn. While many studies conducted in the area of motivation have indicated that motivation alone is not sufficient to increase academic performance, motivation has been consistently a necessary component in any formula for achievement (Aderman&Maehr, 1994). Both behaviourist and cognitive psychologists agree that motivation is essential for learning. Yet how to motivate learners in the classroom continues to be one of the puzzling problems confronting the educators. You are therefore, requested to pay particular attention to this unit.

6.2 Learning Outcomes

By the end of this unit, you are expected to;

- examine types of motivation
- discuss Abraham Maslow's theory of Hierarchy of needs.
- analyse behavioural approach to motivation.
- discuss cognitive theories of motivation
- examine psychoanalytic approach to motivation.

6.3 Time Frame

You need about two (2) hours interacting with this material.

6.4 Content

- Abraham Maslow
- Behaviouristic approaches to motivation
- Drive
- Learned motives
- Classical conditioning
- Instrumental learning

- The Cognitive Theories of Motivation
- Cognitive Theories of Motivation
- The Expectancy Theory
- Goal-Setting Theory
- Psychoanalytic Theory

6.5 Abraham Maslow

Abraham Maslow developed the Hierarchy of Needs model in 1940-50s USA, and the Hierarchy of Needs theory remains valid today for understanding human motivation, management training, and personal development. Indeed, Maslow's ideas surrounding the Hierarchy of Needs, concerning the responsibility of employers to provide a workplace environment that encourages and enables employees to fulfil their own unique potential (self-actualization), are today more relevant than ever. Abraham Maslow's book Motivation and Personality, published in 1954 (second edition 1970) introduced the Hierarchy of Needs, and Maslow extended his ideas in other work, notably his later book Toward A Psychology Of Being, a significant and relevant commentary, which has been revised in recent times by Richard Lowry, who is in his own right a leading academic in the field of motivational psychology.

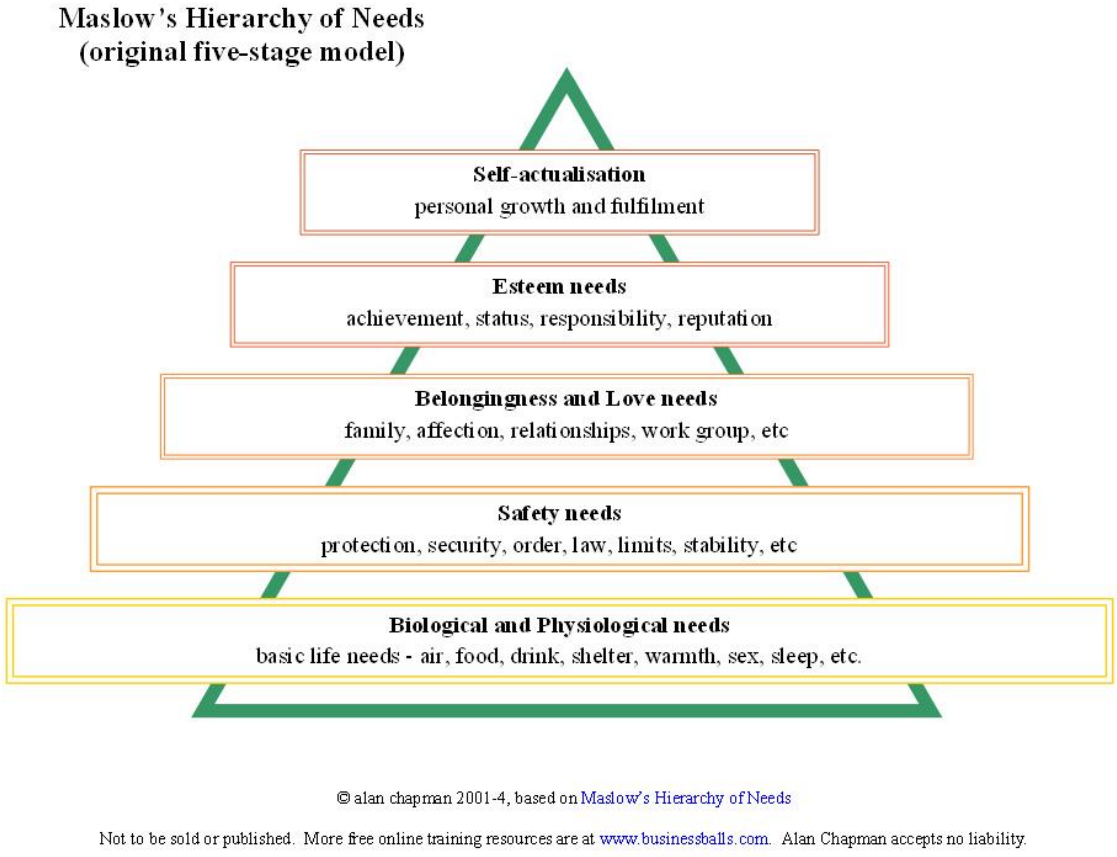
Abraham Maslow was born in New York in 1908 and died in 1970, although various publications appear in Maslow's name in later years. Maslow's PhD in psychology in 1934 at the University of Wisconsin formed the basis of his motivational research, initially studying rhesus monkeys. Maslow later moved to New York's Brooklyn College.

The Maslow's Hierarchy of Needs five-stage model below (structure and terminology - not the precise pyramid diagram itself) is clearly and directly attributable to Maslow; later versions of the theory with added motivational stages are not so clearly attributable to Maslow. These extended models have instead been inferred by others from Maslow's work. Specifically, Maslow refers to the needs Cognitive, Aesthetic and Transcendence (subsequently shown as distinct needs levels in some interpretations of his theory) as additional aspects of motivation, but not as distinct levels in the Hierarchy of Needs.

Where Maslow's Hierarchy of Needs is shown with more than five levels these models have been extended through interpretation of Maslow's work by other people. These augmented models and diagrams are shown as the adapted seven and eight-stage Hierarchy of Needs pyramid diagrams and models below.

There have been very many interpretations of Maslow's Hierarchy of Needs in the form of pyramid diagrams. The diagrams on this page are my own interpretations and are not offered as Maslow's original work. Interestingly in Maslow's book Motivation and Personality, which first introduced the Hierarchy of Needs, there is not a pyramid to be seen.

Figure **5 Maslow's Hierarchy Of Need Original Five Stage Model (**Source, Wayn , 2010 Themes and Variation**).**



Each of us is motivated by needs. Our most basic needs are inborn, having evolved over tens of thousands of years. Abraham Maslow's Hierarchy of Needs helps to explain how these needs motivate us all.

Maslow's Hierarchy of Needs states that we must satisfy each need in turn, starting with the first, which deals with the most obvious needs for survival itself.

Only when the lower order needs of physical and emotional well-being are satisfied are we concerned with the higher order needs of influence and personal development.

Conversely, if the things that satisfy our lower order needs are swept away, we are no longer concerned about the maintenance of our higher order needs.

Maslow's original Hierarchy of Needs model was developed between 1943-1954, and first widely published in Motivation and Personality in 1954. At this time the Hierarchy of Needs model comprised five needs. This original version remains for most people the definitive **Hierarchy of Needs.**

The original needs

Biological and Physiological needs - air, food, drink, shelter, warmth, sex, sleep, etc.

Safety needs - protection from elements, security, order, law, limits, stability, etc.

Belongingness and Love needs - work group, family, affection, relationships, etc.

Esteem needs - self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, etc.

Self-Actualization needs - realising personal potential, self-fulfillment, seeking personal growth and peak experiences.

This is the definitive and original Maslow's Hierarchy of Needs.

While Maslow referred to various additional aspects of motivation, he expressed the Hierarchy of Needs in these five clear stages.

Here is a quick simple self-test based on the original Maslow's 5-level Hierarchy of Needs. It's not a scientific or validated instrument - merely a quick indicator, which can be used for self-awareness, discussion, etc.

1970s-adapted needs (7 levels)

Biological and Physiological needs - air, food, drink, shelter, warmth, sex, sleep, etc.

Safety needs - protection from elements, security, order, law, limits, stability, etc.

Belongingness and Love needs - work group, family, affection, relationships, etc.

Esteem needs - self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, etc.

Cognitive needs - knowledge, meaning, etc.

Aesthetic needs - appreciation and search for beauty, balance, form, etc.

Self-Actualization needs - realising personal potential, self-fulfillment, seeking personal growth and peak experiences.

N.B. Although Maslow referred to additional aspects of motivation, 'Cognitive' and 'Aesthetic', he did not include them as levels or stages within his own expression of the Hierarchy of Needs.

1990s-adapted needs (8 levels)

Biological and Physiological needs - air, food, drink, shelter, warmth, sex, sleep, etc.

Safety needs - protection from elements, security, order, law, limits, stability, etc.

Belongingness and Love needs - work group, family, affection, relationships, etc.

Esteem needs - self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, etc.

Cognitive needs - knowledge, meaning, etc.

Aesthetic needs - appreciation and search for beauty, balance, form, etc.

Self-Actualization needs - realising personal potential, self-fulfillment, seeking personal growth and peak experiences.

Transcendence needs - helping others to achieve self-actualization.

N.B. Although Maslow referred to additional aspects of motivation, 'Cognitive', 'Aesthetic', and 'Transcendence', he did not include any of these as additional stages in the Hierarchy of Needs.

Here is a quick self-test based on the extended 8-level Hierarchy of Needs. Like the 5-level Hierarchy of Needs self-test it is not a scientific or validated instrument - merely a quick indicator for helping self-awareness, discussion, etc.

See also the free Maslow's Hierarchy of Needs Quiz, which can be used to test/reinforce the learning offered in this article.

6.6 Behavioristic approaches to motivation

The behavioristic approach examines how motives are learned and how internal drives and external goals interact with learning to produce behaviour. Learning theorists have taken a somewhat more global perspective when studying motivation than researchers using the biological approach. These researchers have regarded motivation as one component out of several that combine to cause behaviour. Thus, for example, one major theory regards learning and motivation as combining multiplicatively to determine behaviour. Among the behavioristic approaches, three concepts are especially prominent: drive, learned motives, and incentives.

6.7 **Drive**

Although in many respects Freud's psychoanalytic theory of behaviour was a drive theory, the term drive was first used by Robert S. Woodworth, an American psychologist, in 1918. The concept of drive is closely tied to the concept of homeostasis. It was assumed that drive would be triggered when internal conditions changed enough to be detected and to initiate the motivational changes that amounted to drive. Thus it was assumed that some tissue need within the body would instigate drive, which would, in turn, instigate behaviours aimed at reducing the drive. According to this sort of analysis, energy depletion would lead to a hunger drive, which would in turn lead to food-seeking behaviours. Drive, then, would serve to energize appropriate behaviours, either innate or learned, which would effect a lowering of the need state of the individual.

The most extensive theoretical model of drive was developed by Clark Hull in the 1940s. Hull argued that drive is general in nature and that various motives such as hunger, thirst, or sex may add to the overall drive level of an individual. Since drive was regarded as the instigator of behaviour, increases in drive level were expected to lead to increases in activity. According to Hull's model, drive is directed by what he termed drive stimuli. These internal stimuli were thought to be different for different motives and to direct the activity of an individual in ways appropriate for the particular motive state present. Thus, for example, a hungry person might go to the refrigerator seeking food because drive stimuli linked with hunger had been associated with responses of obtaining food from the refrigerator in the past.

Finally, Hull suggested that learning itself depends upon adequate drive. Responses were thought to be strengthened when followed by drive or drive-stimulus reduction. If drive or drive stimuli were not reduced, then learning would not occur.

Hull's drive theory generated a tremendous body of research, but the model of motivation he evolved was not more effective than others in explaining behaviour. For example, studies showed that increases in activity that occur when subjects are deprived depend largely on the species of the subject and the manner in which the activity is tested. Some species do not become more active when deprived, and changes in activity that are apparent when one type of apparatus is used (*e.g.*, a running wheel) are not seen when other types of apparatus (*e.g.*, a stabilimeter cage—for measuring caged animal activity) are used. Furthermore, drive stimuli, the proposed directional mechanism in Hull's model, have proved to be very elusive, and it is not clear that under normal circumstances their presence, if they exist, is crucial to the direction of behaviour. Finally, several studies have shown that learning can occur under circumstances that would seem to preclude any reduction in drive or drive stimuli. Since Hull's model tied learning to a reduction in drive, these studies pose a problem. Although explicit theoretical models of drive have not proved to be any better at explaining motivation than other approaches, the drive concept, in general, would seem to have some validity if only because people often express their subjective feelings of motivation in terms that suggest they are driven. In particular, the drive concept would often seem to apply to feelings associated with human sexual motivation. The drive theory no longer has wide acceptance in the motivational field.

6.8 Learned motives

One of the most significant contributions that the learning approach has made to the study of motivation is its emphasis on the ability of individuals to learn new motives. It has been demonstrated that new motives may be acquired as a result of three learning techniques: classical, instrumental, and observational learning.

Classical conditioning

In classical conditioning, also called Pavlovian conditioning, a neutral stimulus gains the ability to elicit a response as a result of being paired with another stimulus that already causes that response. Such learning situations can then lead to changes in motivated behaviour.

Pavlov, for example, showed that dogs would develop what appeared to be neurotic behaviour if they were required to make finer and finer discriminations between stimuli in a classical conditioning discrimination experiment. The dogs became motivated to avoid the experiment room, were restless during the experimental session, and sometimes bit the apparatus. The neurosis developed when the dogs were no longer able to discriminate between the two stimuli presented to them. Later researchers have noted that this motivational change may have resulted from a lack of predictability or control on the part of the animal rather than from the classical conditioning process per se.
In 1920 the American psychologists John B. Watson and Rosalie Rayner demonstrated the development of an emotional response in a young boy using classical conditioning techniques. The presentation of a white rat was paired with the striking of a steel bar, which induced fear in the little boy. After only a few pairings, the white rat became capable of inducing fear responses similar to those produced by striking the bar. This early demonstration of learned emotional responses has suggested to psychologists that many human motives may result from the accidental pairing of events. It has been proposed that some fears, phobias, taste aversions, and even eating problems can result from classical conditioning.

Instrumental learning

The second type of learning technique is instrumental learning, or conditioning, also called operant conditioning. In this type of conditioning a response is followed by some consequence which then changes the future probability of that response. For example, instrumental conditioning appears to be one way in which aggressive motivation can be changed. If an aggressive response by one child toward another child is followed by some positive event such as the aggressor getting to play with a desired toy, then the motivation to behave aggressively can be expected to increase in the future. Furthermore, through a process called conditioned reinforcement, neutral stimuli associated with a reinforcer can become reinforcers in their own right. These stimuli can then be used to motivate behaviour. Perhaps the most common example of a conditioned reinforcer is money. A piece of paper with numbers and intricate drawings on it can motivate all sorts of behaviour if that paper has previously been associated with important reinforcers such as food, clothing, sex, and so forth. Money is in effect a token of the things it can buy. Psychologists have used different types of tokens as rewards to implement reinforcement, and token economies, involving the

principles of conditioned reinforcement, have been successfully used to alter behaviour in schools, institutions, and hospitals (see below Applications in society).

6.9 The Cognitive Theories of Motivation

Cognitive Theories of Motivation raise a different perspective of understanding the primary needs of an individual in order to keep the individual motivated and satisfied that will probably lead to greater efficiency and productivity. Certainly, the entire scenario of a job depends on how much an employee is motivated and satisfied with the aim to benefit the company in return. It is the fact that a job is need of both parties, i.e. the employee and the organization. At one point, the organization requires a professional to help achieve the target and put efforts for the growth of the organization. While on the other hand, the employee also seeks any source to satisfy the basic needs of the life with the aim to keep surviving with professional standards.

Cognitive Theories of Motivation

Cognitive Theories of Motivation consist of two ultimate theories that are the Expectancy Theory and the Goal Setting Theory. The Expectancy Theory explains about how and why an individual makes a certain decision of picking the best behavioral option from many. On the other side, the Goal-Setting Theory offers the importance of creating goals and how goals, make a person to be motivated and satisfied enough. Further clarification for both **Cognitive Theories of Motivation** is given below.

The Expectancy Theory

The Expectancy theory was proposed by **Victor H. Vroom** in 1964. It elaborates such a behavioral process in which an individual chooses one specific and necessary option over the others and what is the role of the decision in the process of achieving the career goals. The theory consists of three variables that were introduced by Vroom in order to clearly explain the given behavioral process. The variables are as follows:

- “E” for Expectancy
- “V” for Valence
- “I” for Instrumentality

1. **Expectancy**

The Expectancy variable explains such a belief where the efforts of an employee are the result of a need to accomplish desired performance goals. There are three factors that comprise much impact on the expectancy perception of an individual. **Self-Efficacy**: – The belief of an individual about own efficiency and ability to perform a particular behavior effectively.

- **Goal Difficulty**: – This factor occurs in case the desired performance goals are greater or higher than expected, which might cause the lack of high expectancy perception and may lead to low perception.
- **Control**: – It is a degree which contains the perceived control of a person over performance.

2. **Valence**

In simple words, Valence pertains to such price/value that an individual sets on the basis of rewards or reinforcements. Usually, the process of setting value depends on intrinsic/extrinsic sources of motivation, goals, needs and values of the individual. There are three terms that represent different forms of an individual's values. The term -1 shows that the individual is not happy with the result and tries to avoid it, term 0 tells that the individual is feeling indifferent or strange regarding the results, and term +1 explains that the individual warmly welcome the result.

3. **Instrumentality**

The instrumentality refers to the belief that an individual will receive a reward certainly based on the satisfaction of required performance. The rewards can be of many forms such as extrinsic, intrinsic, non-monetary, non-monetary and more. Instrumentality level will be low when a person receives the reward for a set of activities that must be performed as a job duty. While on the other hand, there are three factors involved in the instrumentality, which are, control, policies and trust.

Motivational Force: – It is the product of three variables of expectancy theory, i.e. expectancy, valence and instrumentality. In short, the product of three variables expectancy is called the motivational force. The appropriate formula to calculate the motivational force is:

Motivational Force Expectancy Instrumentality Valence

OR

MF E I V

According to the formula, if the variables are strong or high in a person, then his/her motivational level can also be termed as greater.

Goal-Setting Theory

The second or other cognitive theory of motivation is the Goal-Setting Theory. In the 1960s, the theory was introduced by Edwin Locke. The primary factor explained by the theory is that the goal-setting comprises direct and enough impact on the task performance. A set of specific and hard to achieve goals will surely lead to a greater accomplishment of tasks and possibly, will motivate an individual additionally. Aside from it, easy to achieve goals may result in poor or very low task performance. Therefore, the set goals must be SMART. The full form of SMART is:
"S" for Specific
"M" for Measurable
"A" for Attainable
"R" for Realistic
"T" for Time-Bound.

Psychoanalytic Theory:
This theory which has been explained by Sigmund Freud, deals with unconscious motivation. According to Freud, the inborn tendencies called instincts influence our behaviour.

There are two groups of instincts with opposite nature:

(a) Life instincts (Eros): these instincts have the life energy called Libido-which motivates the individual towards constructive activities like love, sympathy/helping others, etc.

(b) Death instincts (Thanatos)-motivate the individual for destructive activities like murder, suicides, aggression, attack, etc.

Freud has emphasised that the unconscious motives play more dominant role in determining our behaviour, than conscious or preconscious. He pointed that, our actions are determined by our unconscious motives.

According to him, our unconscious mannerisms, slips of tongue and pen, phobias are the result of these hidden motives. These hidden motives may also drive the people towards various psychosomatic disorders like chronic headaches, insomnia, gastric troubles, etc. Our motives also appear in the form of dreams according to Freud.

6.10 Terminologies

1. Motivation: motivation has been generally defined as an internal process that activates, guides and maintain behaviour overtime
2. Aesthetic need: this is the appreciation of beauty

6.11 Activity

1. Discuss Abraham Maslow's Hierarchy of needs theory
2. Discuss Vroom's expectancy theory.

6.12 Reflection

Do you think Abraham Maslow's theory is true to human motivation?

6.13 Summary

In this unit, you have learnt about theories of motivation. The following approaches to motivation have been clearly described; the humanistic approach (Abraham Maslow's hierarch needs), Behavioural approach to motivation, drive theory, learnt motives and classical conditioning.

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