

F.Y.B.A.
PSYCHOLOGY PAPER - I
FUNDAMENTALS OF
PSYCHOLOGY

Dr. Suhas Pednekar

Vice-Chancellor
University of Mumbai,
Mumbai

Dr. Dhaneswar Harichandan

Director Incharge,
Institute of Distance & Open Learning,
University of Mumbai, Mumbai

Anil R Bankar

Associate Prof. of History & Asst. Director &
Incharge Study Material Section,
IDOL, University of Mumbai

Program Co-ordinator : Dr. Naresh Tambe

Assistant Prof. of Psychology,
IDOL, University of Mumbai.

Editor : Dr. Anita Kumar

Acharya and Marathe College,
Chembur, Mumbai

Course Writers

: Mrs. Vimal Ambre
St. Gonsalo Garcia College of
Arts and Commerce, Vasai

: Mr. Raosaheb Raut

Siddharth College,
Churchgate, Mumbai

: Dr. Anita Kumar

Acharya and Marathe College,
Chembur, Mumbai

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I

Revised Syllabus for Psychology at the F.Y.B.A. brought in to force with effect from the academic year 2018-2019

Objectives: -

1. To impart knowledge of the basic concepts and modern trends in Psychology
2. To foster interest in the subject of Psychology and to create a foundation for further studies in Psychology
3. To make the students aware of the applications of Psychological concepts in various fields so that they understand the relevance of Psychology in different areas of life.

Section A: Fundamentals of Psychology

Module 1 : The story of Psychology and thinking critically with psychological science

- a) What is psychology?
- b) The need for psychological science
- c) How do psychologists ask and answer questions
- d) Frequently asked questions about Psychology

Module 2 : The Biology of Mind

- a) Biology, Behaviour and Mind
- b) Neural Communication
- c) The Nervous System
- d) The Endocrine System
- e) The Brain

Module 3 : Learning

- a) How do we learn?
- b) Classical Conditioning and Operant Conditioning
- c) Biology, Cognition, and Learning
- d) Learning by Observation

Module 4 : Memory

- a) Studying Memory
- b) Building Memories
- c) Memory Storage
- d) Retrieval
- e) Forgetting
- f) Memory construction errors
- g) Improving memory

II

Section B: Fundamentals of Psychology

Module 5: Thinking, Language and Intelligence

- a) Thinking
- b) Language
- c) Thinking and Language
- d) What is Intelligence?
- e) Assessing Intelligence

Module 6: Motivation and Emotion

- a) Motivational Concepts
- b) Hunger
- c) The Need to Belong
- d) Cognition and Emotion
- e) Embodied Emotion

Module 7: Personality

- a) Psychodynamic Theories
- b) Humanistic theories
- c) Trait Theories
- d) Social cognitive theories
- e) Exploring the self

Module 8: Statistics in Psychology: Understanding Data

- a) The tables are turned: a psychologist becomes a research subject
- b) Descriptive statistics: frequency distribution
- c) Measures of central tendency
- d) Measures of variability
- e) Z-scores and the normal curve
- f) Correlation
- g) Inferential Statistics

III

Book for Study

Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013

Book for Study for Unit 4. Statistics in Psychology

Hockenbury, D.H., & Hockenbury, S.E. (2013). Discovering Psychology. 6th edition. New York: Worth publishers

Books for Reference:

- 1) Baron, R. A., & Kalsher, M. J. (2008). Psychology: From Science to Practice. (2nd ed.). Pearson Education inc., Allyn and Bacon
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.
- 3) Ciccarelli, S. K., & White, J. N. (2012). Psychology. 3rd edi. New Jersey: Pearson education
- 4) Feist, G.J, & Rosenberg, E.L. (2010). publications Psychology: Making connections. New York: McGraw Hill
- 5) Feldman, R.S. (2013). Psychology and your life. nd publications 2edi. New York: McGraw Hill
- 6) Feldman, R.S. (2013). Understanding Psychology. th publications 11edi. New York: McGraw Hill
- 7) King, L.A. (2013). Experience Psychology. nd publications 2edi. New York: McGraw Hill
- 8) Lahey, B. B. (2012). Psychology: An Introduction. 11th edi. New York: McGraw-Hill Publications
- 9) Schachter, D. L., Gilbert, D. T., & Wegner, D. M. (2011). Psychology. New York: Worth Publishers.
- 10) Wade, C. & Tavis, C. (2006). Psychology. (8th ed.). Pearson Education inc., Indian reprint by Dorling Kindersley, New Delhi



THE STORY OF PSYCHOLOGY AND THINKING CRITICALLY WITH PSYCHOLOGICAL SCIENCE - I

Unit Structure :

- 1.0 Objective
- 1.1 What is psychology?
 - 1.1.1 Roots of psychology: Psychological science is born
 - 1.1.2 Psychological Science Develops
 - 1.1.3 Contemporary psychology
 - 1.1.4 Psychology's biggest question Nature v/s Nurture controversy
 - 1.1.5 The three main levels of analysis
 - 1.1.6 Subfields of psychology
- 1.2 Summary
- 1.3 Improve your retention and grades
- 1.4 References

1.0 OBJECTIVES

- The chapter here explains what psychology is all about.
- It explains the milestones in psychology's early development.
- Understanding how a behaviour is explained or analysed at three different levels.
- Understanding subfields of psychology.

1.1 WHAT IS PSYCHOLOGY?

Psychology is the scientific study of behaviour and mental processes. Behaviour includes all of our external or overt actions and reactions such as talking, walking, facial expressions, etc. Mental processes refer to all the internal or overt actions of our mind such as thinking, feeling, remembering, etc.

Psychology is considered to be scientific because psychology studies people and their behaviour in a systematic manner through careful and controlled observations. The findings of psychology can be verified and re-verified. Existing theories of psychology are modified in the light of new findings. However,

psychology is not as exact science as pure sciences such as physics and chemistry. In pure sciences such as physics, chemistry, etc. it is possible to make absolutely accurate predictions, but the subject of psychology is human behaviour. Each human being is unique and different from the other and therefore one cannot predict with hundred percent accuracy, how a person will behave in a given situation. Yet Psychology is a science since it rigorously follows scientific methods.

Psychology has four goals- It describes what is happening, explains why it is happening, predicts when will it happen again and through this prediction tries to control human behaviour, i.e., it determines how human behaviour can be changed.

1.1.1 Roots of psychology: Psychological science is born:

Psychology as a subject started when human beings asked questions like who we are? how our thoughts, feelings and actions are produced and how do we understand and manage our environment and people around us. Psychological science is born. It is human nature to be curious about ourselves and the world around us. Before 300 B.C.E the Greek naturalist and philosopher Aristotle spoke about learning memory, motivation, emotion perception and personality. Some of the ideas put forward by him were like heavy meal produces gases and it makes us sleepy. It also collects heat and surrounds heart which becomes a source of personality. Though, in modern times, we laugh at Aristotle's guesses but we have to acknowledge that at least he was asking right questions.

Philosopher's thinking about human behaviour continued till birth of psychology until December 1879 when Wilhelm Wundt started a laboratory at university of Leipzig in Germany. He developed experimental apparatus to measure reaction time. He observed that people take longer time to be aware of their awareness, e.g., his machine measured the time lag between people's hearing a ball hit a platform and their pressing a telegraph key. People responded in about one tenth of a second when asked to press the key as soon as the sound occurred and in about two tenth of a second when asked to press the key as soon as they were consciously aware of perceiving the sound. Wundt was trying to measure atoms of mind - the fastest and simple mental processes. Thus, the first psychological laboratory was staffed by Wundt and his graduate students. Soon the new science of psychology became organised into two different branches or schools of thought. These two early schools were structuralism and functionalism.

Structuralism:

Edward Bradford Titchener student of Wilhelm Wundt was interested in discovering structure of mind. He engaged people in self-reflective introspection (looking inwards) and trained them to report elements of experiences as they looked at a rose or listened to a metronome or smelled a scent or tasted a substance. He asked them to report their immediate sensations, their images and feelings while going through these experiences. He further asked them to relate these sensations to one another. But unfortunately, it was noticed that the introspection method was unreliable for two reasons –

- a.) it required smart and verbal people
- b.) its results differed from person to person and from experience to experience.

So, the method of introspection was not accepted for its subjective nature and structuralism did not continue to exist. Trying to understand mind's structure from simple elements was like trying to understand a car by examining its disconnected parts.

Functionalism:

Philosopher psychologist William James was influenced by evolutionary theory of Charles Darwin and thought it would be more useful to consider the evolved functions of our thoughts and feelings. For example, thinking is done by brain but the question arises why it is done. James assumed that thinking is developed because of its adaptive nature, it helped our ancestors to survive. Similarly, consciousness serves the function of helping us to remember past, adjust to present and plan for our future. William James, a functionalist, engage into the explorations of down to earth emotions, memories, will power, habits and moment to moment streams of consciousness.

William James is more known for his writing and mentoring in 1890 he admitted Mary Whiton Calkins a lady student to his graduate seminar in spite of the objections of Harvard's President these were the years when women did not have a right to vote. When Calkins joined all other male students dropped out. So, James tutored her alone. Later on, she completed all of Harvard's Ph.D. requirements, by scoring more then all male students but still she was denied a degree that she earned from Harvard university. Instead she was offered a degree from Radcliffe College, that was Harvard's undergraduate sister school for women. Calkins resisted the unequal treatment and refused the degree. Later on, she became a distinguished memory researcher and the American Psychological Associations (APA) first female President in 1905.

Later on, Margaret Floy Washburn was the first female psychologist having Ph.D. degree. She wrote an influential book titled as "The Animal Mind" and became second female APA President in 1921. But Washburn's gender closed doors for her also. Her thesis was the first foreign study Wundt published in his journal but she could not join all male organisation of experimental psychologist founded by Titchener. This is in stark contrast to recent past from 1996 to 2012, when out of 16 elected presidents of APA, 8 were women. In United States, Canada, Europe most psychology doctorates are earned by women now.

Publisher Henry Holt was impressed by writings of William James and he offered him a contract to write a textbook of the new science of psychology. James agreed and began his work in 1878 with the view of completing it in two years but actually it took him 12 years to complete "*Principles of psychology*". This is a book that introduced psychology to educated public. More than a century later, people still marvel at the brilliance and elegance of this book.

1.1.2 Psychological Science develops

Let us see how psychology continued to develop from 1920s to till today. In the initial phase, many psychologists believed that compared to everything else in our external universe, if there is one thing about which everyone has maximum knowledge then that is about himself/herself. We have maximum knowledge about ourselves because of inside information. In conformity to this idea, Wundt and Titchener also focused on inner sensations images and feelings. William James used introspective examination for understanding elements of consciousness and emotions. So, the early psychologist define psychology as a science of mental life.

Behaviourism:

In 1920s John B. Watson and B. F. Skinner rejected the method of introspection and redefined psychology as scientific study of observable behaviour. They argued that science is based on observation. We cannot observe sensations, feelings or thoughts and therefore they cannot be studied. However, people's behaviour as they respond to different situations can be observed and recorded, so only observable behaviour should be considered in scientific study of psychology. Many psychologists agreed that behaviourism was one of the major force in psychology right into 1960s.

Freudian Psychology:

The other major force at that time was Freudian Psychology. In 1940, Sigmund Freud spoke about the unconscious thought processes and an emotional response to childhood experiences and their influence on our behaviour. Just as in 1900s, the behaviourists had rejected prevailing definition of psychology at that

time, similarly, two other groups rejected the definition of psychology that was prevailing in 1960s.

Humanistic Psychology:

Humanistic psychologist like Carl Rogers and Abraham Maslow found that Freudian perspective and behaviourism were limited approaches to understand human behaviour. They pointed out that instead of focusing our attention on the meaning of early childhood memories (as propagated by Freud) or learning of conditioned responses (as propagated by behaviourists), it is important to pay attention to the ways that current environmental influences can nurture or limit our growth potential and satisfy our need for love and acceptance. More than early childhood experiences and learning of conditioned response, humanist felt that the current environmental conditions influence the potential of growth.

Cognitive Psychology:

The rebellion of the second group of psychologists who rebelled during 1960s is known as Cognitive Revolution. This revolution once again believed that it is important to see how mind processes and retains information. Cognitive psychology scientifically explores the way we perceive, process and remember information. Cognitive neuroscience, an interdisciplinary study, has enriched our knowledge about brain activity underlying mental activity. It has given us new ways to understand ourselves and to treat disorders such as depression.

In the light of this historical background, we can summarize psychology's concern about observable behaviour and inner thoughts and feelings by defining psychology as the science of behaviour and mental processes. Let us analyse the definition.

Behaviour: It is anything that organism does. It is any action that can be observed and recorded, may be smiling, yelling, studying, talking, running etc.

Mental processes: These are internal susceptible experiences on the basis of which inferences can be drawn about the behaviour like sensations perception, dreams, thoughts, beliefs and feelings.

Science: Psychology is less a set of findings than a way of asking and answering questions.

1. 1.3 Contemporary Psychology:

Psychology as science emerged from the field of biology and philosophy. Wilhelm Wundt was a philosopher and psychologist, William James was an American Philosopher. Freud was a physician; Ivan Pavlov was a Russian Physiologist. The most

influential child observer Jean Piaget was a Swiss biologist. Morton Hunt in 1993, called them as “Magellans of the Mind” (Ferdinand Magellan (1489–1521) was a famous Portuguese navigator who made many discoveries and explored areas of the world previously unknown to his fellow Europeans. Because early psychologists made exciting discoveries and explored unknown frontiers, they were preparing the way (they were pioneers) for future psychologists and can thus be considered “Magellans of the mind.”

Thus, Morton Hunt held that psychology originated in several fields and in many countries. Even today's psychologist are the citizens of many different countries. The international Union of Psychological Science has 71 nations from Albania to Zimbabwe as its members. In China, the first department of Psychology at university level was opened in 1978 and in 2008 there were nearly 200 Departments of Psychology at university level. Apart from that, due to international publications, joined meetings, advent of internet, collaboration across the borders, Psychology is growing rapidly and globalizing. Today Psychology is not only developing at various places but the topics of interest also vary from the study of nerve cell to the study of international conflicts.

1.1.4 Psychology's Biggest Question: Nature v/s Nurture:

The biggest and most persistent question faced by psychologists has been whether human traits develop at birth or later on through experience. Plato(428-348 B.C.E.), assumed that character and intelligence and certain ideas are inherited. Aristotle(384-322 B.C.E.) on the other hand, argued that everything that is there in our mind has come through external world through our senses. In other words, he said that whatever information, sensation, feelings are stored in our mind has come through our experiences of external world.

In 1600s, John Locke also argued that mind is a blank sheet on which experiences write. René Descartes did not agree with this suggestion and believed that some ideas are innate. Two centuries later, Descartes' ideas got support from a naturalist, Charles Darwin.

The role of internal or innate factor was supported by Charles Darwin's concept of natural selection. He explained the diversity in different organisms of the same species as stemming from the process of natural selection. Thus, nature selects the traits that best enable organism to survive and reproduce in a particular environment. Darwin believed that theory explained not only animal structure(such as polar bear's white coat) but animal behaviour also(such as the emotional expressions linked to lust and rage). This theory of evolution as proposed by Charles Darwin has become an important principle for psychology in 21st century.

The nature and nurture issue has continued to remain a major concern of psychologist today. More and more psychologists are exploring relative contributions of biology and experience and exploring questions such as:

1. How and why we human beings are alike? Is it because of our common biology and evolutionary history?
2. How and why we human beings are diverse? Is it because of our differing environments?
3. Diversities or variations are found. Are they because of genetic factors, or variation in the environmental conditions?
4. Are gender differences caused by biological conditions or are they created by existing social environment?
5. Is children's grammar mostly innate or formed by experience?
6. Are personality and intelligence differences caused by hereditary conditions or by environmental conditions?
7. Are sexual behaviours more 'pushed' by inner biology or 'pulled' by external incentives?
8. Psychological disorders such as depression should be treated as disorders of brain or disorders of thoughts?

Contemporary science resolves this Nature and Nurture controversy by saying "Nurture works on what nature endows". In other word's nature biologically endows us with enormous capacity to learn and adapt and nurture as environment decides how this endowment will flourish or will develop. Moreover, every psychological event (every thought, every emotion) is simultaneously biological event. For example, depression can be both – a brain disorder and a thought disorder.

1.1.5 Psychology's Three Main Levels of Analysis:

Table 1.1 Psychology's Current Perspectives:- (Adopted from David Myers)

Perspectives	Focus	Sample Questions	Example of Subfields Using this Perspectives
Neuroscience	How the body and brain enable emotions, memories, and sensory experiences.	How is blood chemistry linked with moods and motives? How do pain messages travel from the hand to the brain?	Biological; Cognitive; Clinical
Evolutionary	How the natural selections of traits have promoted the survival of genes	How does evolution influence behavioural tendencies?	Biological; Developmental; Social
Behaviour genetics	How our genes and our environment influence our individual differences	To what extent are psychological traits such as intelligence, sexual orientation, vulnerability to depression products of genes? Of our environment?	Personality; Developmental
Psychodynamic	How behaviour springs from unconscious drives and conflicts	How can someone's personality traits and disorders be explained by unfulfilled wishes and childhood traumas?	Clinical; Counselling; Personality
Behavioural	How we learn observable response	How do we learn fear particular objects or situations? What is the most effective way to change our behaviour, say to lose weight or stop smoking?	Clinical; Counselling; Industrial-organizational

Cognitive	How we encode, process, store, and retrieve information	How do we use information in remembering? Reasoning? Solving problems?	Cognitive; Clinical; Counselling; industrial-organizational
Social-cultural	How behaviour and thinking vary across situations and cultures	How are we alike as members of one human family? How do we differ as products of our environment?	Developmental; social; Clinical; counselling

Biopsychosocial Approach:

Each one of us is a complex system that is part of a larger social system. At micro level, we are made up of smaller systems such as nervous system and body organs, which is made up of still smaller systems such as cells, molecules and atoms. These tiered systems suggest that different levels of analysis are complementary, because everything is related to everything else. All these levels put together are called biopsychosocial approach.

Biological influences include influences such as natural selection of adaptive traits, genetic predisposition of responding to environment, brain mechanism and hormonal influences.

Psychological influences include learned fears and expectations, emotional responses, cognitive processing and perceptual interpretations. These two contribute to behaviour or mental processes that are expressed in socio cultural conditions like presence of others, expectations of family, society and culture, influence of friends, other groups and compelling models such as media. Understanding at each level gives a perspective to human behaviour.

Each of these levels give a unique advantage to look at behaviour or mental processes. Yet each by itself is incomplete. Psychologists have variety of perspectives and ask different questions and have their own limits. For example, Let us see how different perspectives understand anger. Person studying from neuroscience perspective will focus on brain circuits that cause anger.

- Evolutionary perspective will focus on how anger has helped the survival of the organism.
- Behaviour genetics may study how heredity and experience influence an individual differences in temperament.

- Psychodynamic perspective may say that it is an expression of unconscious hostility.
- Behavioural perspective may try to see which external stimuli triggers anger.
- Cognitive perspective will explain how given situation affects our anger and how anger affects our Thinking.
- Socio cultural perspective will concern itself with how expression of anger may vary in different socio-cultural conditions.

All these perspectives do not still give a complete picture of human behaviour. The table 1.1 summarises key perspectives and their areas of concern and subfields of psychology, and perspectives.

1.1.6 Subfields of Psychology:

Some psychologists conduct basic research that builds psychology's knowledge base for example Biological psychologist they will explore the link between brain and mind, Developmental psychologists will study behaviour and abilities from womb to tomb, Cognitive psychologists study how we perceive think and solve problems, Personality psychologists investigate our relatively permanent traits, social psychologist study how we get impacted by others' social behaviour and how do we impact their behaviour, Counselling psychologists listen carefully to a client's troubled thoughts and emotions and A Social - cultural psychologists will be studying the variations in human values and behaviour in different cultures.

Some psychologists engage in basic research. In applied research, practical problems are tackled like industrial psychologist helping companies to select employees or develop training programs etc. However, all subfields of psychology have common goal – to describe and explain behaviour and the mind underlying it. The specific branches of psychology are given below.

Biological psychologist: They try to understand the relationship between functioning of brain and behaviour. Biopsychology studies how emotions, thoughts and behavior are affected by the brain, the nervous system and neurotransmitters in humans and animals. The field can be viewed as a combination of neuroscience and basic psychology. It focuses on how damage to specific areas of the brain affects neural function and behavior, as well as the influence of drugs and other mind altering substances on the brain and body.

Developmental psychologist: They study how behaviour, abilities change throughout our entire life span. It is the scientific study of growth, change and stability in behavior that occurs throughout

lifespan. It looks into the physical, cognitive, personality and social development. It studies the impact of heredity and environment on development, e.g. age construct, cohorts.

Cognitive psychologist: They are concerned with how we perceive, think and solve problems. It is a study of mental processes such as "attention, language use, memory, perception, problem solving, creativity, and thinking." The term Cognition refers to the mental processes. The mental processes involve gaining knowledge and comprehension. These processes include thinking, knowing, remembering, judging, and problem-solving. These are higher-level functions of the brain and cover language, imagination, perception, and planning.

Personality psychologist: They investigate how traits influence behaviour. Personality psychology is a branch of psychology that studies personality and its variation among individuals. It is a scientific study which aims to show how people are individually different due to psychological forces.

Social psychology: It is a study of how individual behaviour is influenced by people around him. It is a scientific study of how people's thoughts, feelings and behaviors are influenced by the actual, imagined or implied presence of others.

Socio-cultural psychology: It suggests that human behavior is influenced by social and cultural forces outside the individual. This perspective involves ethnicity, gender, sexual orientation, religion, social class, family traditions, culture, nationality, etc.

Industrial organisational psychology: It is a study of behavior in work settings and the application of psychological principles to change work behavior. It covers topics such as selection, training programs, performance evaluation, leadership, motivation and job satisfaction, reducing stress, consumer behavior, cultural diversity, globalization, technology, etc. It uses psychological concepts and methods to help organizations and companies to boost their morale and productivity, design products and implement systems.

Engineering psychology: It is the science of human behaviour and capability, applied to the design and operation of systems and technology. It is concerned with the adaptation of the equipment and environment to people, based upon their psychological capacities and limitations. Its objective is improving overall system performance and comfort.

Clinical Psychology: It is concerned with understanding, evaluating, predicting, alleviating and preventing intellectual, emotional, biological, psychological, social and behavioural

maladjustment, disability and discomfort. It is applied to a wide range of client population, across the life span, in varying cultures and at all socioeconomic levels. It aims to promoting human adaptation, adjustment, and personal effectiveness and satisfaction.

Psychology and helping professions: Psychology also deals with practical problems like how to have a happy marriage, how to overcome anxiety and depression or how to bring up healthy children.

Counselling psychology: Counselling psychologist help people to cope-up with challenges and crisis in academic, vocational and marital life. They help to improve personal and social functioning. The counseling psychologists deal with less serious problems compared to clinical psychologists.

Psychiatry: Psychiatrist are medical personnel, who provide medication for psychological issues like depression, anxiety.

Positive Psychology: Martin Seligman and others have focused researched or human strengths and human potentialities. Positive psychology explores positive emotions, positive character traits and enabling institutions. They are more concerned with, if psychology contribute to good life and help a person to lead a meaningful life. It is a science of positive aspects of human life, such as happiness, optimism, social connectedness, well-being and flourishing. It believes that People want to lead meaningful and fulfilling lives, to cultivate what is best within themselves, to enhance their experiences of love, work, and play

Community psychology: Community psychologists work to create social and physical environment that are healthy for all. For example, if there is a problem of bullying in school, they will try to change that. Some psychologists may train students to cope with stress of transition from elementary school to middle school. Community psychologists seek to study how the school and neighbourhood give birth and encouragement to bullying.

Forensic Psychology: Forensic psychologists apply psychology's principles and methods in the criminal justice system. They may assess witness credibility, or testify in court on a defendant's state of mind and future risk. Forensic psychologists apply psychology to the criminal justice system, assess offenders' state of mind at time of offense - Sanity evaluations, assess competency of individuals to stand trial - Competency evaluations, assess risk of re-offending, assess, witness credibility, assess malingering and deception, evaluate child custody in divorce, prepare for and provide testimony in court, assess consistency of factual information across multiple

sources, advise police on mental illness and criminal psychology, consult with attorneys on mental health issues in the court system, work with at-risk populations such as trauma survivors, design correctional programs, etc.

In summary, we can say psychology is a subject that relates to many fields, psychologists teach in medical schools, law schools, theological seminaries they work in hospitals, factories and corporate houses. They engage in interdisciplinary studies such as psychohistory (psychological analysis of historical character, psycholinguistics the study of language and thinking psychoceramics the study of crackpots.

Psychologists have gained insight into brain, mind, dreams, memories and depression and joy. Psychology helps us to understand how we perceive, think, feel and act.

Strengths & Weaknesses of Psychology:

Psychology also influences modern culture. Learning about psychology's findings changes people. They do not judge psychological disorders as moral failings. They no longer believe that psychological disorders should be treated with punishment and ostracism. Similarly, now they do not regard women mentally inferior to men. They no longer view and rear children as ignorant, wilful beasts that need taming. Morton Hunt rightly pointed out that knowledge has modified attitudes and through them behaviour. Once we are aware of how our body is connected to our mind, how a child's mind grows, how our perceptions are formed and how our memory works, how people differ across the world, our way of thinking will change forever.

However, psychology has certain limitations. It can't answer questions such as –

Why should I live?

Why should I do anything?

Is there any purpose in life that even death cannot destroy?

Yet psychology deepens our appreciation for how we humans perceive, think and feel and act. It enriches our lives and broadens our vision.

Before closing this chapter, let me talk about one of the most important concerns among students and that is how to improve their memory power and grades in the exam.

Close-up: Improve your Retention and Grades:

Very often students are under the impression that to memorize their new learning properly, they need to keep revising

the new lesson, i.e., to keep rereading it again and again. But memory researcher Henry Roediger and Jeffrey Karpicke (2006) believe that apart from rehearsal of the material you need to repeatedly do self- testing yourselves. They called it **testing effect** or **retrieval practice** effect or **test-enhanced learning**. They demonstrated in one of their studies in 2008 that students could recall the meaning of 40 previously learned Swahili words much better if they repeatedly tested themselves, rather than if they spent the same time restudying the words.

The key is that to master new information, you must *actively process* that information. Our brain is like a muscle that grows stronger with exercise. Many studies have shown that people can learn and remember better when they put material to be learnt in their own words, rehearse it and then retrieve and review it again.

These principles are included in a method called **SQ3R study method**. SQ3R is an acronym for 5 steps – Survey, Question, Read, Retrieve and Review.

Survey refers to taking a bird's eye view of the material that needs to be learnt. You should scan the headlines and notice how the material is organized. Secondly, you need to try and answer its learning objective questions and if you try and fail to retrieve the answer, that actually helps you to learn. The reason is that those who test their understanding before reading and find out what is it that they don't know yet, will learn and remember better.

The third activity is read actively, i.e., search for the answers to the questions. At each sitting, read only that much of a chapter that you can absorb without getting tired. Read actively and critically. Ask questions, take notes, make the ideas as your own.

The fourth activity is retrieve. Retrieve the main ideas of the chapter. Test yourself. This will help you to realize what and how much you know and what you still need to master. The testing itself will help you to learn and retain information more effectively. For effective learning, test yourself repeatedly.

The fifth and final step is to review. Read over any notes that you have taken and quickly review the whole chapter. Write down what a concept is before rereading to check your understanding.

Apart from SQ3R method, some other techniques will also help in improving your learning. These are –

Distribute Your Study Time - Spaced practice helps in better retention than massed practice. It means that you will remember material better when you space your time over many study

sessions rather than trying to mug up in one session. Many students make that mistake. They try to mug up entire study material just in one day before exam and they miserably fail to retain that information. It should be memorized over several days in small portions at a time. Instead of trying to learn the entire chapter in one sitting, read just one section and then turn to something else. Interleaving your study of one subject with study of other subjects will boost long term retention and will protect you from false overconfidence that you have memorized the whole chapter.

Learn to Think Critically - Whether you are reading at home or you are learning in a class, note people's assumptions and values. Pay attention to what perspectives or biases underlies an argument and evaluate the evidence or proof given for those assumptions. Find out whether these assumptions are based on informative experiments or are just anecdotal. Evaluate their conclusions and judge whether there are alternative explanations.

Process Class Information Actively –Listen for the main ideas and sub-ideas of a lecture. Write them down. Ask questions during and after class. In class, process the information actively, that will help you to understand and retain it better. Make the information as your own by taking notes in your own words. Relate what you read to what you already know. Tell someone about it.

Overlearn –Very often people suggest that overlearning improves retention. But there are pitfalls to that. We tend to overestimate how much we know. The feeling of familiarity can be deceptively comforting. For optimum effectiveness, one should use retrieval practice more and should spend extra study time on testing his knowledge.

Memory expert Elizabeth Bjork and Robert Bjork (2011) gave following advice to improve your retention and grades:

“Spend less time on the input side and more time on the output side, such as summarizing what you have read from memory or getting together with friends and asking each other questions. Any activities that involve testing yourself- that is, activities that require you to retrieve or generate information, rather than just representing information to yourself – will make your learning both more durable and flexible”.

1.2 SUMMARY

Points to remember

Aristotle before 300 B.C theorised about learning memory, motivation, emotion, perception and personality, psychology as a science was born at university of Leipzig in 1879

The first two schools of thought that emerged were structuralism and functionalism. William Wundt spoke about elements of mind or atoms of mind.

Wundt's student Edward Titchner used method of introspection to study elements of mind but the subjective nature of the method was not accepted by thinkers. Philosopher psychologist William James was more concerned with studying the functions of thoughts and feelings thus rose functionalism

Charles Darwin also spoke about adaptive functions of various human behaviours

In 1890 James mentored first lady student Mary Whiton Calkins who became a memory researcher and the first woman to be President of American Psychological Association Margaret Floy Washburn was the first woman to receive psychology Ph.D. she wrote on "Animal Behaviour"

Henry Holt offered a contract to William James for writing a textbook of new science of psychology it was completed after 12 years known as Principles of psychology

Early pioneers define psychology as a science of mental life John Watson, B F Skinner redefined psychology as scientific study of observable behaviour

Sigmund Freud in 1940's spoke about unconscious thought processes, Carl Rogers and Abraham Maslow focused on current environmental influences.

The second group of psychologists who rebelled against earlier thinking is the cognitive revolution, they emphasise mental processes. Cognitive neuroscience an interdisciplinary study is concerned with brain activity and underlying mental processes to include all these aspects today we define psychology as science of behaviour and mental processes. Contemporary psychology, Psychology is evolved from philosophy and biology. Wundt was philosopher and physiologist James was a American philosopher

Freud was physician, Ivan Pavlov was Russian psychologist. Jean Piaget was a biologist today's psychologist are citizens of many countries. International union of psychology has 71 nations as its members.

The biggest question faced by psychology today is nature or nurture controversy. Today's psychologist are more exploring relative contributions of biology and experience, nature selects the traits that best enable organism to survive and reproduce in the

given environment. This is an issue that will be discussed throughout the chapters. Psychology understands behaviour at three main levels it is a bio-psycho-social approach. Biological influences like Genetic Predispositions brain mechanism etc psychological influences like learned fears expectations, emotions etc and social influences are like influences of family, society, religion on the whole.

The subfields of psychology are connected with the current perspectives (Please refer to the table gives the subfields and the related current perspectives). Like any other field psychology also has certain strengths and weaknesses. At the end, tips are given on how to retain information in your memory and improve your grades.

1.3 QUESTIONS-IMPROVE YOUR GRADE

1. Write a note on roots of psychology
2. Explain the nature and origin of psychology
3. What is the historic or biggest question of psychology
4. Explain the different levels of analysis of human behaviour
5. Explain different sub fields of psychology and their relation to different perspectives.

1.4 REFERENCES

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



THE STORY OF PSYCHOLOGY AND THINKING CRITICALLY WITH PSYCHOLOGICAL SCIENCE - II

Unit Structure :

- 2.0 Objective
- 2.1 The Need for Psychological Science
 - 2.1.1 The Hindsight Bias: I Knew of all along Phenomenon:
 - 2.1.2 Overconfidence:
 - 2.1.3 Perceiving Order in Random Events:
 - 2.1.4 Scientific Attitude: Curiosity, Skepticism And Humble:
 - 2.1.5 Critical Thinking:
- 2.2 How Do Psychologist Ask And Answer Questions
 - 2.2.1 Scientific Method:
 - 2.2.2 Description:
 - 2.2.3 Correlation:
 - 2.2.4 Experiment:
 - 2.2.5 Statistical Reasoning in everyday life: Describing Data
 - 2.2.6 Significant differences
- 2.3 Frequently asked Questions about psychology
- 2.4 Summery
- 2.5 Questions
- 2.6 References

2.0 OBJECTIVE

After reading this unit, you will be able to understand:

- why psychology as a science is required
- What are the errors that we make while understanding human behavior
- What are the different scientific method and how statistical reasoning is done

2.1 THE NEED FOR PSYCHOLOGICAL SCIENCE

There is common feeling that psychology explains or informs what everyone is aware of. Some pace their faith in human

intuitions. For example prince Charles (2000) said that “buried deep within each and every one of us there is an instinctive heartfelt awareness that provides- if we allow it to –the most reliable guide “. Former president of America explained his decision to launch the Iraq War by saying that he is a gut player and he depends on instincts. Today’s psychological science does study intuition but it is observed that our thinking memory and attitude operate at two levels conscious and unconscious. But still our intuitions are more likely to go wrong. The three phenomena, hindsight bias, judgmental overconfidence and even tendency to perceive patterns in random events illustrate why we cannot solely depend on intuition.

2.1.1 The Hindsight Bias: I Knew of all along Phenomenon:

Hindsight bias is defined as the tendency to believe after learning an outcome that one knew it all along and such an outcome was inevitable. It is also known as (I knew it all along) phenomenon. A cricket team’s captain is given the credit if the match is won and captain is faulted if the match is lost. After a cricket match, war or election, its outcome usually seems to be inevitable and then we say after the outcome 'See this is what I was saying or I knew this would happen.

People have tremendous capacity and willingness to explain away contradictory findings as justifiable based on common sense. For example, half the members of a group were told that psychologist have found that separation weakens romantic attraction and as the saying goes “out of site out of mind” and asked them to imagine why this might be true. Most people can and nearly all will then view this true finding as not very surprising. Members of the other half group were told that separation strengthens romantic attractions and as the saying goes “absence makes the heart grow fonder”. They were also asked to imagine why this might be true. People given this untrue result also imagined it and believed the findings. When two opposite findings look like a common sense, there is a problem. Such errors in a recollection and explanations of the events necessitate psychological research. Just asking people how and why they felt or acted in a particular manner can be misleading sometimes. This is not because common sense is usually wrong, but because common sense describes what has happened and does not tell what will happen.

At least in 100 studies done in different countries among children and adults, hindsight bias was observed. It is observed that our intuitions are sometimes right and sometimes wrong. We are all behavior watchers. So many of findings in psychology research seems to be seen before. For example, many people believe that love leads to happiness and they seem to be right as we have a deep need to belong. But our intuitions cannot be always correct.

For example, the famous saying like familiarity breeds contempt or dreams predict future may not be always true as the outcome of an event always depends on number of environmental factors and also on factors such as brain chemical messages(brain chemical messages control our moods and memories), effect of stress on a capacity to fight disease and so on.

2.1.2 Overconfidence:

We generally have a tendency to think that we know more than we do. If someone asks us question about the certainty of our answer we tend to be more confident than correct. The best example is following anagram given by Richard Goranson (1978). He asked people to unscramble the alphabets:

WREAT – WATER
 ETRYN – ENTRY
 GRABE – BARGE

Now see how many seconds would you require to unscramble this alphabet. Did hindsight bias come in the way? Knowing answers make us overconfident. The solution would take only 10 seconds for us to answer while in reality, problem solver requires 3 minutes.

The question arises are we better at predicting social behaviors? Students show that this may not be always the case. Philip Turlock (1998,2005) collected more than 27000 expert prediction on world event such as future of South Africa or whether Quebec would separate from Canada. He found that these predictions which experts made with 80% confidence on average were right less than 40% of the time.

2.1.3 Perceiving Order in Random Events:

We are naturally eager to make sense of the world. Wallace Stevens called it as out “rage for order”. We are more prone to perceive patterns. For example, people tend to see a face or the divine images on the trees or vegetables or moon, or seeing virgin Mary’s image on grilled cheese sandwich. We find order even in random data because random sequences often don’t look random (FALK et al, 2009 Nickerson 2002, 2005). In actual random sequences patterns and streaks (such as repeating digits) occur more often than people expect and they don’t look random to people and they over interpret them. Such pictures we get to see on media also so many dotted lines are shown and then question is asked do you see an image. In some random events, weird seeming streaks do occur. For example, during 2010 world cup German Octopus Paul was offered two boxes each with mussels and with national flag on one side Paul selected the right box eight out of eight times in predicting the outcome of Germany’s 7

matches and Spain's victory in finals. Such happenings are extraordinary. We struggle to give ordinary chance related explanations to such events. The main thing to note is that hindsight bias, overconfidence and perceiving order in random events leads us to overestimate our intuition. But scientific enquiry helps us to differentiate reality from illusion.

2.1.4 Scientific Attitude: Curiosity, Skepticism And Humble:

Scientific attitude is marked by curiosity, skepticism and humbleness. Every science is guided by curiosity, a passion to explore and understand without misleading or without being misled. Scientific attitude is required to come close to real answers of the questions rather than the fantasy based answers. For this purpose being skepticism is more important.

Being skeptical does not only mean being analytical and durable but open for answers. So as a scientist psychologist, approach the world of behaviour with curious skepticism by asking questions like what do you mean? How do you know? The skeptical thinking allows a psychologist to select best suitable answers for explanation of human behavior. For Example, can astrologers predict anyone's future based on position of the planet on the birth chart? Is electroconvulsive therapy an effective treatment for severe depression? Such questions are put to test by psychologist. On the basis of such skeptical thinking the answer for the first question is NO and YES for the second question.

Putting a scientific attitude into practice not only requires curiosity skepticism but also humility. Humility refers to an awareness of one's own vulnerability to errors and openness to surprises and new perspectives. Historians of science tell us that these three attitudes, curiosity, skepticism and humbleness have made modern sciences more advanced. Some deeply religious people may consider science as a threat, but the leaders of scientific revolution, scientist like Isaac Newton and Copernicus were deeply religious, they were acting on the idea that "in order to love and honor God it is necessary to fully appreciate the wonders of his handiwork (Stark 2003). However scientist, like anyone else, have their egos and may cling to their preconceptions, but the ideals of curiosity, skepticism and humbleness helps to maintain objectivity of the obtained information.

2.1.5 Critical Thinking:

Critical thinking is defined as a thinking that does not blindly accept arguments and conclusions. Rather it examines assumptions discerns hidden values, evaluates evidence and assess conclusions. Whether reading a news report or listening to conversation, critical thinkers ask questions.

Scientists always ask questions like how do they know? What is this person's personal agenda? Is the conclusion based on gut feeling or is there some kind of evidence? Does the evidence justify a cause-effect conclusion? Or is there any cause and effect relationship? Are there any alternative explanations?

Critical thinking helps scientists to remain away from the biases. A single occurrence is understood from multiple perspectives. The preconceived notions will be challenged. Thus, critical thinking challenges the popular assumptions of behaviour. For example in 2010 an environmentalist proposed that bitter cold in North America and East Coast snow storms are caused by global warming. Critical thinkers would ask questions like where is the evidence. Is earth actually warming? Are polar ice caps melting? Are vegetation patterns changing? They will always look at the evidence or the facts that support such inference

2.2 HOW DO PSYCHOLOGISTS ASK AND ANSWER QUESTIONS

The scientific attitude of a psychologist is supported by the scientific method. The scientific method is a self-correcting process for evaluating ideas with observation and analysis. Hunches, the plausible sounding explanation of human behavior are tested with the scientific method. These ideas or theories are tested against evidence. If evidence supports then the idea or theory is accepted, otherwise the theory is revised or rejected.

2.2.1 Scientific Method:

Before beginning with the scientific method, it is necessary to understand the concept of Theory. In science, a theory explains with principles that organize observations and predict behaviour or events. A theory is simplified by organizing isolated facts. A theory offers a summary by connecting facts with deeper principles. For example, Effects of sleep deprivation on memory. Now there are a number of observations related to sleep deprivation. For example, people with poor sleeping habits cannot answer questions in the class, they tend to do badly on tests. So, it can be concluded that good sleep improves memory. So, the sleep retention principle summarizes the facts related to effects of sleep loss.

So, it is suggested that sleep loss affects memory. Yet all theories need to be tested. A good theory produces testable predictions called as hypothesis. Hypothesis enables us to revise and predict theory. Hypothesis is a testable prediction. The finding may either confirm or reject the prediction. For example, to test our theory about the effect of sleep on memory, people's retention of

the course material after good night's sleep and after shortened sleep is tested.

Sometimes our theories can bias our observations. We may see what we expect to see. To have control on such biases psychologist usually suggest operational definition of procedures and concepts for example hunger might be defined as a hours without eating, generosity as money contributed. These operational definitions help others in replicating or repeating the original observations with different participants, materials and circumstances if they get similar results the confidence in finding the reliability grows. Definitions are carefully worded statements, so that it becomes possible for others to repeat original observations with different participants.

Finally, it can be said that theory is useful

(1.) to organize range of self-reports and observations.

(2.) Theory implies predictions that anyone can use to check theory or derive practical application for example if people sleep more will their retention improve?

A research may lead to a revised theory, that better organizes and predicts what we know. research may be replicated and supported by similar findings

In psychology hypothesis can be tested and theories can be revised by using descriptive methods such as a case study method, naturalistic observation method, survey methods to observe and describe behavior and why it is important to have random sampling.

2.2.2 Description:

Psychologist used case studies, naturalistic observations, surveys to observe and describe behaviour. Professional psychologist describe behavior objectively and systematically by using methods said above.

a) The Case Study Method:

It is one of the oldest method. It examines one individual in depth in the hope that individual will reveal true things about himself. The early knowledge about brain and areas of brain is based on in depth case studies which showed impairment after and some kind of brain damage.

Studies of only few chimpanzees have shown their capacity for understanding and language. Jean Piaget's theory of Cognitive development is based on case studies of his own children. In depth case studies show what can happen and they give direction for further study.

However, case study method has limitations. For example, individual cases may mislead us and we may draw false conclusions, if the individual is atypical. Dramatic stories and personal experiences attract our attention. But stories can mislead. A case study cannot be used for drawing any general inference or general principle that apply to all. Individual cases can suggest fruitful ideas, but to find the general truth that covers individual cases, we must answer questions with other research methods.

b) Naturalistic Observations:

It is observing and recording behavior in naturally occurring situations without trying to manipulate, and control the situations. Naturalistic Observations does not explain behavior. It only describes behavior. Such description of behavior can be more revealing and interesting. For example, it was believed that only human beings use tools but it is observed that even chimpanzees sometimes insert stick in termite mound and withdraw it, eating the stick's load of termites. This is unobtrusive naturalistic observation. This was the observation without any interference or intervention. Such unobtrusive naturalistic observations have led to later studies of animal thinking, language and emotion. It was due to such observation studies, we know now that chimpanzees and baboons use deception. Similarly, there are some interesting findings based on naturalistic observations about human beings. For example,

human beings laugh 30 times more often in social situation than in a solitary situation as we laugh 17 muscles contort our mouth and squeeze our eyes and we emit series of 75 milliseconds vowel like sounds spaced about $1/5^{\text{th}}$ of a second.

Another interesting example was a study done by Matthias Mehl and James Pennebaker (2003). They studied 52 students from university of Texas to find out what this introductory psychology students say and do in their everyday life. They were made to wear a belt which had electronically activated recorder they wore it for 4 days. This recorder captured 30 seconds of students waking hours of every 12.5 mins. Thus they had information of more than 10000 half minute life slices by the end of the study. The result showed that the percentage of slices when students were talking to someone was 28% and percentage of the time they were at the keyboard of the computer was 9%.

Another study was done at university of Nevada Las Vegas to find out what was there on the minds of the students. This was done by giving them beepers. A beeper interrupted their daily activities, signaling them to record their inner experiences at that moment. The result showed that there were five types of inner experiences such as inner speech, inner seeing unsymbolized thinking, feeling and sensory awareness.

Naturalistic observation enabled Robert Levin and Ara Norenzayan to compare pace of life in 31 countries. Pace of life included walking speed, accuracy of public clock, and speed with which postal clerk completed a request. It was observed that life is fastest in Japan and western Europe whereas life is slower in economically less developed countries. People in colder climates tend to live at a faster pace and are more prone to die from heart disease. However, naturalistic observation merely describes the events but does not tell us why they take place.

C)The Survey Method:

Compared to case history method and naturalistic observation method, the survey method looks at many cases but in less depth. A survey asks people to report their behaviours and opinions. Questions about everything from sexual practices to political opinion are asked in survey. Some of the recent surveys are-

- Half of all Americans reported experiencing more happiness and enjoyment than worry and stress on the previous day (Gallop , 2010)
- Online Canadians reported using new forms of electronic communication and thus receiving 35% fewer emails in 2010 than 2008
- One in 5 people across 22 countries believe that aliens beings have come to earth and now walk among us as disguise humans
- 68% of all humans say that religion is important in their daily lives.

But asking questions in survey can be very tricky answers always depend on the way questions are worded and the type of respondents selected.

Wording Effect: Even subtle changes in order of wording of questions can have major effects. For example, people are more approving if instead of using the word "taxes" we can the word 'revenue enhancers' and instead of using the word "welfare" we use the word "aid of needy". Such wording can change the opinion of the respondents.

For example in 2009 three in four Americans in one national survey approved of giving people a choice of public or private health insurance ,yet in another survey most Americans were not in favour of public health care plan administered by federal government that would compete directly with private health insurance companies . It is here the wording brings about the total change of opinions

Random sampling: Survey method requires a sample that fairly represents populations under study. It is not always possible to survey everyone in the group. Every member of the population must get an equal and fair chance of being selected as a part of sample. This is called as random sampling. In sampling, there is always a temptation to ignore sampling bias and draw conclusion on the basis of vivid but unrepresentative cases. But the best way is to have representative sampling. Representative sampling can be achieved with the help of random sampling where every student from the total population has fair chance of being selected as a part of population under study. Large representative samples are better than small ones.

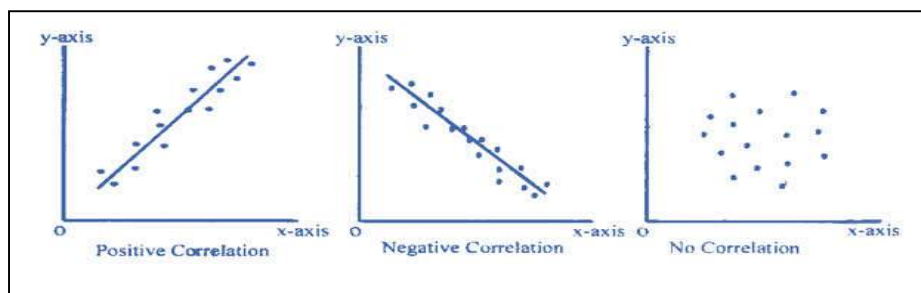
The point to remember is while considering the finding of the survey think critically and look at the size of the sample. For survey method, it is always good to have larger representative sample than larger sample that is not representative.

2.2.3 Correlation:

Naturalistic observation shows that one behavior is related to other. We say that they correlate. A statistical measure correlation coefficient helps us to understand how two variables are closely related. For example, intelligence and school grades are closely related.

The correlation coefficient can be graphically represented in the form of scatter diagram. The following are scatter diagram representing different correlation. Each dot is the scatter plot represents the values of two variables.

Fig. 2.1 Positive, Negative and Zero Correlation



Perfect positive correlation: Perfect positive correlation is a rare phenomenon indicating increase in one variable accompanied by simultaneous increase in another variable. But generally, height and weight are positively correlated.

Zero correlations: Zero correlations are found between the two variables when they are not related. For example height and intelligence.

Perfect negative correlation: Increase in one is accompanied by simultaneous decrease to another variable. For example intelligence and failures in the school.

Correlation & Causation:

Correlations only help us to predict, they explain the nature of relationship. The major limitation of method of correlation is they do not explain or specify whether one is the cause of other.

Correlation helps us to make predictions for example high self esteem is negatively correlated with depression but it cannot be said that it is the exact cause of depression. People with lower self esteem are at the high risk of depression whatever may be the strength of the relationship it cannot be said that one is the cause of other. For example length of marriage correlates with hair loss in men. But it does not mean that marriage causes men to lose their hair or balding men become better husbands. To summarize association does not prove causation.

2.2.4 Experimentation:

Researchers have found that children who were breast feed as infants have somewhat higher intelligent scores than children who were bottle fed with cow's milk. There are three different studies to compare breast fed children and bottle-fed children and they say that breast fed children are the best. Now the question is whether nutrients in mother's milk contribute to brain development. To find answers for such questions, to **isolate cause and effect relationship, researchers perform experiments.** Experiments help researchers in isolating effect of one or more factors by

1. Manipulating the factors of interest and
2. Holding constant (controlling the other factors).

They often create **experimental group** in which people receive treatment and **control group** that does not receive treatment. To minimize the effect of the other differences between the two groups researchers randomly assign people to two conditions. Random assignment equalizes two groups so age, attitude, characteristics, etc. and their effects can be minimized. For example, in a study on effects of feeding, one bottle fed group was compared with the breast-fed group children by effectively controlling all other factors except nutrition. This supported conclusion that breast feed is best for development of intelligence.

Experimental method is different than survey method. In survey naturally occurring relationships are uncovered whereas in experiment we manipulate the factors to determine the effects of the variables.

Experimenters often use blind (uninformed) technique about what treatment each group is receiving. The study uses **double blind procedure** where neither participants or researchers are aware of which group is receiving the treatment. This is done to avoid **placebo effect** where results are caused by the expectations alone.

Independent Variable:

Experiment is a research method in which an investigator manipulates one or more factor to observe effect on some behavior or mental process. Experiments enable researchers to isolate or manipulate effect of one factor on other. This is an independent variable. Independent because experimenter can vary it independently of other factors. It is a variable as it is increased or decreased by the experimenter.

Dependent Variable:

Dependent variable is a consequence of an independent variable. Dependent variable can be discussed as an effect of an independent variable. Both variables, independent and dependent, are given precise operational definitions which specify the procedures that manipulate the independent variable or measure the dependent variable. These definitions answer the question, "what do you mean?". The answer to this question with a level of precision enables others to replicate the study.

Confounding Variables:

The other factors which can potentially influence the results of the independent variable are called as confounding variables. The random assignment of the group can control the potential influence of confounding variables.

In short, we can say a variable is anything that can vary (infant's nutrition, intelligence or anything- anything within the limits of what is possible and ethical). Experiments aim to manipulate an independent variable, measure the dependent variable and allow random assignment to control all other confounding variables. Experiments can be helpful in the evaluation of social programs eg: if early childhood education programmed can help in boosting impoverished children chances of academic success.

2.2.5 Statistical Reasoning in Everyday Life:

Statistics are the tools that help us to see and interpret what unaided eye might miss. For example, researchers Michel Norton and Dan Ariely invited 5522 to estimate the percent of wealth possessed by richest 20 % in the country and their average guess was 58% (dramatically underestimated) but in reality, 20% possessed 84% wealth of the nation. Statistics helps everyone. One need not be deceived by such offhand estimates.

Describing Data:

Once the researchers collect the data, they need to organize and summarize it in some measurable way to make that data more meaningful.

Measures of Central Tendency:

One of the simplest way is to convert it into bar graphs. The other method is to summaries data by using measures of central tendency. They give you single score that represents a set of scores. Measures of central tendency can be given as follows.

1. **Mean:** An arithmetic average. It is a total sum of scores divided by total number of scores.
2. **Median:** median is a midpoint, 50th percentile. if all scores are arranged from highest to lowest, half scores will be above the median and half scores will be below the median.
3. **Mode:** It is the most frequently occurring score in the distribution.

Measures of central tendency summaries the data but if distribution is lopsided or skewed by a few way-out or extreme scores, where scores are either more on the higher side or lower side then the measures of central tendency do not give you real picture, because mean is influenced by extreme scores. For example, if you are looking for the mean of the marks scored by 50 students in class and in this group if there are 5 students scoring 100 on 100 it will change sum total of score and it may inflate the average score obtained by the students. So, in this case a few atypical cases will distort the average

Median also does not give you complete picture for e.g. it is said that 78% of the people in India live life below poverty line if we use median here can we say anything conclusive about the people's income in the 50% above and 50% below range in reality top 22% of the people have maximum share in the income of the nation. Once again, few atypical cases distort this score.

Measures of variation

As shown above, in central tendency, a single number leaves out lot of information. So it helps to know how much variation is there in the data. They tell you how similar or diverse scores are. Averages derived from scores with low variability are more reliable than averages derived from scores with high variability.

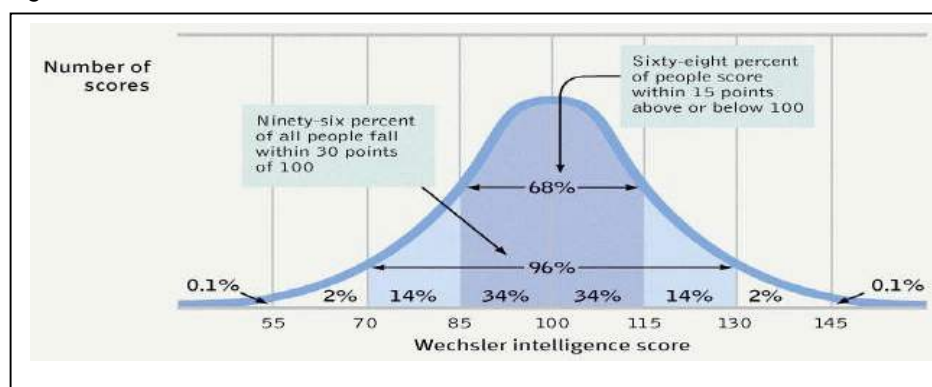
The measures of variability are:

1. **Range** – It is the gap between the lowest score and the highest score. It provides crude estimate of variation. Couple of extreme

scores once again can increase the gap between highest and lowest score

2. **Standard deviation:** it is another measure of finding out how scores deviate from one another. This measure tells you whether scores are packed together or dispersed. The computation tells you how much each scores differs from the mean

Fig. 2.2 Standard deviation



The meaning of standard deviation can be understood better if you know how much scores differ or tend to be away from average. For example, large number of people show variations in height weight intelligence scores, grades. These scores form a symmetrical bell-shaped distribution where most cases fall near the mean and few fall near the either extremes of the curve. **This curve is also known as bell shaped curve.**

The above figure 2.2 shows that nearly 68% of the cases fall within one standard deviation on either side of the mean. It means 68% of the people taking intelligence test will score near plus or minus 15 points of 100. About 95% will score within plus or minus 30 points.

2.2.6 Significant differences

How do we know that whether observed differences can be generalized to other population? The average score in one group (for e.g. breast-fed babies) could be considerably different from the average score in another group (bottle fed babies) not because of real differences but because of chance fluctuations in the people selected as a sample. The question is how confidently can we say that observed differences are not cause by chance factors and for this purpose we can ask how reliable and significant differences are. When is the observed difference reliable? It is when we have to decide that whether it is safe to generalize from a sample under study. At this time, the following three principles should be kept in mind

a. **Representative samples are better than bias samples.**

Generalizations can be based on representative samples rather than on exceptional cases. It is always not possible to have random sample of whole population under study, so it is important to keep in mind what population a study has sampled.

b. **Less variable observations are more reliable than more variable observations.**

Observations with less variability can be more dependable as more variability means possibility of other factors interfering with the results

c. **More number of case are better than fewer number of cases.**

Averages based on many cases are more reliable than less number of cases. To summarize generalizations based on few unrepresentative cases are unreliable.

When the Difference Is Significant-Significance of observed differences can be established by statistical testing. When averages of two sample are each reliable, measures of their respective population (that is , if they are based on large number of representative sample, with less variability) then their differences are also likely to be reliable, for e.g. we study gender differences and aggression we select two homogeneous group of men and women (group with less variability) and hear there is a sample average score with a large difference then we can have confidence that there is a real difference between the two. Thus when sample averages are reliable and the difference between them is large then we say difference is statistically significant, means observed difference is not caused by chance factors.

In judging significance level of the observed difference psychologist are very conservative. The conclusions cannot be stretched beyond what observation suggest. Statistical significance only says that there is a likelihood that results occur not by chance factors but it does not say anything about importance of the results

2.3 FREQUENTLY ASKED QUESTIONS ABOUT PSYCHOLOGY

The frequently asked questions about psychology are as follows:

Can laboratory experiments eliminate everyday life?

The experimenter intends to turn laboratory experiment into a simplified reality, one that simulates and controls important features of everyday life. Here experimenter recreates psychological forces under controlled conditions.

The purpose of experimenter is not to create real life situations but to test theoretical principles (Mook 1983) For example. In aggression studies, deciding whether to push a button that delivers a shock may not be same as slapping someone but the underlying principle is the same. It is the resulting principle and not the specific finding that help to explain every day behavior

When psychologists apply laboratory research on aggression to actual violence they apply theoretical principles of aggressive behavior. These are the principles refined on the basis of laboratory research. Many such findings are based on laboratory research it has to be remembered that psychological science focuses less on particular behavior but more on seeking general principles that help to explain many behaviours.

Does behavior depend on one's culture and gender?

Joseph Henrich, Steven Heine, and Norenzayan (2010) studied Western Educated, Industrialized, Rich, and Democratic cultures (WEIRD cultures). Most of them form only 12% of humanity. Do such studies tell about people in general? Culture refers to shared ideas and behaviours that one generation passes onto the next generation. It influences our standards of promptness and frankness attitude towards premarital sex and varying body shapes, tendency to be formal or informal, willingness to maintain eye contact, distance maintained in conversation and so on.

With these differences in mind is it possible to say what is true for one group or community is true for others also. Our biological heritage says that we all are human beings and are one but we grow up in a different social cultural environmental setup. Some findings are common but not all for example people diagnose with dyslexia, a reading disorder exhibit same malfunction of brain irrespective of culture they belong to. Variation in language interferes with communication across the cultures. Yet all languages share deep principles of grammar.

People in different cultures vary in feelings of loneliness. We all are alike in certain aspects but we are different in many other aspects

Why do psychologist study animals and what ethical guideline safeguard human and animal research participants?

Psychologist study animals for many reasons. Some are as follows:

- a. They find animals fascinating. They want to find out how different species learn, think and behave
- b. We share some common biology with animals. It can be used for understanding treatment for human diseases

- c. The processes by which learning takes place are similar in human beings and in animals especially in rats and monkeys. The neural mechanism of learning can be understood by performing experiments on animals

Roger Ulrich (1991) said that similarities between animals and human beings does not defend our use of animals for the purpose of research.

Is it right to place well being of human being above that of animals?

Is it right to expose monkeys to HIV like virus in search of treatment of AIDS. Is our use of animals as natural as the behavior of carnivorous animals? The answers for these questions depend on culture?

If human life is given first priority what safe guards should protect wellbeing of animals. Different governments have given different guidelines. British psychological society guidelines call for housing of animals under reasonably natural living conditions with companions for social animals(Lea 2000).

American Psychological Association guidelines state that researchers must ensure

“the comfort, health and humane treatment” of animals and minimize infections, illness and pain (APA 2002).

European parliament also now mandates standards for animal’s care and housing (Vogel 2000). Animal studies have benefited animals also Ohio team of researchers have identified stress hormones in dogs. They have devised handling and stroking methods to reduce stress in dogs. Other studies have helped in improving care and management of animals. By revealing our behavioral kinship with animals and the remarkable intelligence of chimpanzees, gorillas and other animals, experiments have led to increased empathy and protection for them.

The Guidelines for Performing Experiments on Human Beings:
The American Psychological Association Ethics code urges researchers to obtain

1. Informed consent of potential participants
2. Protect them from harm and discomfort
3. Keep information confidential about each participant
4. Use deception or stress them temporarily only when it is absolutely necessary and justifiable, e.g., some experiments

- won't work if participants know everything beforehand and participants might try to confirm the researcher's predictions.
5. Fully debrief people or explain the research afterwards most universities have their committees for ethics.

Is Psychology free of value judgments?

Psychology is not free of value judgments. Values do influence what we study and how we study. There are questions like Productivity or work morale. Should gender differences or sex discrimination be studied? Should we study conformity or independence? It has been observed that values do color the facts

Psychologist may have preconceptions that can bias observations. Even the words used for describing something reflect values. For example, one person may describe a behavior as rigid other may call it consistent. One person may speak about faith other may term it as fanaticism. Professional judgments of how to raise children, how to live life, how to have self-fulfillment in life are the value based advices.

Psychology cannot address all questions, but it Studies how learning can be enhanced. It looks into how problems like war, overpopulation crime and family crisis can be dealt with. This involves attitude and behavior. Psychology cannot speak about all of life's great questions but it addresses important questions.

2.4 SUMMARY

We often feel that our gut feeling is more important than anything else. It is the intuition that we use for understanding human behavior. Intuition has its own limitations. Three phenomena like hindsight bias, over confidence and tendency to perceive an order in random events suggest that we cannot solely depend on intuition.

Hindsight bias refers to I knew of all along phenomena. It is an error in recollection. Overconfidence in a thinking that we know more than what we actually know we tend to be more confident than correct.

Perceiving order in random events is our natural tendency to make sense of our world the events are perceived to be together giving same kind of meaning.

The scientific attitude includes curiosity, skepticism and humbleness. These are the three main components of scientific attitude curiosity in asking questions, if it is a passion to explore and understand whether misleading or being misled being skeptical refers to offering the most plausible explanation that

makes the facts. Putting Scientific attitude requires curiosity, skepticism and humility. Humility is awareness of own vulnerability to errors and opens to surprises. Scientific attitude prepares a person to think smarter.

In critical thinking assumptions are examined hidden values are judged and evidence is evaluated. Psychologist ask and answer questions by scientific method. It is a self-correcting process of evaluating ideas with observation and analysis

Scientific Method has three important components: Theory, hypothesis and Operational definition of words. Theory explains principles that organizes observation and behavior. Theory simplifies by organizing isolated facts. A good theory produces testable predictions called as hypothesis. They enable us to reject or revise a theory. They specify what results would support a theory and what results would disconfirm of our theories can bias our observation. To check their biases psychologists, report their research with precise operational definitions so that some studies can be replicated.

A theory is useful if it organizes range of self report observations Implies predictions that anyone can use to check theory or derive practical application. Theories and hypothesis can be refined by using description method. Psychologist use description for explaining behavior and observation. It is done in a systematic manner through observation

The case study examines an individual in depth with the hope of revealing things true of himself. Intensive case studies are sometimes revealing but no generalization can be made on the basis of observation of one person

Naturalistic observations is a method that records behavior in natural settings Naturalistic observation does not explain behavior. It may provide snapshots of everyday life. Researcher does not have control over condition.

Survey method looks at many cases in less depth. A survey asks people to report their behavior or opinion. The answers obtain for questions depend upon the wording effect even subtle changes in the order of wording questions can have major effects.

Random sampling in everyday thinking we tend to generalize from the sample we observes especially vivid cases. But it has to be remembered that the best cases for generalizing is from a representative sample. It is not possible to study everyone in the population under study; therefore representative sample is used for drawing inference.

Correlation is a statistical measure showing how things vary together thus they tell us how well one predicts another. The correlation coefficient can be graphically represented by drawing scatter plots. They are used for depicting nature of correlation. There can be three types of relationships that exist between two variables: Perfect positive correlation, Zero correlation and Perfect negative correlation. A correlation is positive if two sets of scores rise and fall together. Correlation is negative if sets of scores relate inversely one set of scores goes up and other goes down. A correlation coefficient helps us to see world more clearly by revealing the extent to which two things correlate.

Correlation and causation helps us to make predictions. It just tells us how two variables are associated. It has to be remembered that association does not prove causation correlation indicates the possibility of cause and effect relationship but does not prove the cause and effect relationship

In an experiment researcher isolate cause and effect relationship. They isolate cause and effect relationship by manipulating factors of interest and by holding other factors constant. This is often done by creating experimental and control group. Experimental group that receives the treatment and control group is a group that is tested under normal circumstances. An experiment is not complete without independent and dependent variable. Independent variable is one that varies independently to other factors Dependent variable are that varies depending on what happens during the experiment. Confounding variables are variable that can potentially influence the results of the experiment.

Statistical reasoning is used for describing the data. Data can be discussed by using measures of central tendency and measures of variability.

Measures of central tendency are mean, median and mode. Mean is an average. It is inferred by exceptional scores. Mode is 50% percentile a point where 50% cases are above and below the median

The measures of variation is the measure that tells you about the amount of variation in the data. How similar or diverse the scores are. Averages derived from the scores of low variability are more reliable than averages derived from the scores of high variability

Range is the gap between lowest and highest score. The more useful measure for understanding how one score deviates from one another is standard deviation. It tells you whether scores are packed or dispersed. The meaning of standard deviation can be

understood with the help of normal deviation curve. It is graphic representation of traits. Traits like height weight and intelligence fall in normal distribution curve The observed differences are considered as reliable when selected sample is representative in nature, observation are less variable and when there are more number of cases.

The difference is significant if the observed difference is not because of chance factors The frequently asked questions about psychology are Can laboratory experiment illustrate everyday life, secondly does behavior depends on one's culture or gender

Why do psychologist study animals? Are there ethical guidelines for conducting research and animals? The answer for this question are explained at the length in the notes but it can be remembered that American Psychological Association gives guidelines for protecting the welfare of human participants.

2.5 QUESTIONS

1. What it intuition and explain the errors that we make while going by gut feeling
2. Explain what is scientific attitude
3. What are the characteristics of experimental method?
4. Why statistical reasoning is required in everyday life?
5. Write notes on
 - a. Scientific method
 - b. Case study method
 - c. Survey method
 - d. Method of correlation
 - e. Write notes on
 - f. Measures of central tendency
 - g. Measures of variability
 - h. Behavior culture and gender
 - i. Ethical guidelines for conducting research on humans and animals.

2.6 REFERENCES

- 1) Myers, D. G. (2013). Psychology.10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology.(Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



THE BIOLOGY OF MIND - I

Unit Structure :

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Neural Communication
- 3.3 The Nervous System
- 3.4 Check your progress
- 3.5 Summary
- 3.6 Questions
- 3.7 References

3.0 OBJECTIVES:

After reading this unit, you will be able to understand –

- Why it is important to understand the biological functioning of our body
- The structure and functions of neurons
- The Central and Peripheral Nervous System

3.1 INTRODUCTION:

There is a famous saying by Descartes, a French philosopher, that “I think, therefore I am”. But, the fact remains that we cannot claim to exist, think or behave without our bodies. Our entire behavior, thinking, emotion and even urges are biological functions. We cannot laugh, love, study, aggress, compete, study, explore without our bodies. Without our genes, our brain, our appearance, reflexes, we are nobody.

Many ancient philosophers tried to identify where exactly is our mind in our body. Plato rightfully mentioned mind is in the head, that means in brain. Aristotle on the other hand believed the mind to be in heart. Modern science has proved that it is your brain and not your heart that falls in love. In early 1800s, Franz Gall gave the concept of phrenology, study of bumps on the skull. He believed that bumps on the skull can indicate the mental abilities and character traits of a person. However, research proved phrenology is nothing but a gimmick and one cannot judge abilities or personality of a person from the bumps on the skull. But it can't be denied that brain does have control over different aspects of

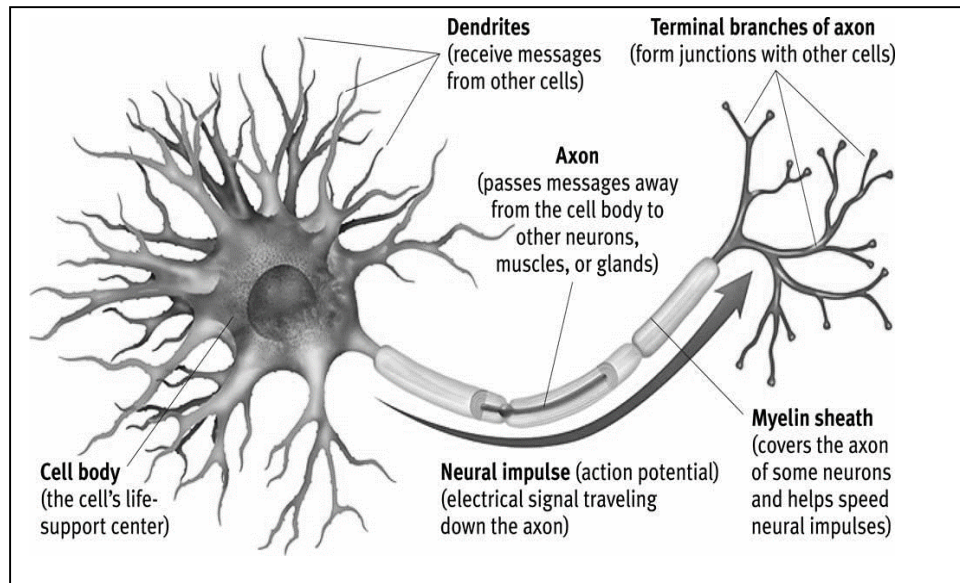
behavior. Phrenology was beneficial because it did bring researchers' attention to the fact that different brain regions are responsible for particular functions. This triggered the research to find the link between biology and psychological events and have discovered a strong interplay between our biology and our behavior and mind. For instance, it has been discovered that we are each a system composed of subsystems that are in turn composed of even smaller subsystems. Tiny cells organize to form body organs. These organs form large system for digestion, circulation and information processing. These systems are part of larger system- the individual who in turn is part of family and society. So, we are biopsychosocial systems. To understand our behavior, we need to study how these biological, social and psychological systems work and interact.

3.2 NEURAL COMMUNICATION:

Neural communication is any type of signaling that takes place between neurons throughout the nervous system. So, let us first see what are neurons and how do they transmit the information.

3.2.1 Neuron:

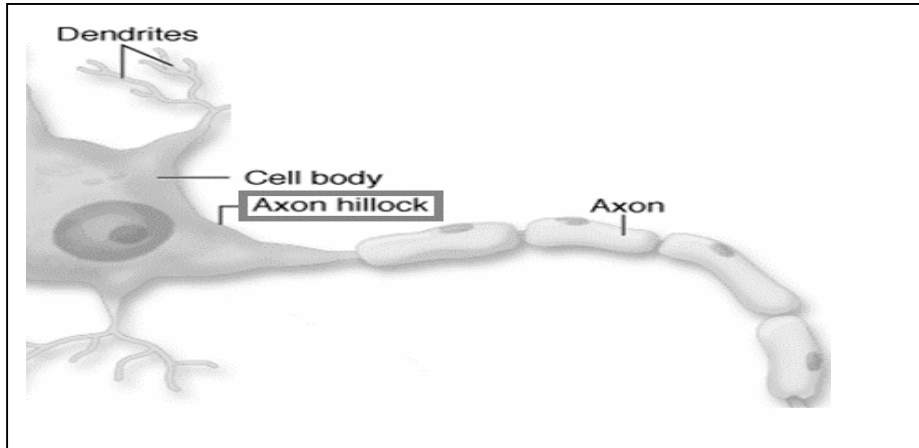
Fig.3.1



The neuron (nerve cell) is the fundamental unit of the nervous system. Neurons have many different shapes and sizes. However, a typical neuron consists of a cell body, dendrites, an axon and synaptic terminals. As you can see in figure 3.1 dendrites are like fibers branching out from cell body. Dendrites are thin structures that arise from the cell body, often extending for

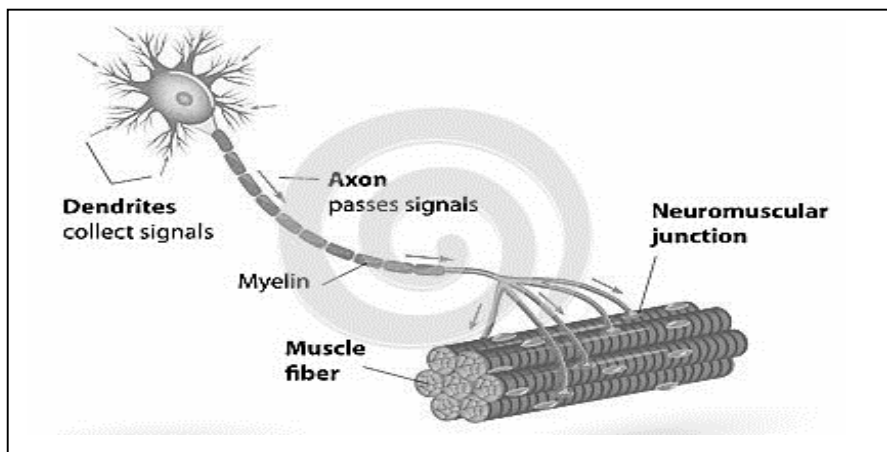
hundreds of micrometers and branching multiple times, giving rise to a complex "dendritic tree". The dendrites receive information and pass it on to cell body. On the other side of cell body, an axon arises from the cell body at a site called the axon hillock and travels for a long distance. See Fig.3.2.

Fig.3.2



Compare to dendrites, axons may be very long projecting several feet through the body. Axons are covered in a myelin sheath, a layer of fatty tissues that insulates axons and that increases the speed of impulses passed through those axons. This is similar to electric wires used at home. They are insulated with plastic cover so that electric impulse passing through wire does not get lost and speed does not come down. The myelin sheath is laid down up to the age of 25 approximately. As myelin sheath keeps covering neurons, our neural efficiency, judgement and self-control grows. If the myelin sheath degenerates, multiple sclerosis takes place and the communication to muscles slows down and eventually loss of muscle control takes place.

Fig.3.3



Many neurons have only one axon, but this axon undergoes extensive branching, enabling communication with many target cells. Axon passes the message through axon terminal branches to other neurons or to muscles or glands. Axon terminal transmit signals to other neuron dendrites or tissues (like a radio transmitter)So, we can say dendrites listen and axons speak. See Fig.3.3.

When neuron's dendrites receive information from our senses or from neighboring neurons, in the form of electrical or chemical signals, they transmit these signals through an impulse called the action potential, which is a brief electrical charge that travels down its axon. Researchers measure brain activities in milliseconds and computer activities in nanoseconds. So, even though our brain is much more complex than a computer, it slower than computer in executing simple responses.

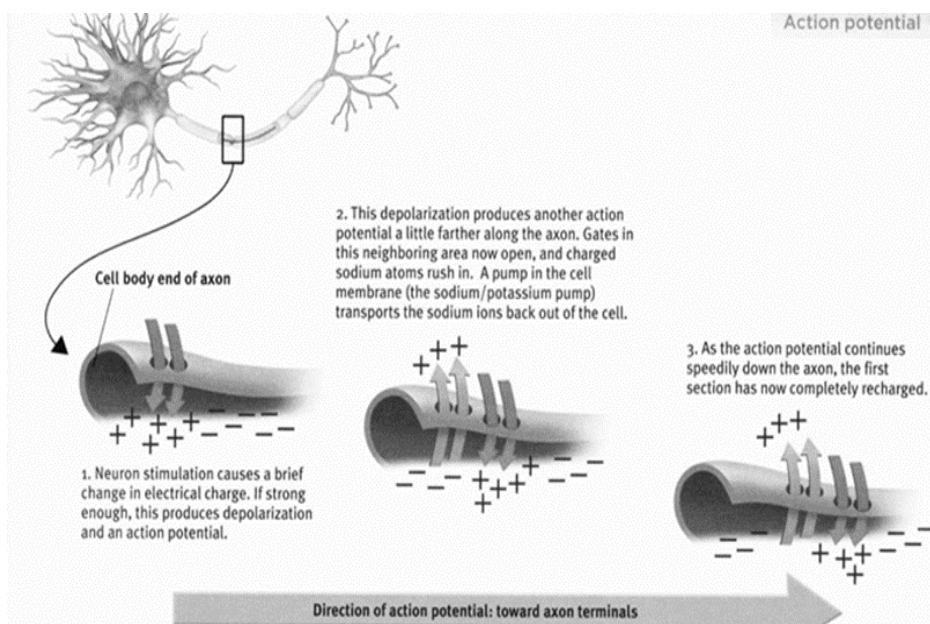
A neuron that is at rest, that is not currently firing a neural impulse is actually electrically charged. The inside of the cell is actually a semiliquid solution in which there are electrically charged particles called **ions**.There is semiliquid solution surrounding the outside of the cell also. This outside semiliquid also contains sodium ions. The ions inside the cell are negatively charged while the ions outside the cell are positively charged. This difference in charges is an electrical potential. The cell wall itself is permeable (porous), so, some substance that is outside the cell can enter through this porous cell wall and some substance with in the cell can come out of the cell through this porous wall. Positively charged sodium ions are too big to enter the cell membrane when the cell is at rest because even though the cell membrane is permeable, the openings are too small at resting state. When the cell is resting, that state is called resting potential. As the outside ions are positively charged and ions inside the cell are negatively charged, these opposite electrical charges attract each other. The sodium ions cluster around the cell wall.

3.2.2 Action Potential:

When the cell receives a strong enough stimulation from another cell (that is when dendrites of the cell get activated), the cell membrane opens up special gates, one after the other, all down its surface that allows the sodium ions to rush into the cell. This causes the inside of the cell to become positive and outside of the cell becomes negative. This electrical charge reversal starts at the axon hillock where axon is closest to cell body, where the first gate opens and then proceeds down the axon in a kind of chain reaction. This electrical charge reversal is known as **action potential** because the electrical potential is now in action rather than at rest. In other words, action potential means that the cell is now positive inside and negative outside at the point where the

gate opened. Each action potential sequence takes about one-thousandth of a second. Depending upon the type of fiber in a neuron, some neural impulse travels at speeds ranging from 2 miles per hour (slowest) to 270 miles per hour (fastest). After the action potential passes, the cell membrane pumps the positive sodium ions back outside the cell and shuts the gates one by one until the next action potential opens the gates again. The cell becomes negative inside and positive outside once again, restoring the cell to its resting potential. Resting pause is also known as refractory period. In short, we can say that when the cell is stimulated, the first gate opens and the electrical charge at that gate only is reversed. Then the next gate opens and charge at that gate only is reversed. In the meantime, the first gate closes and the charge returns to its original state, i.e., negative inside and positive outside the cell. The action potential is the sequence of gates opening all the way down to the length of the cell.

Fig.3.4



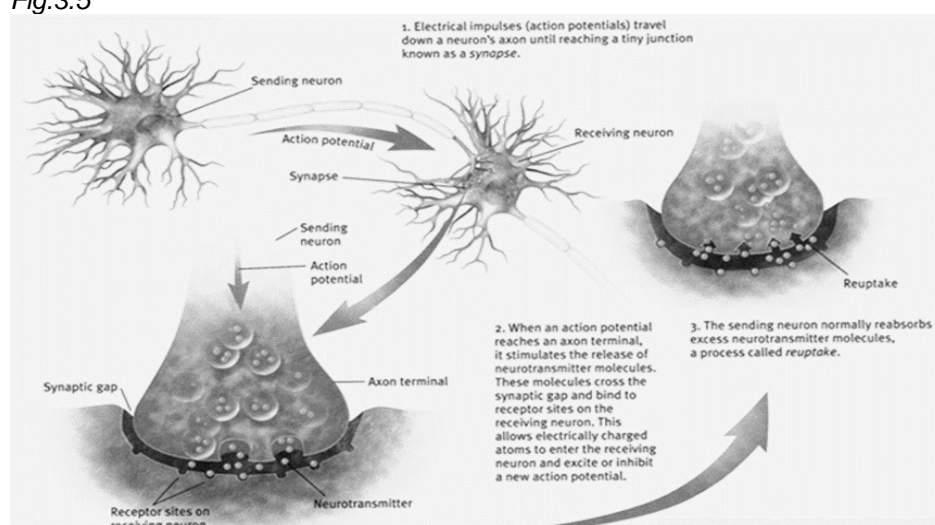
Each neuron is itself a miniature decision making device performing complex calculations as it receives signals from hundreds or even thousands of other neurons. Most signals are excitatory that is like pushing a neuron's accelerator, some are inhibitory, that is like pressing the break. If excitatory signals minus the inhibitory signals exceed a minimum intensity or threshold, the combined signals trigger an action potential. It is similar to saying, majority wins. If excitatory signals are more than inhibitory signals then action potential takes place. When a neuron does fire, it fires in an all-or-none fashion. Neurons are either firing at full strength or not firing at all. Increasing the level of stimulation above the threshold does not increase the neural impulse's intensity. However, a strong stimulus can trigger more neurons to fire and to

fire more often and more quickly. But it does not affect the action potential's strength or speed. See Fig. 3.4.

3.2.3 How Neurons Communicate:

Now let us see how do neurons communicate with each other and with the body. If you see fig. 3.1, you will see that at the end point, axon has many branches that are called axon terminals. Dendrites of receiving neuron and axon terminals of message sending neuron don't touch each other. The axon terminal of one neuron is separated from the receiving neuron by a synaptic gap /synaptic cleft which is less than a millionth of an inch wide. So how do the neurons send message across the tiny synaptic gap.

Fig.3.5



The answer is that the tip of each axon terminal has a little knob on it. These knobs are called synaptic knob or terminal buttons. The synaptic knob has a number of little saclike structures in it that are called synaptic vesicles. These synaptic vesicles are filled with fluid and a chemical substance called neurotransmitters. When an action potential reaches the synaptic knob/terminal button at the axon's end, it triggers release of chemical messengers called neurotransmitters. Within $1/10,000^{\text{th}}$ of a second, the neurotransmitter molecules cross the synaptic gap and bind to the receptor sites on the receiving neuron. The dendrites of a receiving neuron contain special little locks called receptor sites. These locks have a special shape that allows only a particular molecule of neurotransmitter to fit into it, just as a key fit into a lock. The neurotransmitter unlocks tiny channels at the receiving site and electrically charged atoms flow in, exciting or inhibiting the receiving neuron's readiness to fire. Then in a process called **reuptake**, the sending neuron reabsorbs the excess neurotransmitters. See Fig 3.5.

3.2.4 How Neurotransmitters influence us:

Research studies have shown that neurotransmitters influence our hunger, thinking, depression and euphoria, addiction and therapy and many other functions. However, right now we will see the influence of neurotransmitters on our motions and emotions. Particular neurotransmitters affect specific behaviors and emotions. However, neurotransmitter systems don't operate in isolation, they interact and their effects vary with the receptors that they stimulate. For example, a neurotransmitter called Acetylcholine plays a role in learning and memory. It is also the messenger at every junction between motor neurons (which carry information from the brain and spinal cord to the body) and skeletal muscles. When ACh is released to our muscle cell receptors, the muscle contracts. If ACh transmission is blocked as happens during some kinds of anesthesia, the muscle cannot contract and we are paralyzed.

Our body releases several types of neurotransmitter molecules similar to morphine in response to pain and vigorous exercise. These **endorphins** explain why people have good feeling as "runner's high", the painkilling effect of acupuncture, and the indifference to pain in some severely injured people. So, endorphins lessen pain and boosts good mood.

3.2.5 Impact of Drugs and Other Chemicals on Neurotransmitters:

When the brain is flooded with opiate drugs such as heroin and morphine, the brain may stop producing its own natural opiates. When the drug is withdrawn, the brain may then be deprived of any form of opiate, causing intense discomfort. For suppressing the body's own neurotransmitter production, nature charges a price. Drugs and other chemicals affect brain chemistry at synapses, often by either exciting or inhibiting neuron's firing.

Agonist molecules may be similar enough to a neurotransmitter to bind its receptor and mimic its effects. Some opiate drugs are agonists and produce a temporary "High" by amplifying normal sensation of arousal and pleasure.

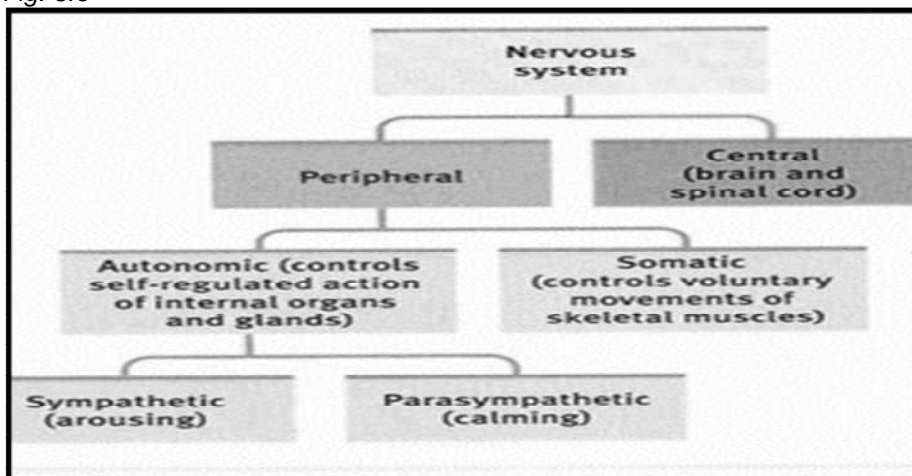
Antagonists also bind to receptors but their effect is instead to block a neurotransmitter's functioning. **Botulin**, a poison that can form in improperly tinned food, causes paralysis by blocking ACh release. Small injections of botulin- Botox- smooth wrinkles by paralyzing the underlying facial muscles. These antagonists are enough like the natural neurotransmitters to occupy its receptor sites and block its effects. But they are not similar enough to stimulate the receptor. It is like having a foreign coin which is identical to size and shape of Indian coin that fits into vending machine slot but won't operate the machine. **Curare**, a poison that

hunters apply to arrow's tips occupies and blocks ACh receptor sites on muscles, so that animal struck with arrow gets paralyzed.

3.3 THE NERVOUS SYSTEM

The essence of living is to take in information from the world and the body's tissues, to make decisions and to send back information and orders to the body's tissues. All this happens due to our body's nervous system. So, let us see how our nervous system works. The nervous system is the body's speedy, electrochemical communication network, consisting of all the nerve cells of the peripheral and central nervous system. Nerves are like electric wires. These nerves are formed by bundles of axons and link the CNS with the body's sensory receptors, muscles and glands. Our nervous is broadly divided into two parts- (see Fig.3.6& Fig.3.7)

Fig. 3.6

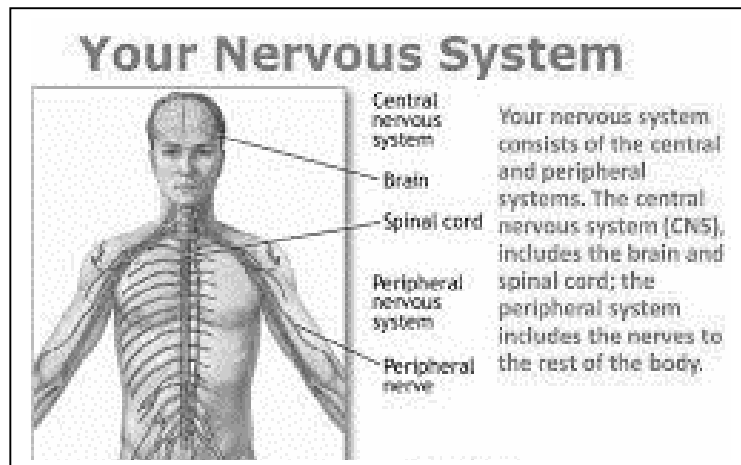


3.3.1 The Central Nervous System (CNS)

It consists of the brain and spinal cord. It is the body's decision maker. Both the brain and the spinal cord are composed of neurons that control the life sustaining functions as well as all thoughts, emotions and behavior.

The Brain: The brain enables our humanity – our thinking, feeling and acting. It consists of approximately 40 billion neurons, each connecting with roughly 10,000 other neurons. The brain's neurons cluster into work groups called **neural networks**. Just as people tend to network with their neighbors, similarly, neurons network with nearby neurons with which they can have short, fast connections. Neurons that fire together wire together. For instance, learning to play violin, speaking a foreign language, solving a math problem takes place as feedback strengthens connections.

Fig.3.7



The Spinal Cord: It is a two-way information highway connecting the peripheral nervous system and the brain. The inner part of spinal cord appears to be grey while outer part appears to be white. The inner part of spinal cord is mainly composed of cell bodies of neuron and outer part of spinal cord consists of axons and nerves. The outer section of spinal cord is merely a message pipeline, bringing messages from the body up to the brain and messages or decisions from the brain down to the body.

There are three types of neurons- sensory neurons that carry messages from the senses to spinal cord, motor neurons that carry messages from the spinal cord to the muscles and glands and interneurons that connect the sensory neurons to the motor neurons and make up the inside of the spinal cord and the brain itself.

The Reflex: Our reflexes are our automatic responses to stimuli and are an example of how our spinal cord works. The inner part of spinal cord which is made up of cell bodies is actually a primitive sort of brain. This part of the spinal cord is responsible for certain reflexes which are very fast, lifesaving reflexes. A simple spinal reflex pathway is composed of a single sensory neuron and a single motor neuron and these often communicate through interneuron. For example, knee-jerk response, even a headless warm body can do it.

Another such pathway enables the **pain reflex**. When our finger touches a flame, neural activity (excited by the heat) travels via sensory neuron to interneurons in our spinal cord. These interneurons respond by activating motor neurons leading to the muscles in our arm. Since the simple pain reflex pathway runs through the spinal cord and right back out, our hand jerks away from the flame before the brain receives and responds to the information that caused us to feel the pain. This is the reason why it appears that our hand jerks away not by our choice but on its own.

The question comes to mind that if information travels to and from the brain through the spinal cord, what will happen if the top of spinal cord is severely damaged. Then there will be no connection between brain and spinal cord. Logically then, with your brain literally out of touch with your body, you would lose all sensation and voluntary movement in body regions with sensory and motor connections to the spinal cord below its point of injury. The research shows that we are capable of giving a response even when certain brain centers are damaged. For instance, Goldstein(2000) reported that when the brain center controlling the erection is damaged, men paralyzed below the waist were capable of having an erection(a simple reflex) when their genitals were stimulated.

3.3.2 The Peripheral Nervous System (PNS):

It is responsible for collecting information and for transmitting central nervous system's decisions to other parts of the body. The peripheral nervous system has two parts – Somatic and autonomic nervous system.

Somatic nervous system:

It enables voluntary control of our skeletal muscles. It is made up of all the nerves carrying messages from the senses to the CNS and all of the nerves carrying messages from the CNS to the muscles of the body- especially the skeletal muscles, that is, muscles connected to the bones of our body. This allows people to move their bodies. For example, when people are walking, raising their hands in class, smelling a flower or seeing a pretty picture, they are using somatic nervous system.

Autonomic nervous system:

While the somatic part of the peripheral nervous system controls the senses and voluntary muscles, the autonomic part of the peripheral nervous system controls everything else in the body such as organs, the glands and the involuntary muscles of our internal organs and influences activities such as heartbeat, digestion and glandular activity. Usually this system operates on its own, that is why it is called autonomic nervous system.

Autonomic nervous system also consists of two parts-

- the sympathetic nervous system and
- parasympathetic nervous system.

The sympathetic nervous system:

It is located in the middle of the spinal cord column, running from near the top of the ribcage to the waist area. It arouses and expends energy. If something alarms or challenges us (e.g. coming across a snake) our sympathetic nervous system will increase the heartbeat, raise our blood pressure, slow our digestion, raise blood

sugar and cool us with perspiration. This makes us alert and ready for action. The heart draws blood away from nonessential organs such as skin (so at first the person may appear pale), and sometimes draws blood from even the brain itself (so the person might actually faint). Blood needs lot of oxygen before it goes to the muscles, so the lungs work overtime too (the person may begin to breath faster). While dealing with a stressful situation, digestion of food and elimination of waste are not necessary functions, so these systems tend to be shut down. Saliva dries up, the urge to go to the bathroom will be suppressed but if the person is really scared, the bladder or bowels may actually empty.

In fact, the sympathetic nervous system is known as “fight-or-flight system” because it allows people and animals to deal with all kinds of stressful events. The sympathetic division’s job is to get the body ready to deal with the stress. It is also said that the sympathetic division is in sympathy with one’s emotions. These emotions may be anger, extreme joy, or extreme excitement. Even extreme emotions can be stressful and it deals with them.

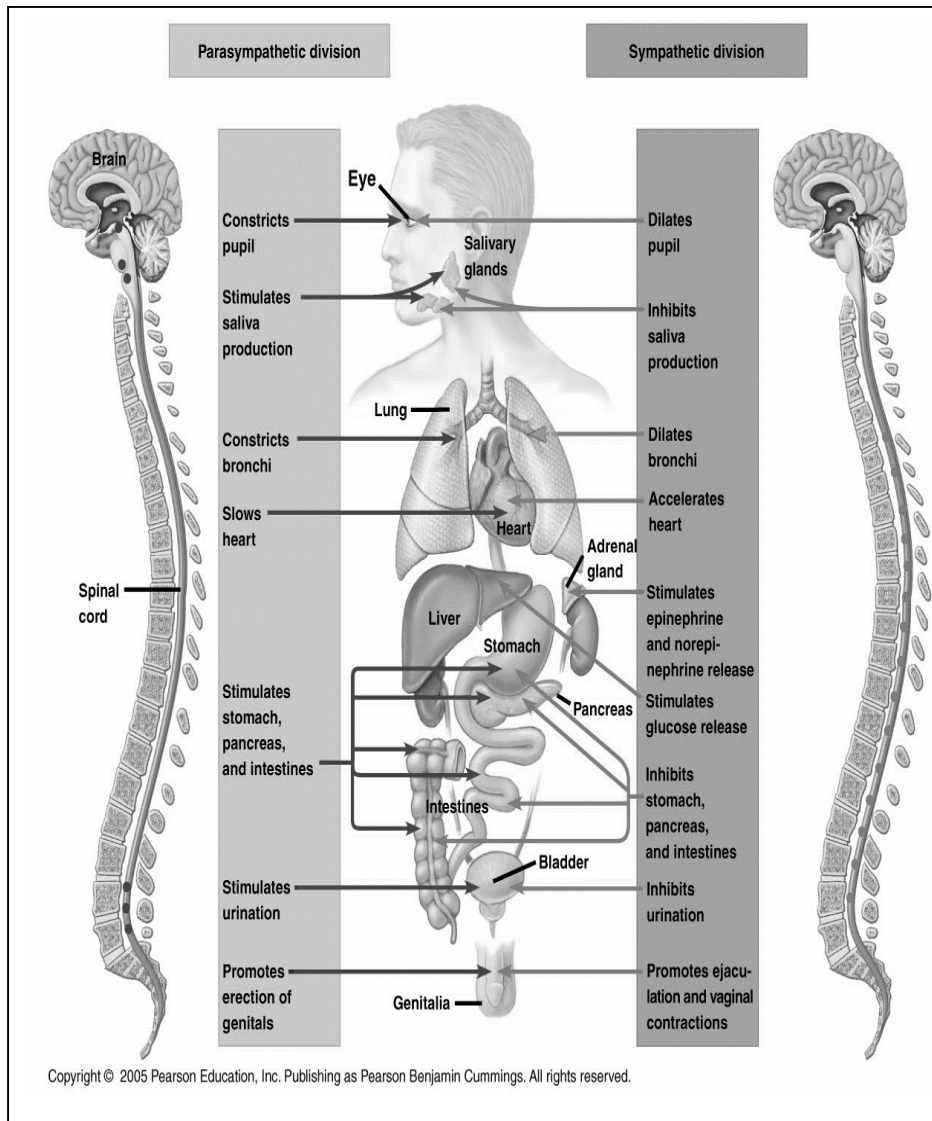
The parasympathetic nervous system:

It gets activated once the danger is over and it will produce opposite effects. It will conserve our energy by decreasing our heart beat, lowering blood sugar, constricts the pupils, reactivates digestion and excretion, etc.

In everyday situations, the sympathetic and parasympathetic nervous systems work together to keep us in a steady internal state. In other words, its job is to restore the body to normal functioning after a stressful situation ends.

If the sympathetic division can be called the fight-or-flight system, the parasympathetic division can be called “the-eat-drink-and-rest system”. The neurons of this division are located at the top and bottom of the spinal column or either side of the sympathetic division of neurons. The parasympathetic division does more than just react to the activity of the sympathetic division. It is responsible for most of the ordinary, day to day bodily functioning. It keeps the heart beating regularly, breathing normal, and digestion going. People spend most part of the day in eating, sleeping, digesting and excreting. So, it is the parasympathetic division that is normally active.

Fig 3.8



See Fig 3.8 to see the summary of difference between sympathetic and parasympathetic division.

3.4 CHECK YOUR PROGRESS:

Write short notes on

- Importance of studying human biology
- Structure of neuron
- Action potential
- Influence of neurotransmitters
- Impact of drugs and other chemicals on neurotransmitters
- The peripheral nervous system
- The central nervous system
- Sympathetic division of the autonomic nervous system
- Parasympathetic division of the autonomic nervous system

3.5 SUMMARY:

In this unit, we began with why it is necessary for us to understand the biological part of human body. We said our cognitive part is intertwined with our biological part. While talking about the biological part we have concentrated on nervous system. The smallest unit of nervous system is neuron. So we discussed the structure and functioning of neuron. We also discussed how communication takes place among neurons, how neurotransmitters influence our actions, motions and emotions, and how neurotransmitters get influenced by certain drugs and chemicals. Then we discussed the nervous system in broader terms, where we said that nervous system is divided into two parts- central nervous system (that consists of brain and spinal cord) and peripheral nervous system (that consists of nerves reaching out to each and every part of the body. The peripheral nervous system can be further divided into somatic and autonomic nervous system and autonomic nervous system can be further divided into the sympathetic and parasympathetic nervous system. The sympathetic nervous system gets activated when we are faced with extremely stressful situation and it readies body to face that challenging situation. On the other hand, the parasympathetic division of autonomic nervous system helps us to cool down after the stressful situation is over and it is involved in our daily activities.

3.6 QUESTIONS:

1. With the help of a diagram, explain the structure and functioning of a neuron.
2. Write a detailed note on neural communication.
3. How neurons communicate and how neurotransmitters influence us?
4. Explain in detail action potential and how neurons communicate.
5. What are the functions of the nervous system's main divisions?

3.7 REFERENCE:

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



THE BIOLOGY OF MIND - II

Unit Structure :

- 4.0 Objectives
- 4.1 Introduction
- 4.2 The Endocrine System
- 4.3 The Brain - The Tools of Discovery
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4.0 OBJECTIVES:

After reading this unit you will be able –

- To understand the role of various glands in influencing our body functions and behavior
- Understand the structure of brain and functions of various parts of brain

4.1 INTRODUCTION:

In previous unit, we studied about the neurons. In present unit, we will look at endocrine system –a set of glands that are interconnected with our nervous system and play a significant role in the growth and functioning of the body. We had also mentioned before a famous saying by Descartes, a French philosopher, that “I think, therefore I am”. We exist as vibrant, full of life human beings, because we have a very complex organ in our body called brain. Our brain differentiates us from other species of animal kingdom and frees us from instincts. It is because of our brain that we are not merely responding to the environment and merely surviving, we are also thinking, storing memories, knowledge and we are creating. Our brain enables us to have foresight, imagine and plan and it is due to our brain that we are able to develop technology that has helped us to conquer not only the other species who are bodily much stronger to us, but also to travel beyond our planet. So, let us see, how our endocrine system and brain functions.

4.2 THE ENDOCRINE SYSTEM:

The endocrine system is a second communication system interconnected with our nervous system. The endocrine system is the collection of glands that produce hormones that regulate metabolism, growth and development, tissue function, sexual function, reproduction, sleep, and mood, among other things.

The endocrine system is made up of the pituitary gland, thyroid gland, parathyroid glands, adrenal glands, pineal gland, pancreas, ovaries (in females) and testicles (in males). The endocrine system affects almost every organ and cell in the body. The glands secrete a form of chemical messengers that is called hormones. These hormones travel through the blood stream and affect other tissues, including the brain. When hormones act on the brain, they influence our interest in sex, food and aggression. Some hormones are chemically identical to neurotransmitters. So we can say that endocrine system and nervous system are close relatives. Like relatives, they are similar to each other yet there are subtle differences between them. For instance, in nervous system the message travels at a fraction of a second while in endocrine message through bloodstream takes several seconds or more to travel from gland to the target issue. It is similar to saying that nervous system messages are like text messages while endocrine messages are like posting a letter.

However, endocrine messages have long lasting effects than neural messages. That is why, when we get upset, it takes time for us to cool down. When we face any danger, the adrenal gland which is situated on top of the kidney releases epinephrine and norepinephrine (or what we call adrenaline and noradrenaline). These hormones increase heart rates, blood pressure and blood sugar, enabling us to have a surge of energy to deal with the emergency. But when the emergency passes away, the hormones and the feelings of excitement lingers for some time before fading.

Another endocrine gland that is most influential is pituitary gland. It is a pea sized gland situated in the core of the brain, where it is controlled by an adjacent brain area- the hypothalamus. The pituitary gland releases certain hormones such as growth hormone that stimulates physical development and oxytocin hormone. Oxytocin hormone enables uterine contractions associated with birthing, milk flow during nursing and orgasm. Oxytocin also promotes pair bonding, group cohesion and social trust. In an experiment, it was found that those who were given a nasal spray of oxytocin were more likely to trust strangers with their money than those who were not given spray of this hormone (Kosfeld et.al., 2005)

Pituitary secretions also influence the release of hormones by other endocrine glands. Thus, we can say, pituitary gland is like a master gland which is controlled by hypothalamus. For example, a stressful event triggers hypothalamus, hypothalamus instructs pituitary gland to release a hormone that causes adrenal glands to release cortisol, a stress hormone that increases blood sugar.

Fig.4.1



Figure 4.1 reveals the intimate connection of the nervous and endocrine systems.

The Pineal gland: The Pineal gland is also located in the brain, nearer to the back. It secretes melatonin hormone that controls circadian rhythm, induction of drowsiness and lowering of the core body temperature. In other words, it regulates the sleep-wake cycle.

The Thyroid Gland: The thyroid gland is a butterfly-shaped gland located at the base of the neck. It releases hormones to regulate metabolic rate of our body by stimulating body oxygen and energy consumption. It also plays a role in bone growth and development of the brain and nervous system in children. Thyroid hormones also help maintain normal blood pressure, heart rate, digestion, muscle tone, and reproductive functions.

Parathyroid Gland: It regulates calcium levels in the blood and bone metabolism.

Pancreas: The pancreas has digestive and hormonal functions. One part of the pancreas, the exocrine pancreas, secretes digestive enzymes. The other part of the pancreas, the endocrine pancreas, secretes hormones called insulin and glucagon. These hormones regulate the level of glucose in the blood.

4.3 THE BRAIN - THE TOOLS OF DISCOVERY:

In ancient times, scientists had no tools to study a living human brain. They used to dissect the brains of dead humans and animals to understand how brain worked. But it was impossible to tell the functioning of various parts of brain from the dead brain.

Early clinical observations by doctors and psychologists revealed that there is some connection between brain and mind. For example, it was found that damage to one side of the brain often caused numbness or paralysis on the body's opposite side.

This suggested that body's right side is wired to the left side of the brain and left side of the body is wired to right side of the brain. It was also observed that our vision or ability to see clearly was impacted with the damage to the back portion of the brain and a person will have speech difficulties if the left-front part of the brain is damaged.

However, now many new techniques have been developed to study living brain. Some of them are –

Deep Lesioning and Electrical Stimulation:

One way to study the functioning of various areas of the brain is by damaging those areas selectively and deliberately, and then studying its impact on animals or humans' abilities. Another way is that instead of destroying the part of brain, scientists may just stimulate electrically some particular area of the brain and watch the results. Both destroying and stimulation of specific areas of brain is done by same method. A thin wire insulated everywhere except the very tip is surgically inserted into the brain of the test animal. If brain tissue is to be destroyed then a strong electric current is passed through the tip of the wire to destroy the neurons. This is called deep lesioning. We obviously need to do studies using this method only with animals for ethical reasons.

In the laboratory, studies have shown that damage to one area of hypothalamus in a rat's brain reduces eating to the point of starvation, whereas damage to another area of brain produces overeating.

If researchers want to only stimulate a particular area of the brain, then a mild current is passed through the tip of the wire, causing the neuron to react as if they have received a message. This is called electrical stimulation of the brain. Now days, neuroscientists can also chemically or magnetically stimulate parts of brain.

Laboratory studies using this stimulation method have shown that depending on the stimulated part of the brain people may giggle, hear voices, turn their head, feel themselves falling or they may have out – of - body experience.

Scientists, now days can also study the messages of individual neurons. For example, modern microelectrodes (very small tip of the wire) can detect, exactly where the information goes in a cat's brain when someone strokes its whiskers. Researchers can also listen the chatter of billions of neurons and can see color representations of the brain's energy consuming activity.

The EEG:

Our mental activities emit electrical, metabolic and magnetic signals that help scientists to study the brain at work. This is a very safe way to study the activity of the living brain. Electrical activity in the brain's billions of neurons creates regular waves across its surface. Scientists study these electrical activities by using a method called electroencephalogram (EEG). EEG is an amplified read-out of these electrical waves. Researchers record the brain waves through a shower cap like hat that is filled with electrodes that are covered with a conducting gel. Electrodes are small metal disks that are placed directly on the skin of the skull. These microelectrodes are attached to wires and the wires are attached to pens that rest on the moving graph paper. These microelectrodes can detect electrical activity which causes pens to move and create short irregular curvy lines or waves that indicate many things, such as stages of sleep, seizures, presence of tumors, etc. The EEG can also be used to identify which areas of the brain are active during tasks such as reading, writing, and speaking.

PET (Positron emission tomography):

PET is a neuroimaging technique that allows us to see inside the living brain. It shows the picture of brain activity by showing each brain area's consumption of its chemical fuel, the sugar glucose. The person, whose brain the scientist wants to study, is injected with a radioactive glucose. The computer detects the activity of the brain cells by looking at which cells are using up the radioactive glucose and projecting the image of that activity onto a monitor. Active neurons are glucose hogs and after a person receives temporarily radioactive glucose, the PET scan can track the gamma rays released by this "food for thought" as the person performs the given task. The computer uses colors to indicate different levels of activity. Areas that are very active usually show up as white or very light and the areas that are inactive show up as dark blue. With this method, researchers can actually have the person perform different tasks while the computer shows what his brain is doing during the task. PET scan can show which brain areas are most active when the person is doing mathematics calculations, looks at images of faces, or daydreams.

MRI (Magnetic Resonance Imaging):

The person's head is put in a strong magnetic field, which aligns the spinning atoms of brain molecules. Then a radio wave pulse momentarily disorients the atoms. When the atoms return to their normal spin, they give out signals that provide a detailed picture of soft tissues, including the brain.

Since many images are taken milliseconds apart, it shows how the brain responds to different stimuli, enabling researchers to study both the functional and structural brain abnormalities in

psychological disorders. MRI scans have revealed a larger than average neural area in the left hemisphere of musicians who display perfect pitch. They have also revealed enlarged ventricles, that is fluid filled areas, in some patients of schizophrenia.

fMRI (Functional MRI):

fMRI can reveal the brain's functioning and its structure. Blood goes to the parts of brain that are active. By comparing MRI scans taken less than a second apart, researchers can watch as specific brain areas are activated and oxygen-laden bloodflow increases. For example, when a person looks at a picture, the fMRI machine detects blood rushing to the back of the brain because that area processes visual information. Such pictures of the brain's changing activity give us a new insight into how brain divides its work. For instance, a fMRI study suggested which part of the brain is most active when people feel pain or rejection, listen to angry voices, think about scary things, feel happy or become sexually excited. In another study, 129 people were given eight different tasks to perform such as reading, gambling or rhyming and their brains were studied through fMRI. It was found that neuroscientists were able to predict with 80% accuracy what mental activity was being done by the participant.

All these techniques to study brain have helped psychologists in the same way as microscope helped the biology and telescope helped in astronomy.

4.3.1 Older Brain Structures:

The capacities of human beings and animals come from their brain structures. In primitive animals, brain structure is very simple and regulates basic survival functions. In lower mammals, a more complex brain structure enables emotions and greater memory apart from survival functions. In advanced mammals such as human beings, a more advanced brain structure processes more information and enables increased foresight apart from all other functions performed by less advanced brain structures.

The increased complexity of human's brain comes from new brain system that is built on top of the old brain system. Just as in case of earth, if we dig deeper, we can see the original rocks on which new landscapes have come up, similarly, if we dig deep down, we can see the fossil remnants of the past that is brainstem components performing the same tasks that they did for our ancestors.

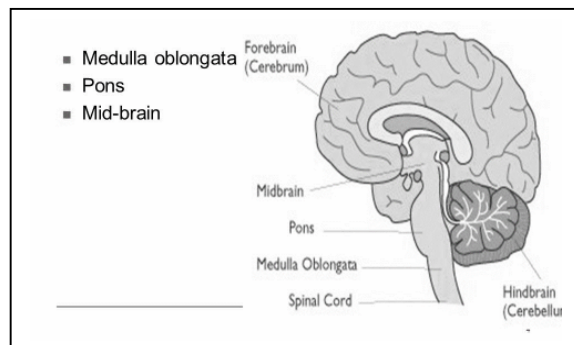
So, let us start with the base of the brain and then study the top portion of the brain or the newer systems of the brain.

The Brainstem:

The brain stem is the oldest and innermost part of the brain. The brainstem consists of the medulla oblongata, pons, and midbrain.

The medulla oblongata: The medulla oblongata is the lower half of the brainstem continuous with the spinal cord. Its upper part is continuous with the pons. It begins where the spinal cord swells slightly after entering the skull. This slight swelling is called medulla. (See Fig. 4.2) The medulla contains the cardiac, respiratory, vomiting and vasomotor centres dealing with heart rate, breathing and blood pressure. We don't need higher brain or conscious mind to regulate our heart's rate and breathing. The brainstem takes care of those tasks. It is in the medulla that the nerves coming from and going to the left and right side of the body cross over, so that the left side of the brain controls the right side of the body and vice versa.

Fig.4.2



The Pons: The Pons lies between the medulla oblongata and the midbrain. The pons is the larger swelling just above the medulla. The term pons in Latin means bridge and the pons is actually a bridge between the lower and upper part of the brain. It influences sleep and dreaming, helps in coordinating the movements of right and left sides of the body and arousal.

The midbrain: The midbrain is a small region of the brain that serves as a relay center for visual, auditory, and motor system information. It is front part of the brainstem, and any disruption to this area can cause irreversible damage and impairment. Illnesses most commonly associated with this region of the brain are stroke, schizophrenia, and Parkinson's disease.

The Thalamus:

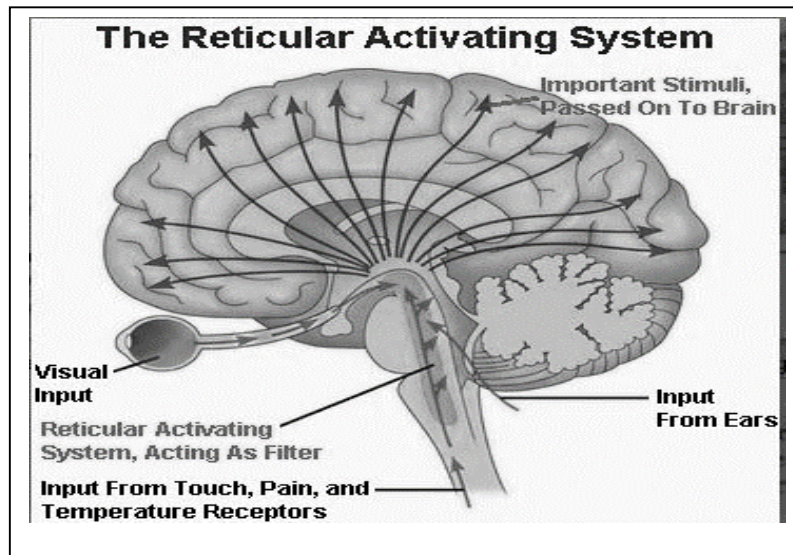
Just above the brain stem is the thalamus. It is a pair of egg shaped structures. The thalamus receives information from all the senses except smell and relays this information to the higher brain regions which deal with seeing, hearing, tasting and touching,

where it can be processed. If this part of the brain is damaged, all sensory information would not be processed and sensory confusion will take place.

The Reticular Formation:

Inside the brainstem, between your ears, the reticular formation extends through the central core of the medulla, pons, and stops in the midbrain. It is an intricate system composed of finger shaped network of neurons that extends from the spinal cord through thalamus.(See Fig. 4.3) It regulates arousal, attention, sleep and awaking cycle. It filters incoming stimuli to discriminate irrelevant background stimuli. Basically, it allows people to ignore constant unchanging information (such as the noise of a fan) and become alert to changes in the information (for example, if the noise of the fan stops).

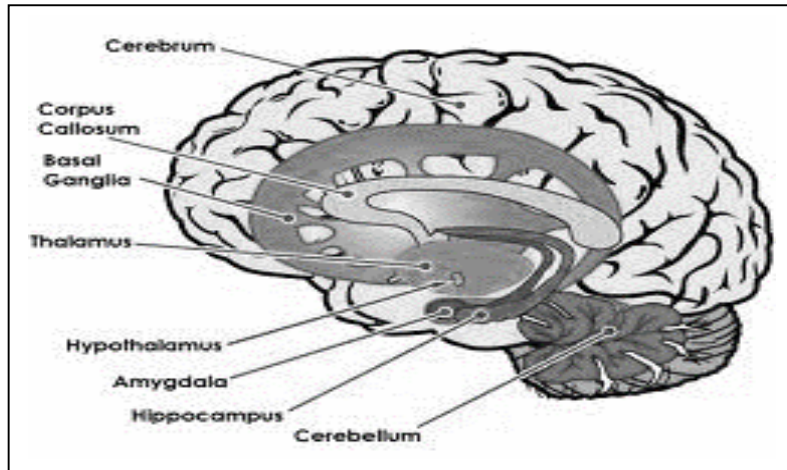
Fig.4.3



It is essential for governing some of the basic functions of higher organisms and is one of the oldest part of the brain. Damage to the reticular formation can lead to coma or death. In less severe cases, a damaged reticular formation can cause fatigue, changes in sexual arousal and disrupted sleep patterns.

The cerebellum:

Fig.4.4



Cerebellum is placed at the base of the skull just behind the pons and below the main part of the brain. It looks like a small brain. Cerebellum means little brain. The cerebellum is part of the lower brain. The cerebellum is not unique to humans. Evolutionarily speaking, it is an older portion of the brain. It is present in animals that scientists believe existed before humans. The cerebellum makes up approximately 10% of the brain's total size but it accounts for more than 50% of the total number of neurons located in the entire brain. In adults, it weighs around 150 gm.

Functions of Cerebellum: It helps -

- to judge time, modulate our emotions and
- to discriminate sounds and textures.
- to coordinates voluntary movements (especially those movements that have to happen in rapid succession such as walking, diving, skating, dancing, typing, playing musical instrument and even the movement of speech) – It controls the timing and pattern of muscle activation during movement.
- To maintain balance and equilibrium- people can sit upright because the cerebellum controls all the little muscles needed to keep them from falling out of their chair. Because of cerebellum, people don't have to consciously think about their posture, muscle tone and balance.
- It enables nonverbal learning and memory.
- Learned reflexes, skills and habits are also stored here which allows them to become more or less automatic.
- It also contributes to emotional responses.

If a person's cerebellum is damaged, he will have difficulty in walking, standing, keeping his balance or shaking hands. He can't even get a spoon to his mouth. The movements will be jerky and exaggerated. He won't be able to dance or play any musical instruments such as guitar. Alcohol influences cerebellum and that is why a drunk person cannot walk properly, or drive properly. People with damaged cerebellum may also suffer from tremors, cannot judge distance and when to stop, are unable to perform rapid alternating movements. They have slurred speech and abnormal eye movements.

The Limbic System:

Brain stem is the oldest part of the brain and the cerebral hemisphere is the highest and newest region of the brain. Between the oldest and newest brain areas lies the limbic system. It derives its name from a Latin word *Limbus* which means border. In this case, forming a border around the brain stem. The Limbic system contains three parts – the amygdala, the hypothalamus, and the hippocampus. (See Fig.4.4)

The Amygdala:

Amygdala is almond shaped mass of nuclei located near the hippocampus. It is involved in emotional responses, hormonal secretions, and episodic-autobiographical memory. Research has linked amygdala to aggression and fear. Information from the senses goes to the amygdala before the upper part of the brain is even involved, so that people can respond to danger quickly, sometimes before they are consciously aware of what is happening.

Research has shown that damage to amygdala causes loss of the aggressive behavior, and fear (Kluver & Bucy 1939). Another research showed that electrical stimulation of one part of an amygdala makes a docile pet cat aggressive while electrical stimulation of another part of amygdala makes it fearful.

The Hypothalamus:

The hypothalamus is a very small (size of an almond) but very powerful part of the brain that is located just below the thalamus and is part of the limbic system. 'Hypo' means 'just below', since it is just below the thalamus, it is called hypothalamus. It links the nervous system to the endocrine system via the pituitary gland. It sits right above the pituitary gland and controls the pituitary gland by either stimulating or inhibiting the secretion of pituitary hormones. Pituitary gland is called 'master gland' because it controls the functions of all other endocrine glands, so the ultimate regulation of hormones lies with the hypothalamus.

Functions of the hypothalamus: It regulates –

- Body temperature,
- Thirst,
- Hunger and weight control,
- Fatigue,
- Sleep cycles
- Sexual activity,
- Emotions,
- Important aspects of parenting and attachment behaviors.
- Childbirth
- Blood pressure and heart rate
- Production of digestive juices
- Balancing bodily fluids

As signals are sent to the brain from different areas of the body, they let the hypothalamus know if balance is not being achieved. The hypothalamus then responds by releasing the right hormones into the bloodstream to balance the body back out.

One example of this is the body's ability to maintain an internal temperature of 98.6°F. If the hypothalamus receives the signal that the body's internal temperature is too hot, it will tell the body to sweat. If it receives the signal that the temperature is too cold, the body will create its own heat by shivering.

Olds and Milner (1954) accidentally made a remarkable discovery about the hypothalamus. They were trying to implant an electrode in a rat's reticular formation but inadvertently placed it in hypothalamus. They observed that the rat kept returning to the location where it had been stimulated by this misplaced electrode. Thus, they discovered a brain center that gives pleasure rewards. In a series of experiments later on, they went on to discover other 'pleasure centers' in hypothalamus. Other scientists called these pleasure centers as reward centers. It was observed that when rats with implanted electrodes were allowed to press pedals to trigger their own stimulation in these areas, rats kept pressing the pedals at a very high speed – sometimes up to 7000 times an hour – till they dropped from fatigue. Not only that, to get this stimulation, they would even cross an electrified floor, that normally a starving rat would not do to reach food.

In fact, research with animals have shown that both a general dopamine related reward system and specific centers associated with pleasures of eating, drinking and sex are activated by the stimulation of different parts of hypothalamus. The question arises can we generalize this research to human beings also? The answer is yes. Research has shown that human beings also have limbic centers for pleasure. In one study, a neurosurgeon implanted

an electrode in such areas to calm a violent patient. Stimulated patient reported mild pleasure, though he did not show the same intensity as the stimulated rat showed in Old's experiment. Other experiments have shown the effects of a dopamine related reward system also.

Researchers believe that addictive disorders such as alcoholism, drug abuse, binge eating may be originating from malfunctioning in natural brain systems for pleasure and wellbeing. People who are genetically predisposed to reward deficiency syndrome may crave for whatever gives that missing pleasure or relieves negative feelings.

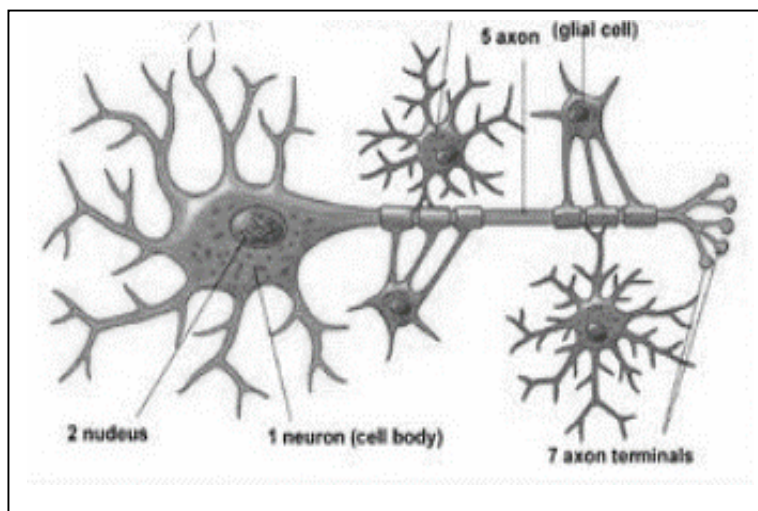
The Hippocampus:

The hippocampus is the Greek word for "seashore". The hippocampus looks like seashore. The hippocampus plays an important role in the consolidation of information from short term memory to long term memory and in spatial memory that enables navigation. It processes conscious memories and converts them in long term memory. Animals or humans who lose their hippocampus due to surgery or injury, lose their ability to form new memories (recent memory) of facts or events. Elderly people who develop memory problems associated with deterioration of the hippocampus tend to forget where they live, where they kept their keys, and similar location problems.

4.3.2 The cerebral cortex:

If we open up the skull of a human being and look inside, the brain looks like a wrinkled organ, almost resembling the meat of an oversized walnut. This wrinkled portion that you are seeing is cerebral cortex. Underneath cerebral cortex is the cerebrum. The cerebrum is the largest part of the brain, forming 85% of its weight. The cerebrum consists of two cerebral hemispheres joined by a curved thick band of nerve fibers called corpus callosum. The cerebral cortex is a thin surface layer that covers two hemispheres of cerebrum just like the bark covers a tree trunk. This thin layer is made up of interconnected neural cells. It is formed of grey and white matter. The two hemispheres are filled with axons connecting the cortex to the brain's other regions. The cerebral cortex – the thin layer contains 20 to 23 billion nerve cells and 300 trillion synaptic connections.

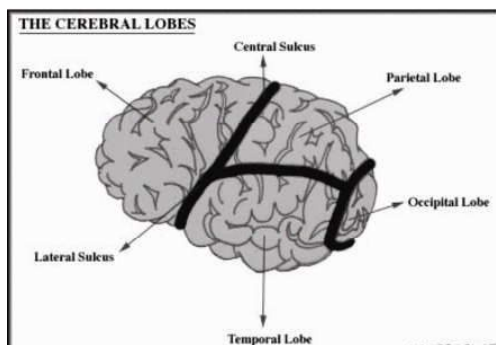
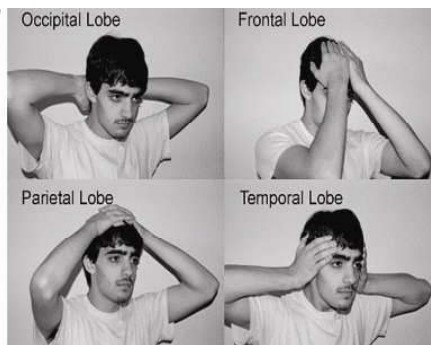
These billions of nerve cells are supported by glial cells (glue cells). Glial cells are the non-excitabile supporting cells of the nervous system. These glial cells are nine times more than neurons and look like spiders. They support the neurons and are involved in the nutrition and maintenance of nerve cells. One can say, neurons are like queen bee while glial cells are like worker bees. (See Fig. 4.5)

Fig.4.5

Apart from providing nutrition, they give insulating myelin, guide neural connections and mop up ions and neurotransmitters. Because of their non-conducting nature, the glial cells act as insulators between the neurons and prevent neuronal impulses from spreading in unwanted directions. They also play a part in our learning and thinking. By “chatting” with neurons, they participate in information transmission and memory. Although glia cells DO NOT carry nerve impulses (action potentials) they do have many important functions. In fact, without glia, the neurons would not work properly.

In complex animal brains, the number of glia cells compared to neurons increases. After Einstein's death, scientists carried out a postmortem of his brain and found that though he did not have more or larger than usual neurons but he had more than average concentration of glial cells.

The cerebral cortex is highly wrinkled. Essentially this makes the brain more efficient, because it can increase the surface area of the brain and the number of neurons within it. Animals like frog that have small cortex do not have too many wrinkles in their cerebral cortex. As we move up the ladder of animal life, the cerebral cortex expands and becomes more wrinkled. As the cerebral cortex expands, an organisms' adaptability increases and genetic control loosens. Since human beings and other mammals have larger cortex, their capacity for learning, thinking adaptability is higher. It is the complex functioning of our cerebral cortex that makes us distinctly human. Over time, the human cortex undergoes a process of *corticalization*, or wrinkling of the cortex. This process is due to the vast knowledge that the human brain accumulates over time. Therefore, the more wrinkly your brain, the smarter and more intelligent you are.

Fig.4.6**Fig.4.7**

Each hemisphere's cortex is subdivided into four lobes separated by prominent fissures or folds (see Fig. 4.6). These lobes are frontal, occipital, parietal and temporal lobes. The frontal lobes start from the front of the brain and moves upto the top of the brain. Frontal lobes are behind the forehead. The parietal lobes are at the middle section of the brain. The occipital lobes are at the back of the head and temporal lobes are just above the ears. (see approximate locations of lobes in Fig. 4.7) Each of the four lobes carry out many functions and many functions require interplay of several lobes. For instance, the frontal lobe is associated with reasoning, motor skills, higher level cognition, and expressive language. The parietal lobe is associated with processing tactile sensory information such as pressure, touch, and pain. Damage to the temporal lobe can lead to problems with memory, speech perception, and language skills. The occipital lobe is associated with interpreting visual stimuli and information. Damage to this lobe can cause visual problems such as difficulty recognizing objects, an inability to identify colors, and trouble recognizing words.

Motor Cortex:

Motor Functions: In 1870 physicians Gustav Theodor Fritsch and Eduard Hitzig, using awake dogs as their subjects, electrically stimulated the area of the brain we now know as the motor cortex and found that the stimulation caused the dogs to move involuntarily. Additionally, they found that stimulating the motor cortex in different locations caused different muscles to move. This experiment led to the identification of the motor cortex as the primary area of our brain involved with planning, controlling and executing voluntary movements. Signals sent to your muscles all originate in the motor cortex region. The motor cortex region is responsible for all voluntary muscle movements, like taking a drink of water or getting yourself out of bed in the morning. Scientists found that body areas that require precise control such as fingers and mouth occupy the greatest amount of cortical space. A Spanish neuroscientist Jose Delgado stimulated a spot on a patient's left motor cortex, triggering the right hand to make a fist. When he

asked the patient to keep his fingers open during the next stimulation, the patient's fingers closed despite his best efforts. This indicated that motor cortex has control over involuntary movements also. In another experiment Gibbs (1996) could predict a monkey's arm motion a 10th of a second before it moved, by repeatedly measuring motor cortex activity before specific arm movement. This indicated that motor cortex is also involved in intention and planning the movements. Such type of research studies have compelled scientists to look at brain computer interface. Initial studies done with monkeys on brain controlled computers have been successful. Brain controlled computers can be a boon for people who have suffered paralysis or amputation and cannot speak or move. In one of such research study, a paralyzed young man could mentally control a TV, draw shapes on a computer screen and play video games (Hochberg et.al. 2006).

Sensory Function:

The cortical area at the front of the parietal lobes, parallel to and just behind the motor cortex is called the sensory cortex. If we stimulate a point on the top of this band of tissue, the person may report being touched on the shoulder and if you stimulate some point on the side of this band of tissue, the person may feel something on the face. Visual information from eyes is received in the visual cortex in occipital lobes, at the back of the brain. If you are hit hard at the back of your head, you may go blind. If that area is stimulated, you may see flashes of light or dashes of color. (See Fig.4.8 & 4.9) The auditory cortex is situated in temporal lobes just above the ears and receives information from the ears. Most of this auditory information travels a circuitous route from one ear to the auditory receiving area above opposite ear.

Fig. 4.8

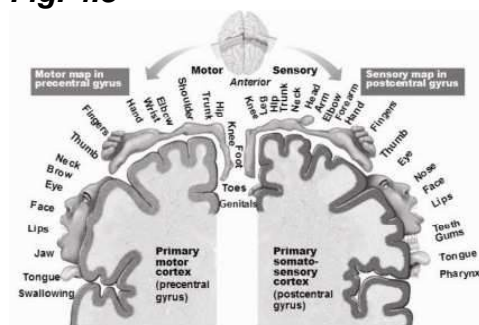
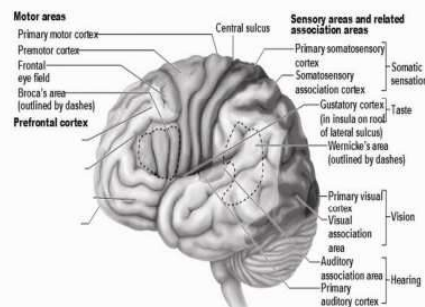


Fig. 4.9



The amount of cortex devoted to a particular body part is directly proportional to that part's sensitivity. For instance, our supersensitive lips project to a larger cortex area than do our toes.

Association Areas:

Association areas are made up of neurons in the cortex that are devoted to making connections between the sensory

information received in the brain and stored memories, images and knowledge. Association areas give meaning to sensory information coming in the brain. It means that these areas interpret, integrate and act on sensory information and link it to stored memories – a significant part of thinking. Unlike the sensory and motor areas, association area functions cannot be neatly mapped. Association areas take up an increasingly larger percentage of the cerebral cortex as brain size increases among different species.

Association areas are found in all four lobes. In the frontal lobes, they enable judgment, planning, and processing of new memories. Higher order association cortex carries out complex mental processes not associated with any particular sense. These highest mental processes, like language, thinking, and planning, do not depend on specific sensory information. Memory, language, attention and religious experience result from the synchronized activity among distinct brain areas. More than 40 distinct brain regions become active in different religious states, such as praying and meditating. So our mental experiences arise from coordinated brain activity.

People with damaged frontal lobes may have intact memories, high score on intelligence tests and good skills, but they would not be able to plan ahead to begin the skilled task.

Damage to frontal lobe can also change the personality of a person and remove his inhibitions. For example, the case of a railroad worker Phineas Gage. In 1848, he met with an accident, where an iron rod went through his left cheek and came out of the top of his skull. This severely damaged his frontal lobes. He was immediately able to sit and speak and later on return to his work. But he was no more friendly, soft spoken person. After this accident, he became irritable, disrespectful and dishonest person. His mental abilities and memories were intact but his personality had changed.

Similar results have been reported by other studies of damaged frontal lobes. People with damaged frontal lobes become less inhibited, impulsive and their moral judgments are not restrained by normal emotions. Their moral compass gets disconnected from their behavior.

Parts of association areas in the parietal lobes in Einstein's brain were large and unusually shaped. They are responsible for mathematical and spatial reasoning. Another association area, on the underside of the right temporal lobe, enables us to recognize faces. If this area is destroyed due to injury or stroke, a person would be able to describe facial features and recognize gender and age of the other person but will be unable to identify the person.

The Brain's Plasticity:

The brain plasticity refers to the brain's ability to CHANGE throughout life. In addition to genetic factors, the environment in which a person lives, as well as the actions of that person, play a significant role in plasticity.

Brain plasticity occurs in the brain:

- 1- At the beginning of life: when the immature brain organizes itself.
- 2- In case of brain injury: to compensate for lost functions or maximize remaining functions.
- 3- Through adulthood: whenever something new is learned and memorized

Plasticity and brain injury:

When brain gets damaged, two things happen –

1. Damaged neurons usually do not regenerate. If you get a cut on your skin, your skin cells regenerate and your wound gets healed, but that does not happen with neurons. If your spinal cord is severed, you would be paralyzed permanently.
2. Since brain functions seem to be preassigned to specific areas, if a newborn suffers damage to temporal lobe facial recognition areas, later on he will be unable to recognize faces.

However, there is a silver lining to this gloomy picture. Some neural tissues can reorganize in response to damage. As mentioned above, the brain is constantly changing, building new pathways as it adjusts to minor mishaps and new experiences. In young children, plasticity can occur even after serious damage. But in order to reconnect, the neurons need to be stimulated through activity.

Constraint-Induced Therapy:

This therapy can be used to rewire the brain and improve the dexterity of a brain damaged child or adult stroke victim. In this therapy, therapists force patients to not to use their fully functioning limb and to use "bad" hand or leg. This gradually reprograms the brain. For example, a 50 year old surgeon had suffered a stroke. His left arm was paralyzed. During his rehabilitation, his good arm and hand were immobilized and he was asked to clean tables. At first, the task appeared to be impossible. Then slowly the bad arm remembered how to move. He learnt to write again, to play tennis again. The functions of the brain areas killed in the stroke were transferred themselves to healthy regions. (Doidge,2007).

Research has shown that blindness and deafness makes unused brain areas available for other uses. If a blind person uses one finger to read Braille, the brain area dedicated to that finger expands as the sense of touch invades the visual cortex that

normally helps people to see. Plasticity also explains why deaf people have enhanced peripheral vision. In those people whose native language is sign language only, the temporal area which is normally dedicated to hearing does not get any stimulation and finally it looks for other signals to process and starts processing signals from visual system.

Similarly, if a tumor in left hemisphere disrupts language, the right side hemisphere compensates. If a finger is amputated, the sensory cortex that was receiving input from this finger will start receiving input from the adjacent fingers, which then become more sensitive.

Neurogenesis:

Though brain tries to repair itself by reorganizing existing tissues, sometimes it tries to repair itself by generating new brain cells. This process is known as neurogenesis. It was long considered that the number of neurons was fixed and they did not replicate after maturity of the brain. But in 1990s, scientists discovered the process of neurogenesis in the brains of humans and some other animals such as rats, birds, monkeys. These baby neurons originate deep in the brain and then migrate to other parts of the brain to form connections with neighboring neurons. Master stem cells that can develop into any type of brain cell have been found in the human embryo. When stem cells from the brain are isolated and grown in a dish, they continuously divide and create large spherical masses of cells. If these cells are injected into a damaged brain, neural stem cells turn themselves into replacement for lost brain cells. This research gives hope for brain damaged people. However, there are number of behavioral, environmental, pharmacological and biochemical factors that affect this process. For example, exercise, sleep, nonstressful but stimulating environments, diet, etc. are natural promoters of neurogenesis. Studies have shown that Cardiovascular exercise such as running, interval training, cross fit and yoga are the single most effective ways of boosting neurogenesis. Diet plays an important role in brain health and neurogenesis. Excess refined sugar, refined and processed foods have a detrimental effect on the brain and should be avoided. Blueberries, green tea, spices and turmeric are supportive of neurogenesis. Meditation has been found to increase grey matter density in a number of different brain regions, including the hippocampus and is beneficial for neurogenesis.

4.3.3 Our divided brain; right-left differences in the intact brain

Split Brain:

As we have seen in above discussion, our brain has two same looking hemispheres – left and right hemisphere that serve different functions. These two hemispheres are joined together a

large band of neural fibers called corpus callosum. The corpus callosum carries the messages between the two hemispheres. In one research case, doctors removed this corpus callosum of a patient suffering from major epileptic seizures. The result of this operation was that seizures stopped and in spite of having split brain, there was no change in the personality intellect of the person with split brain.

Many more experiments were conducted to see the effect of cutting corpus callous. For instance, it has been found that -

- a.) When split-brain patients are shown an image only in their left visual field (the left half of what both eyes take in, they cannot vocally name what they have seen. This can be explained in three steps: (1) The image seen in the left visual field is sent only to the right side of the brain; (2) For most people, the speech-control center is on the left side of the brain; and (3) Communication between the two sides of the brain is inhibited. Thus, the patient cannot say out loud the name of that which the right side of the brain is seeing.
- b.) If a split-brain patient is touching a mysterious object with only the left hand, while also receiving no visual cues in the right visual field, the patient cannot say out loud the name of that which the right side of the brain is perceiving. This can be explained in three steps: (1) Each cerebral hemisphere contains only a tactile (connected with the sense of touch) representation of the opposite side of the body; (2) For most humans, the speech-control center is on the left side of the brain; and (3) Communication between the two sides of the brain is inhibited. In the case that the speech-control center is on the right side of the brain, the object must now be touched only with the right hand to achieve the same effect.
- c.) Gazzaniga and Sperry's split-brain research is now legendary. They reported that in patients with split-brain syndrome the right hemisphere, which controls the left hand and foot, acts independently of the left hemisphere and the person's ability to make rational decisions. This can give rise to a kind of split personality, in which the left hemisphere give orders that reflect the person's rational goals, whereas the right hemisphere issues conflicting demands that reveal hidden desires. A few people who had undergone split-brain surgery experienced the unruly independence of their left and right hemisphere. So, while a patient's left hand unbuttoned his shirt, his right hand buttoned it. In another case, a patient's right hand picked up an item from the shelf and put it in the shopping basket while his left hand put that item back on the shelf. Sperry (1964) said,

split brain surgery leaves people with two separate minds. Both hemispheres can understand and follow an instruction simultaneously to copy different figures with the left and right hand.

- d.) Gazzaniga's research found that the right hemisphere of the brain is poor at making inferences. On the other side, the developed human left hemisphere excels at inferences, constantly searching for patterns that can "make sense" of what is going on, bringing order out of chaos, and giving us answers to "why?" questions by discovering causes behind phenomena. Gazzaniga (1988) reported that when two minds are in conflict, the left hemisphere does mental gymnastics to rationalize reactions that it does not understand. For instance, if a patient follows an order sent to the right hemisphere ("walk"). Unaware of the order, the left hemisphere does not know why the patient began walking. Yet, when asked why was he walking, instead of saying "I don't know", due to interpretive left hemisphere, the patient improvised and said, "I am going into the house to get a Coke". This indicates that conscious left hemisphere is an interpreter that instantly constructs theories to explain our behavior.

Right-Left Differences in the Intact Brain:

Myers points out that research with people with split brains and people with intact brains shows that we have unified brains with specialized parts. Thus, if we observe the two hemispheres without optical aids (with the naked eye), they may seem to be the same; however, their differential functioning combines to produce an integrated unit (the harmony of the whole). People with intact brain also show left-right hemisphere differences in mental abilities.

The left hemisphere: It is more responsible for language than the right hemisphere. If you inject a sedative into the left hemisphere, you will lose the ability to speak. This is also the case for those who rely on sign language. Just as hearing people use the left hemisphere to process speech, deaf people use the left hemisphere to process sign language. If left hemisphere is damaged, it will disrupt a deaf person's signing just as it would disrupt a hearing person's speaking.

The left hemisphere is better with literal interpretations of language, e.g., when primed with the word foot, the left hemisphere is more likely to recognize the connected word, heel.

The right hemisphere: It is better at making inferences, for example, when primed with the words foot, cry and glass, the right hemisphere is more likely to recognize "cut" as the associated word. Right hemisphere helps -

- a.) create our sense of self
 - b.) helps us to modulate our speech to make meaning clear
- People with damage to this region might:
- a.) Insist they can move a limb that is paralyzed
 - b.) Have a hard time determining someone's relationship to themselves, e.g., A man who thought medical professionals were his family members
 - c.) Might not recognize themselves in mirror
 - d.) Might assign ownership of a limb to someone else, e.g., "That's my husband's arm"

In short, we can compare left hemisphere with right hemisphere by saying that in a normal individual

Left Brain people:

1. Right brain is engaged while completing a perceptual task and left brain is involved when carrying out a linguistic task.
2. Left brain individuals are rational, respond to verbal instructions, process information in a controlled, systematic, linear manner. They solve problem logically and sequentially looking at the parts of things, makes objective judgments.
3. Left brain persons are list makers. They enjoy making a master schedule and doing daily planning. They have no trouble processing symbols, memorizing vocabulary words and math formulas.
4. Analytic reader
5. Primary reliance on language in thinking and remembering
6. Prefers talking and writing
7. Prefers multiple choice test
8. Controls feelings
9. Prefers hierarchical authority structures
10. Talks, and talks, and talks
11. Sees cause and effect
12. Draws on previously accumulated, organized information

Right Brain People:

1. Right brain people process from a whole to a part, holistically. They have difficulty in following a lecture unless they are given the big picture first.
2. They are color sensitive. They try using colors to establish sequences.

3. They are concrete. They want to see, feel, or touch the real object. Right brain individuals need to back up everything visually. They Responds to demonstrated instructions.
4. They may have trouble learning to read using phonics. They may know what they mean but often have trouble finding the right words.
5. They prefer to see words in context and to see how formulas work. They learn better with hands on activities.
6. They are intuitive. They may know the right answer to a problem, but are not sure how they got it. On a quiz, they have a gut feeling as to which answers are correct, and they are usually right. They solve problems with hunches, looking for patterns and they make subjective judgments.
7. The right side of the brain pays attention to coherence and meaning, tells you if it “feels” right.
8. When giving directions, they use their hands and give names of places along the way.

4.4 CLOSE-UP - HANDEDNESS

Handedness refers to individual preference for use of a hand, known as dominant hand. An individual gives better performance with his dominant hand. The less preferred or less capable hand is called the nondominant hand. There are three types of handedness - right-handedness, left handedness and mixed handedness. It is well known fact that almost 90% of human beings are primarily right-handed and only 10% of us (more among males and less among females) are primarily left handed. There are few who use both their hands for different activities, e.g., they may write with right hand and eat with left hand. It has been found that almost all right handers process speech in the left hemisphere and their left hemisphere is slightly larger than their right hemisphere. Left handers are more diverse. Most of them process speech in the left hemisphere only, but some process language in right hemisphere or use both hemispheres.

It has been observed that right-handedness is common in all human cultures and even in monkeys and apes. In fact, right-handedness appears before the influence of culture takes place, e.g., 9 out of 10 fetuses suck the right hand's thumb. This universal prevalence of right-handedness in humans and other primates suggests that either genes or some prenatal factors are responsible for right-handedness.

In general, people think that it is not right to be left-handed. Studies have shown mixed results for deciding whether being right handed is better or left handed. It has been found that people with reading disabilities, allergies and migraine headaches are mostly left-handed. On the other hand, studies have also reported that left handedness is more common among musicians, mathematicians, professional baseball and cricket players, artists and architects. In Iran, left handed students taking university entrance exam outperformed righties in all subjects (Noroozian et.al.,2003). So, it is difficult to say being right handed is better than being left-handed.

4.5 CHECK YOUR PROGRESS:

Write short notes on

- a.) The Brainstem
- b.) Pituitary gland
- c.) The Hypothalamus
- d.) MRI & fMRI
- e.) Importance of association cortex
- f.) Brain Plasticity
- g.) Handedness

4.6 SUMMARY:

In this unit, we have seen that everything psychological is simultaneously biological. We began with looking at the impact of endocrine system. It influences our bodily growth, helps in facing challenges and influences our emotions. We also looked at brain and its complexities. To understand brain, we used techniques like EEG, MRI, PET.

We have old brain consisting of brain stem, the thalamus, the reticular formation and the cerebellum. Between new brain parts and old brain parts lies limbic system. The limbic system contains the amygdala, the hypothalamus and the hippocampus. The new brain is the highest part of our brain and consists of cerebral cortex. The cortex has two hemispheres and four lobes. These two hemispheres are connected with each other with corpus callosum. Even though both hemispheres have different distinct functions, they work in tandem and if one part is damaged, the other part takes over its functions. So, we have brain plasticity. We also read about how our personality changes if our frontal lobes are damaged, that epileptic seizures can be stopped by splitting brain. We studied what kind of difficulties are faced by split brain individuals and what is the difference between right and left hemisphere. Finally, we also looked at how handedness influences our behavior. That means how left-handed people are different from right handed people. I hope you enjoyed knowing about the marvel called brain.

4.7 QUESTIONS:

1. How does the endocrine system transmit information and interact with the nervous system?
2. What structures make up the brainstem, and what are the functions of the brainstem, thalamus, and cerebellum?
3. What are the limbic system's structure and functions?
4. What are the functions of the various cerebral cortex regions?
5. Write a detailed note on brain plasticity.
6. What do split brains reveal about the functions of our two brain hemispheres?

4.8 REFERENCE:

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) Pvt. Ltd.



LEARNING-I

Unit Structure :

- 5.0 Objectives
- 5.1 Introduction: How Do We Learn?
 - 5.1.1 Learning
 - 5.1.2 Characteristics of Learning
 - 5.1.3 Types of Learning:
- 5.2 Classical Conditioning
 - 5.2.1. Pavlov's Experiment:
 - 5.2.2. Pavlov's Legacy:
- 5.3 Operant Conditioning
 - 5.3.1 Skinner's Experiment
 - 5.3.2 Skinner's Legacy
- 5.4. Contrasting Classical and Operant Conditioning
- 5.5. Summary
- 5.6. Questions
- 5.7. References

5.0 OBJECTIVES:

After studying the unit you must be able

- Define learning and understand its characteristics.
- Highlight the main aspects in Classical Conditioning theory.
- Highlight the main aspects in Operant Conditioning theory.
- Compare the Classical Conditioning theory and Operant Conditioning theory of learning.

5.1 INTRODUCTION: HOW DO WE LEARN?

Learning is perhaps one of the most important human abilities. You might think of learning in terms of what you need to do before an upcoming exam, the knowledge that you take away from your classes, or new skills that you acquire through practice, these changes represent only one component of learning. In fact, learning is a very broad topic that is used to explain not only how we acquire new knowledge and behavior but also a wide variety of other psychological processes including the development of both appropriate and inappropriate social behaviors. Learning allows us

to create effective lives by being able to respond to changes. We learn to avoid touching hot stoves, to find our way home from school, and to remember which people have helped us in the past and which people have been unkind. Without the ability to learn from our experiences, our lives would be remarkably dangerous and inefficient. The principles of learning can also be used to explain a wide variety of social interactions, including social dilemmas in which people make important, and often selfish, decisions about how to behave by calculating the costs and benefits of different outcomes. Learning encompasses everything we do and think. It plays a central role in the language we speak, our thoughts, our attitudes, our beliefs, our goals and our personality traits which could be adaptive or maladaptive. Post this chapter you will be in position to understand how learning plays an important role in many of the psychological processes.

5.1.1 Learning:

Kimble defined learning as a “more or less permanent change in behaviour potentiality, which occurs as a result of repeated practice.” Learning can be defined as any relatively permanent change in knowledge or behaviour that occurs as result of practice or experience. This definition has some important components.

- 1) Learning is a change in behavior for better or worse.
- 2) It is a change that takes place through practice or experience.
- 3) Changes due to growth or maturation are not learning.
- 4) Before it can be called learning, the change must be relatively permanent and it must last a fairly long time.
- 5) This change may not be evident until a situation arises in which the new behavior can occur.

5.1.2 Characteristics of learning:

- 1) Learning is a constant modification of behavior that continues throughout life.
- 2) Learning is dependent upon one's innate intelligence and other capabilities.
- 3) Learning is not possible without the basic minimum ability needed to learn a task. As the nature of the task becomes complex, so does the requirement for higher abilities.
- 4) Learning is developmental, time being one of its dimensions. Learning is related to maturation too. The maturity of the individual is an important factor in learning.
- 5) Environmental aspects of learning like opportunities as well as facilities to learn are also important.

- 6) What is learned need not be “correct” or adaptive. We learn good habits as well as bad. Learning need not always involve any overt manifestations. Attitudes and emotions can be learnt as well.
- 7) Learning involves the whole person, socially, emotionally and intellectually. Interest and learning are positively related. The individual learns best those things, which he is interested in learning. Most kids find learning to play games easier than learning to find square root of numbers.
- 8) Learning is responsive to incentives. In most cases positive incentives such as reward are most effective than negative incentives such as punishments.
- 9) Learning is always concerned with goals. These goals can be expressed in terms of observable behaviour.

Thus, it is apparent that learning goes on with life and the process of life. It is all pervasive, reaching into various aspects of human life. You learn at each moment of your life.

Philosophers from Aristotle to David Hume were of the opinion that we, human beings learn through association. Our mind naturally connects events that occur in sequence. Learned associations often operate subtly. Learned associations also feed our habitual behavior. As we repeat behaviors in a given context, the behavior becomes associated with the context, e.g., drinking tea in the morning. Our next experience of the context then evokes our habitual response, e.g., the moment we get up in the morning, by habit we want to have tea. Studies have shown that on an average, a particular behavior becomes part of our habits if it takes place consistently for 66 days.

Even other animals learn through association. This is known as associative learning. The process of learning associations is called conditioning. There are two forms of associative learning –

1. Classical Conditioning
2. Operant Conditioning

Let us see both these forms of associative learnings in detail.

5.2 CLASSICAL CONDITIONING

In the early part of the 20th century, Russian physiologist Ivan Pavlov (1849–1936) was studying the digestive system of dogs when he noticed an interesting behavioral phenomenon: The dogs began to salivate when the lab technicians who normally fed them entered the room, even though the dogs had not yet received any food. Pavlov realized that the dogs were salivating because they knew that they were about to be fed; the dogs had begun to

associate the arrival of the technicians with the food that soon followed after their appearance in the room. With his team of researchers, Pavlov began studying this process in more detail.

5.2.1. Pavlov's Experiment:

He conducted a series of experiments in which, over a number of trials, dogs were exposed to a sound immediately before receiving food. He systematically controlled the onset of the sound and the timing of the delivery of the food, and recorded the amount of the dog's salivation. Initially the dogs salivated only when they saw or smelled the food, but after several pairings of the sound and the food, the dogs began to salivate as soon as they heard the sound. The animals had learned to associate the sound with the food that followed.

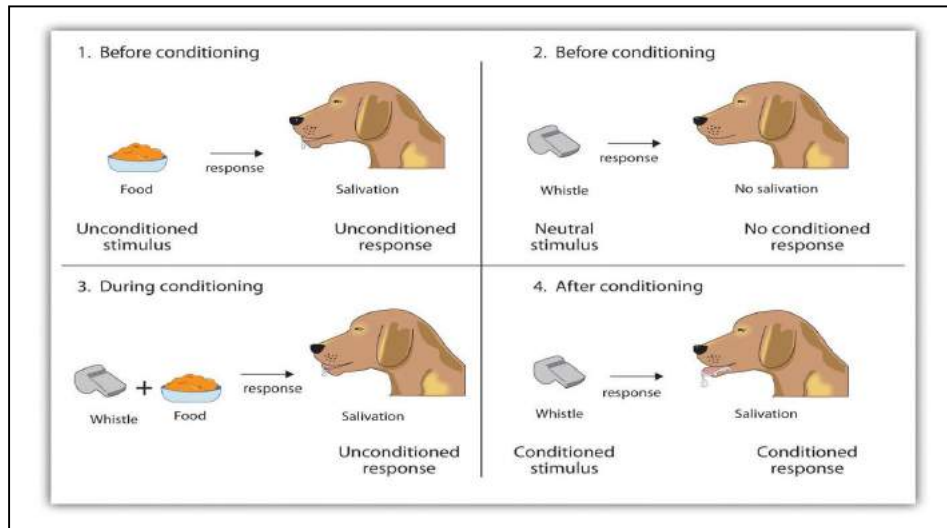
Pavlov had identified a fundamental associative learning process called classical conditioning. Classical conditioning refers to learning that occurs when a neutral stimulus (e.g., a tone) becomes associated with a stimulus (e.g., food) that naturally produces a behavior. After the association is learned, the previously neutral stimulus is sufficient to produce the behavior.

As you can see in the Figure below "Panel Image of Whistle and Dog", psychologists use specific terms to identify the stimuli and the responses in classical conditioning. The unconditioned stimulus (US) is something (such as food) that triggers a naturally occurring response, and the unconditioned response (UR) is the naturally occurring response (such as salivation) that follows the unconditioned stimulus. The conditioned stimulus (CS) is a neutral stimulus that, after being repeatedly presented prior to the unconditioned stimulus, evokes a similar response as the unconditioned stimulus. In Pavlov's experiment, the sound of the tone served as the conditioned stimulus that, after learning, produced the conditioned response (CR), which is the acquired response to the formerly neutral stimulus. Note that the UR and the CR are the same behavior—in this case salivation—but they are given different names because they are produced by different stimuli (the US and the CS, respectively).

Top left: Before conditioning; the unconditioned stimulus (US) naturally produces the unconditioned response (UR). Top right: Before conditioning, the neutral stimulus (the whistle) does not produce the salivation response. Bottom left: The unconditioned stimulus (US), in this case the food, is repeatedly presented immediately after the neutral stimulus. Bottom right: After learning, the neutral stimulus (now known as the conditioned stimulus or CS), is sufficient to produce the conditioned responses (CR).

Conditioning is evolutionarily beneficial because it allows organisms to develop expectations that help them prepare for both good and bad events. Imagine, for instance, that an animal first smells new food, eats it, and then gets sick. If the animal can learn to associate the smell (CS) with the food (US), then it will quickly learn that the food that has bad smell creates the negative outcome, and will not eat it the next time.

Figure 5.5.1.: Panel Image of Whistle and Dog (Classical Conditioning)



Key Elements in Classical Conditioning Model:

Pavlov identified four key elements in his classical conditioning model:

- 1) **Conditioned stimulus (CS):** An originally irrelevant stimulus that, after association with an unconditioned stimulus (US), comes to trigger a conditioned response.
- 2) **Conditioned response (CR):** The learned response to conditioned stimulus is called Conditioned response.
- 3) **Unconditioned stimulus (US):** A stimulus that unconditionally—naturally and automatically—triggers a response.
- 4) **Unconditioned response (UR):** The original response to the unconditioned stimulus is called unconditioned response, such as salivation when food is in the mouth.

Conditioning Processes:

Pavlov and his associates explored five major conditioning processes: acquisition, extinction, spontaneous recovery, generalization and discrimination.

1) Acquisition:

Association between conditioned stimulus and an unconditioned stimulus is called acquisition. In simple words, the conditioned stimulus and the unconditioned stimulus are repeatedly paired together and behavior increases. Acquisition is also called initial learning of stimulus response relationship. Timing is an important factor in acquisition. Pavlov found that the time lapse between presenting neutral stimulus and unconditioned stimulus should not be more than half a second.

Another important point in acquisition is the sequence. Conditioning will not occur if unconditioned stimulus appears before neutral stimulus. This is because classical conditioning is biologically adaptive. It helps humans and animals to prepare for good or bad events, e.g. , in Pavlov's experiment , for the dog , the originally neutral stimulus becomes conditioned stimulus after signaling an important biological event- the arrival of food. If instead of food , something else, such as a flower was presented, the conditioning would have not taken place. If food was presented before presenting sounding the bell, even then conditioning would not have taken place, because the sound of bell does not help dog. It can be concluded that 'conditioning helps an animal survive and reproduce- by responding to cues that help in gaining food, avoid danger, locate mates and produce offspring.(Hollis, 1997)

2) Extinction:

Extinction refers to the repeated presentation of the conditioned stimulus without unconditioned stimulus following it. In other words, the unconditioned stimulus is repeatedly presented. This results in conditioned response decreasing gradually. For example, if buzzer is presented again and again without presenting food, dog will gradually stop salivating to the buzzer.

3) Spontaneous recovery:

After a pause, when the CS is again presented alone, the behavior may occur again, though in weaker form, and then again show extinction. The increase in responding to the CS following a pause after extinction is known as spontaneous recovery.

4) Generalization:

Generalization refers to the tendency to respond to stimuli that resemble the original conditioned stimulus. For example, dog will salivate to the sounds of bell, buzzer, etc. The ability to generalize has important evolutionary significance. If we eat some red berries and they make us sick, it would be a good idea to think twice before we eat some purple berries. Although the berries are not exactly the same, they nevertheless are similar and may have the same negative properties.

Researchers have also found that we like unfamiliar people more if they look somewhat like someone we have learned to like. These examples show that people's emotional reactions to one stimulus have generalized to another similar stimuli.

5) Discrimination:

The tendency to respond differently to stimuli that are similar but not identical. Organisms must also learn that many stimuli that are perceived as similar are functionally different and they have to respond adaptively to each. This learned ability to distinguish between a conditioned stimulus and other irrelevant stimuli is called discrimination. For example, dog could learn to distinguish between different sounds of buzzer depending upon which sound was followed by unconditioned stimulus (food).

6) Second-order Conditioning:

An existing conditioned stimulus can serve as an unconditioned stimulus for a pairing with a new conditioned stimulus, this process is known as second-order conditioning. (provide an example)

Laws of Classical (Pavlovian) conditioning:

There are three basic laws in classical conditioning. Complete information about the laws are given below.

1) Law of Excitation:

It says that if a previously neutral CS is paired with the UCS, the CS acquires excitatory properties. That is, it acquires the properties of eliciting the CR.

2) Law of Internal Inhibition:

Internal inhibition develops when the conditioned stimulus is not attended by the unconditioned, whether this is once or always, but in the latter event only under certain circumstances. This law characterized a group inhibition phenomenon which are caused by change in the conditioned association itself and unlike the various forms of unconditional inhibition are acquired in learning process.

3) Law of External Inhibition:

In essence, this law states that excitatory or inhibitory process in the conditioning can be disrupted by novel distracting stimuli. This is called law of external inhibition since the inhibition is not being acquired in the learning process but from outside.

5.2.2. Pavlov's legacy:

Most psychologists agree that classical conditioning is a basic form of learning. If we judged by today's knowledge of cognitive processes and biological predispositions, Pavlov's ideas were incomplete. But if we see further than Pavlov did, it is because

we stand on his shoulders. Why does Pavlov's work remain so important? If he had merely taught us that old dogs can learn new tricks, his experiments would long ago have been forgotten. Why should we care that dogs can be conditioned to salivate at the sound of a tone? The importance lies first in this finding: Many other responses to many other stimuli can be classically conditioned in many other organisms—in fact, in every species tested, from earthworms to fish to dogs to monkeys to people (Schwartz, 1984). You have to put in mind that subsequent studies have found out that the principle made with the dog is applicable to all types of species including us, human beings. Through Pavlov's work we were able to find out that a process such as learning can be studied objectively. For instance Doctor's use Classical conditioning to cure patients. Patients easily get cured by sugar water because they believed their doctor gave them the proper medication.

Thus, classical conditionings one way that virtually all organisms learn to adapt to their environment. Second, Pavlov showed us how a process such as learning can be studied objectively. He was proud that his methods involved virtually no subjective judgments or guesses about what went on in a dog's mind. The salivary response is a behavior measurable in cubic centimeters of saliva. Pavlov's success therefore suggested a scientific model for how the young discipline of psychology might proceed—by isolating the basic building blocks of complex behaviors and studying them with objective laboratory procedures. These approaches made him one of the leaders in behaviorism and behavior psychology

5.3 OPERANT CONDITIONING

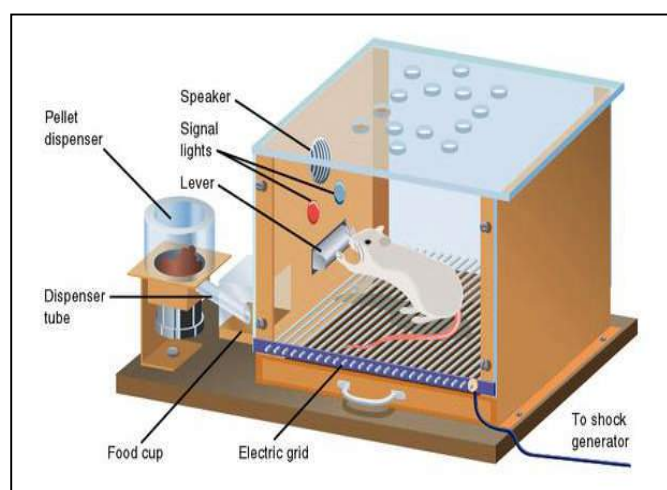
Psychologist Edward L. Thorndike (1874–1949) was the first scientist to systematically study operant conditioning. In his research Thorndike (1898) observed cats that had been placed in a “puzzle box” from which they tried to escape. At first the cats scratched, bit, and swatted haphazardly, without any idea of how to get out. But eventually, and accidentally, they pressed the lever that opened the door and exited to their prize, a scrap of fish. The next time the cat was constrained within the box, it attempted fewer of the ineffective responses before carrying out the successful escape, and after several trials the cat learned to almost immediately make the correct response. Observing these changes in the cat's behavior led Thorndike to develop his law of effect, the principle that responses that create a typically pleasant outcome in a particular situation are more likely to occur again in a similar situation, whereas responses that produce a typically unpleasant outcome are less likely to occur again in the situation (Thorndike, 1911). The essence of the law of effect is that successful

responses, because they are pleasurable, are stamped in by experience and thus occur more frequently. Unsuccessful responses, which produce unpleasant experiences, are stamped out and subsequently occur less frequently.

5.3.1 Skinner's Experiment:

Instrumental conditioning is sometimes also, roughly speaking called as operant conditioning. This term was coined by B.F. Skinner. The influential behavioral psychologist B. F. Skinner (1904–1990) expanded on Thorndike's ideas to develop a more complete set of principles to explain operant conditioning. Skinner created specially designed environments known as operant chambers (usually called Skinner boxes) to systematically study learning. A Skinner box (operant chamber) is a structure that is big enough to accommodate a rodent or bird and that contains a bar or key that the organism can press or peck to release food or water. It also contains a device to record the animal's responses. The most basic of Skinner's experiments were quite similar to Thorndike's research with cats. A rat placed in the chamber reacted as one might expect, scurrying about the box and sniffing and clawing at the floor and walls. Eventually the rat chanced upon a lever, which it pressed to release pellets of food. The next time around, the rat took a little less time to press the lever, and on successive trials, the time it took to press the lever became shorter and shorter. Soon the rat was pressing the lever as fast as it could eat the food that appeared. As predicted by the law of effect, the rat had learned to repeat the action that brought about the food and cease the actions that did not.

Figure 5.2: Skinner's Experimental Box



Skinner studied, in detail, how animals changed their behavior through reinforcement and punishment, and he developed terms that explained the processes of operant learning. Skinner

used the term reinforcer to refer to any event that strengthens or increases the likelihood of a behavior and the term punisher to refer to any event that weakens or decreases the likelihood of a behavior. What is reinforcing depends on the animal and the conditions. For people, it may be praise, attention while for a hungry rat it may be food.

Types of Reinforcers:

He used the terms positive and negative to refer to whether a reinforcement was presented or removed, respectively.

1. Positive reinforcement strengthens a response by presenting something pleasant after the response.

2. Negative reinforcement strengthens a response by reducing or removing something unpleasant. For example, giving a child praise for completing his homework represents positive reinforcement, whereas taking aspirin to reduce the pain of a headache represents negative reinforcement. In both cases, the reinforcement makes it more likely that behavior will occur again in the future.

Difference Between Negative Reinforcement and Punishment:

Reinforcement, either positive or negative, works by increasing the likelihood of a behavior. Punishment, on the other hand, refers to any event that weakens or reduces the likelihood of a behavior. Positive punishment weakens a response by presenting something unpleasant after the undesirable response, whereas negative punishment weakens a response by reducing or removing something pleasant. A child who is grounded after fighting with a sibling (positive punishment) or who loses out on the opportunity to go to recess after getting a poor grade (negative punishment) is less likely to repeat these behaviors.

Although the distinction between reinforcement (which increases behavior) and punishment (which decreases it) is usually clear, in some cases it is difficult to determine whether a reinforcer is positive or negative. On a hot day, a cool breeze could be seen as a positive reinforcer (because it brings in cool air) or a negative reinforcer (because it removes hot air). In other cases, reinforcement can be both positive and negative. One may smoke a cigarette both because it brings pleasure (positive reinforcement) and because it eliminates the craving for nicotine (negative reinforcement).

Table 5..1: How Positive and Negative Reinforcement and Punishment Influence Behavior.

Operant conditioning term	Description	Outcome	Example
Positive reinforcement	Add or increase a pleasant stimulus	Behavior is strengthened	Giving a student a prize after he gets an A on a test.
Negative reinforcement	Reduce or remove an unpleasant stimulus	Behavior is strengthened	Taking painkillers that eliminate pain increases the likelihood that you will take painkillers again.
Positive punishment	Present or add an unpleasant stimulus	Behavior is weakened	Giving a student extra homework after she misbehaves in class.
Negative Punishment	Reduce or remove a pleasant stimulus	Behavior is Weakened	Taking away a teen's computer after he misses curfew.

It is also important to note that reinforcement and punishment are not simply opposites. The use of positive reinforcement in changing behavior is almost always more effective than using punishment. This is because positive reinforcement makes the person or animal feel better, helping create a positive relationship with the person providing the reinforcement. Types of positive reinforcement that are effective in everyday life include verbal praise or approval, the awarding of status or prestige, and direct financial payment. Punishment, on the other hand, is more likely to create only temporary changes in behavior because it is based on coercion and typically creates a negative and adversarial relationship with the person providing the reinforcement. When the person who provides the punishment leaves the situation, the unwanted behavior is likely to return. Reinforcement helps to increase a behavior, while punishment helps to decrease a behavior. Reinforcers and punishers have different types of consequences.

3. Primary reinforcers: Such as food, water, and caresses, are naturally satisfying.

Primary punishers: such as pain and freezing temperatures, are naturally unpleasant.

4. Secondary reinforcers: Such as money, fast cars, and good grades, are satisfying because they've become associated with primary reinforcers.

Secondary punishers: such as failing grades and social disapproval, are unpleasant because they've become associated with primary punishers.

Secondary reinforcers and punishers are also called conditioned reinforcers and punishers because they arise through classical conditioning. Most real-world reinforcers are not continuous; they occur on a partial (or intermittent) reinforcement schedule—a schedule in which the responses are sometimes reinforced, and sometimes not. In comparison to continuous reinforcement, partial reinforcement schedules lead to slower initial learning, but they also lead to greater resistance to extinction. Because the reinforcement does not appear after every behavior, it takes longer for the learner to determine that the reward is no longer coming, and thus extinction is slower. The four types of partial reinforcement schedules are summarized in below table.

5. Immediate & Delayed Reinforcers: Unlike other animals, humans do respond to delayed reinforcers, for example, the salary at the end of the month, good marks at the end of the exam, trophy at the end of the series of game, etc. To function effectively, human beings need to learn to delay gratification. Experimental studies have shown that even four-year kids show this ability to delay gratification. While choosing a candy, they prefer having a big reward next day rather than eating a small candy today. Children who learn to delay gratification tend to become socially more competent and high-achieving adults.

Shaping

Perhaps you remember watching a movie or being at a show in which an animal—maybe a dog, a horse, or a dolphin—did some pretty amazing things. The trainer gave a command and the dolphin swam to the bottom of the pool, picked up a ring on its nose, jumped out of the water through a hoop in the air, dived again to the bottom of the pool, picked up another ring, and then took both of the rings to the trainer at the edge of the pool. The animal was trained to do the trick, and the principles of operant conditioning were used to train it. The question arises how they learn such complex behaviors. The answer is that it takes place through the

concept of shaping in operant conditioning. Skinner said that in everyday life, we continuously reinforce and shape others' behaviour.

Shaping is based on the method of successive approximation.

That is to begin with a person/animal is rewarded or given positive reinforcement even if the response is in the direction of right response and not exactly the right response. Gradually, rewarding responses that are ever-closer to the final desired behavior and ignore all other responses. For example, suppose a trainer wants a rat to learn to press the lever to get the food. In initial stages, the trainer will reward the rat with food even if rat moves in the direction of the lever. Once the rat starts regularly being close to bar, the food will be given only when it moves closer to the lever. Once, the rat regularly remains closer to lever, then food will be given only when it presses the lever. Thus, rat can be trained to press the lever by rewarding it for each step in the right direction. This method is used by human beings and animal trainers alike.

Reinforcement Schedules:

One way to expand the use of operant learning is to modify the schedule on which the reinforcement is applied. To this point we have only discussed a continuous reinforcement schedule, in which the desired response is reinforced every time it occurs; whenever the dog rolls over, for instance, it gets a biscuit. Continuous reinforcement results in relatively fast learning but also rapid extinction of the desired behavior once the reinforcer disappears. The problem is that because the organism is used to receiving the reinforcement after every behavior, the responder may give up quickly when it doesn't appear.

Table5. 2: Reinforcement Schedules.

Reinforcement schedule	Explanation	Real-world example
Fixed-ratio Schedule	Behavior is reinforced after a specific number of responses.	Factory workers who are paid according to the number of products they produce.
Variable-ratio Schedule	Behavior is reinforced after an average, but unpredictable, number of responses.	Payoffs from slot machines and other games of chance.

Fixed-interval Schedule	Behavior is reinforced for the first response after a specific amount of time has passed.	People who earn a monthly salary.
Variable-interval Schedule	Behavior is reinforced for the first response after an average, but unpredictable, amount of time has passed.	Person who checks voice mail for messages.

Partial reinforcement schedules are determined by whether the reinforcement is presented on the basis of the time that elapses between reinforcement (interval) or on the basis of the number of responses that the organism engages in (ratio), and by whether the reinforcement occurs on a regular (fixed) or unpredictable (variable) schedule. In a fixed-interval schedule, reinforcement occurs for the first response made after a specific amount of time has passed. For instance, on a one-minute fixed-interval schedule the animal receives a reinforcement every minute, assuming it engages in the behavior at least once during the minute. Animals under fixed-interval schedules tend to slow down their responding immediately after the reinforcement but then increase the behavior again as the time of the next reinforcement gets closer. (Most students study for exams the same way). In a variable-interval schedule the reinforcers appear on an interval schedule, but the timing is varied around the average interval, making the actual appearance of the reinforcer unpredictable. An example might be checking your e-mail: You are reinforced by receiving messages that come, on average, say every 30 minutes, but the reinforcement occurs only at random times.

Interval reinforcement schedules tend to produce slow and steady rates of responding. In a fixed-ratio schedule, a behavior is reinforced after a specific number of responses. For instance, a rat's behavior may be reinforced after it has pressed a key 20 times, or a salesperson may receive a bonus after she has sold 10 products. Animals trained under "Different Partial Reinforcement Schedules", once the organism has learned to act in accordance with the fixed-reinforcement schedule, it will pause only briefly when reinforcement occurs before returning to a high level of responsiveness. A variable-ratio schedule provides reinforcers after a specific but average number of responses. Winning money from slot machines or a lottery ticket are examples of reinforcement that

occur on a variable-ratio schedule. For instance, a slot machine may be programmed to provide a win every 20 times the user pulls the handle, on average. Ratio schedules tend to produce high rates of responding because reinforcement increases as the number of responses increase.

5.3.2 Skinner's legacy:

B. F. Skinner was known as one of the most intellectual psychologist in the late twentieth century. He repeatedly insisted that external influences shape behavior. According to him, internal thoughts and feelings don't shape behaviour. He counseled people to use operant conditioning principles to influence others' behavior. He said we should use rewards to evoke more desirable behavior.

According to Skinner external consequences already haphazardly control people's behavior. Why not administer those consequences toward human betterment? Wouldn't reinforcers be more humane than the punishments used in homes, schools, and prisons? And if it is humbling to think that our history has shaped us, doesn't this very idea also give us hope that we can shape our future? The operant conditioning principles are used considerably in variety of situations. Reinforcement technologies are also work in schools, businesses and homes.

5.4. CONTRASTING CLASSICAL AND OPERANT CONDITIONING

As we have seen, both classical and operant conditionings involve associative learning i.e., the establishment of a relationship between two events. Each learning process produces a new behaviour. Some of the differences between operant and classical conditioning lie in the extent to which reinforcement depends on the behavior of the learner. In classical conditioning, the learner is automatically reinforced. That is how it learns to respond to a once neutral stimulus. In operant conditioning, the learner must provide a correct response in order to receive the reinforcement. Another difference between the two forms of conditioning is the type of behavior to which each method applies. Classical conditioning applies to a behavior that is always wanted. In operant conditioning, a behavior can be learned or extinguished. If you want to train a dog not to do something, you would use a form of punishment. In essence, then in the operant model the learner actively operates on his environment i.e., emits the response while under the classical model the learner simply responds to the environment i.e., the response is elicited from him/her. Classical and operant conditioning are similar, but they do differ in a few ways. Both are fairly reliable ways to teach an organism to act in a specific manner and modify behaviour.

5.5. SUMMARY

In this unit we began by explaining the concept of learning, characteristics of learning and types of learning. We then explained Pavlov's Classical Conditioning theory through experiments. In classical conditioning theory we have studied elements of classical conditioning and different laws of classical conditioning. Following this we have studied operant conditioning theory. Different elements of operant conditioning were explained. In operant conditioning we have also studied concepts like positive reinforcement, negative reinforcement, positive punishment, negative punishment. We have also studied complex behaviors through operant conditioning. Following this we explained the different types of reinforcers (primary reinforcers, secondary reinforcers, primary punishers, secondary punishers) and different types of reinforcement schedules such as Fixed-ratio Schedule, Variable-ratio Schedule, Fixed-interval Schedule and Variable-interval Schedule. Towards the end of the unit we have compared the concepts of classical conditioning and operant conditioning.

5.6. QUESTIONS

- a) What is learning? Discuss in details.
- b) Explain Operant Conditioning theory?
- c) Explain Classical Conditioning theory?
- d) Discuss different concepts in Classical Conditioning?
- e) Discuss different concepts in Operant Conditioning?
- f) What is difference between Classical Conditioning theory and Operant Conditioning theory?

5.7. REFERENCES

Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013.

Feldman, R.S. (2013). Understanding Psychology.th publications 11edi. New York: McGraw Hill

B. B. (2012). Psychology: An Introduction. 11th edi. New York: McGraw-Hill Publications.

Schachter, D. L., Gilbert, D. T., & Wegner, D. M. (2011). Psychology. New York: Worth Publishers.



LEARNING - II

Unit Structure :

- 6.0 Objectives
- 6.1 Introduction: Biology, Cognition, And Learning
 - 6.1.1 Biological Constraints on Conditioning:
 - 6.1.2. Cognition's Influence on Conditioning:
- 6.2 Learning by Observation
 - 6.2.1 Mirrors and Imitation in The Brain
 - 6.2.2 Applications of Observational Learning
 - 6.2.3 Thinking Critically About: Does Viewing Media Violence Trigger Violent Behaviour?
- 6.3 Summary
- 6.4 Questions
- 6.5 References

6.0 OBJECTIVES

Dear students! Just to refresh your memory, from the previous chapter you must have a fair idea about the nature of learning, factors affecting learning, classical and operant conditioning and their implications in human life. In this unit you will be learning about Cognitive approaches to learning. At the completion of this unit you will be able to

- Explain the relationship between Biology, Cognition, and Learning.
- Highlight Biological constraints on conditioning and cognition's influence on conditioning
- Understand observational learning.
- Explore the Effects of Violence on Aggression.

6.1 INTRODUCTION: BIOLOGY, COGNITION, AND LEARNING

In previous chapter, we have studied classical conditioning and operant conditioning in details. As you have seen in the previous unit, behavioural psychologists emphasize changes in behaviour as the outcome of learning. They are concerned with the effects of external events on the individual's responses. In contrast, Cognitive psychologists say that learning itself is an internal

process that cannot be observed directly. The change occurs in a person's ability to respond to a particular situation. The change in behaviour is only a reflection of the internal change. Interestingly both behaviorism and cognitivism began as opposition to structuralism of Wundt. Wilhelm Wundt, who set up the first experimental psychology laboratory in Europe around 1879, was looking for the basic elements in psychology- the smallest parts of analyzable consciousness analogous with the Physics' atomic theory of matter. Wundt thought that by analyzing consciousness into tiny elements or 'atoms' he would make Psychology as respectable a science as Physics! Wundt, using the technique of introspection trained his subjects to look within themselves and report all of their most fleeting and minute feelings and sensations. We will discuss in detail how biology and cognition influences learning in next two topics.

6.1.1 Biological constraints on conditioning:

The school of behaviorism was born under the impetus of John B. Watson. Watson was very much influenced by Ivan Pavlov's work. Questioning Wundt's attempt to analyze consciousness into all its basic parts, Watson insisted on objectivity and he considered only behaviour that consisted of observable stimuli and response to be worthy of investigations.

Ever since Charles Darwin, scientists have assumed that all animals share a common evolutionary history and thus commonalities in their makeup and functioning. Pavlov and Watson, for example, believed the basic laws of learning were essentially similar in all animals. So it should make little difference whether one studied pigeons or people. Moreover, it seemed that any natural response could be conditioned to any neutral stimulus. As learning researcher Gregory Kimble proclaimed in 1956, "Just about any activity of which the organism is capable can be conditioned and . . . these responses can be conditioned to any stimulus that the organism can perceive."

Twenty-five years later, Kimble (1981) humbly acknowledged that "half a thousand" scientific reports had proven him wrong. More than the early behaviorists realized, an animal's capacity for conditioning is constrained by its biology. Each species' predispositions prepare it to learn the associations that enhance its survival. Environments are not the whole story.

John Garcia was among those who challenged the prevailing idea that all associations can be learned equally well. While researching the effects of radiation on laboratory animals, Garcia and Robert Koelling (1966) noticed that rats began to avoid drinking water from the plastic bottles in radiation chambers. Could classical conditioning be the culprit? Might the rats have linked the plastic-

tasting water (a CS) to the sickness (UR) triggered by the radiation (US)? To test their hunch, Garcia and Koelling gave the rats a particular taste, sight, or sound (CS) and later also gave them radiation or drugs (US) that led to nausea and vomiting (UR).

Two surprising findings emerged: First, even if sickened as late as several hours after tasting a particular novel flavor, the rats thereafter avoided that flavor. This appeared to violate the notion that for conditioning to occur, the US must immediately follow the CS. Second, the sickened rats developed aversions to tastes but not to sights or sounds. This contradicted the behaviorists' idea that any perceivable stimulus could serve as a CS. But it made adaptive sense, because for rats the easiest way to identify tainted food is to taste it. (If sickened after sampling a new food, they thereafter avoid the food—which makes it difficult to eradicate a population of “bait-shy” rats by poisoning.)

Humans, too, seem biologically prepared to learn some associations rather than others. If you become violently ill four hours after eating contaminated mussels, you will probably develop an aversion to the taste of mussels but not to the sight of the associated restaurant, its plates, the people you were with, or the music you heard there. In contrast, birds, which hunt by sight, appear biologically primed to develop aversions to the sight of tainted food (Nicolaus et al., 1983). Organisms are predisposed to learn associations that help them adapt.

The discovery of biological constraints affirms the value of different levels of analysis, including the biological and cognitive, when we seek to understand phenomena such as learning. And once again, we see an important principle at work: Learning enables animals to adapt to their environments. Responding to stimuli that announce significant events, such as food or pain, is adaptive. So is a genetic predisposition to associate a CS with a US that follows predictably and immediately: Causes often immediately precede effects. Often, but not always, as we saw in the taste-aversion findings. Adaptation also sheds light on this exception. The ability to discern that effect need not follow cause immediately—that poisoned food can cause sickness quite a while after it has been eaten—gives animals an adaptive advantage. Occasionally, however, our predispositions trick us. When chemotherapy triggers nausea and vomiting more than an hour following treatment, cancer patients may over time develop classically conditioned nausea (and sometimes anxiety) to the sights, sounds, and smells associated with the clinic (Hall, 1997). Merely returning to the clinic's waiting room or seeing the nurses can provoke these conditioned feelings (Burish & Carey, 1986; Davey, 1992). Under normal circumstances, such revulsion to sickening stimuli would be adaptive.

However, there are limits on operant conditioning. Mark Twain said it so well, “Never try to teach a pig to sing. It wastes your time and annoys the pig.” We can learn and retain behavior that reflects our biological predispositions, e.g., you can teach pigeons to flap their wings to avoid being shocked and to peck to get food. Flapping wings and pecking for food are natural pigeon behaviors. But you can’t teach a pigeon to peck to avoid shock and to flap its wings to get food. So biological constraints predispose organisms to learn associations that are naturally adaptive.

6.1.2. Cognition’s influence on conditioning:

In their dismissal of “mentalistic” concepts such as consciousness, Pavlov and Watson underestimated the importance of cognitive processes (thoughts, perceptions, expectations) and biological constraints on an organism’s learning capacity.

Cognitive Processes:

The early behaviorists believed that rats’ and dogs’ learned behaviors could be reduced to mindless mechanisms, so there was no need to consider cognition. But Robert Rescorla and Allan Wagner (1972) showed that an animal can learn the predictability of an event. If a shock always is preceded by a tone, and then may also be preceded by a light that accompanies the tone, a rat will react with fear to the tone but not to the light. Although the light is always followed by the shock, it adds no new information; the tone is a better predictor. The more predictable the association, the stronger the conditioned response. It’s as if the animal learns an expectancy, an awareness of how likely it is that the US will occur. Such experiments help explain why classical conditioning treatments that ignore cognition often have limited success. For example, people receiving therapy for alcohol dependency may be given alcohol spiked with a nauseating drug. Will they then associate alcohol with sickness? If classical conditioning were merely a matter of “stamping in” stimulus associations, we might hope so, and to some extent this does occur. However, the awareness that the nausea is induced by the drug, not the alcohol, often weakens the association between drinking alcohol and feeling sick. So, even in classical conditioning, it is (especially with humans) not simply the CS–US association but also the thought that counts.

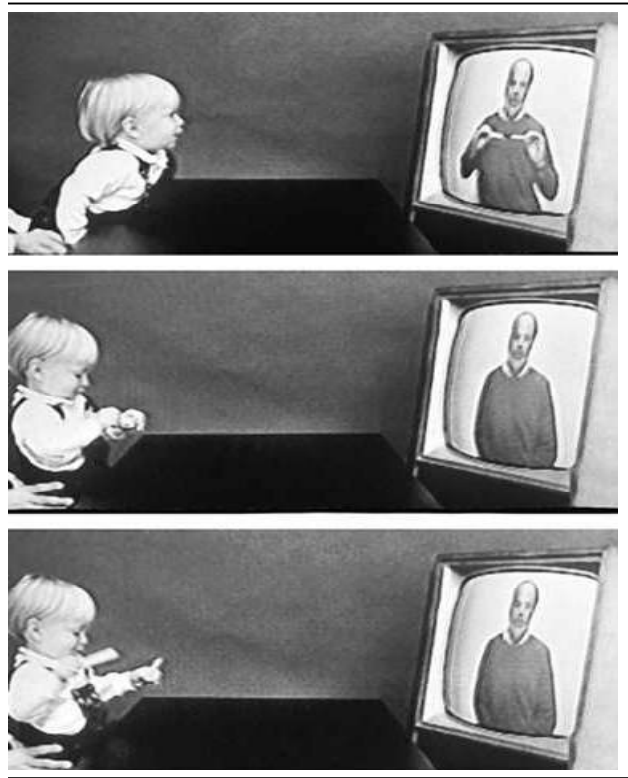
Evidence of cognitive processes have also come from experiments on rats in maze running. In the experiments, Tolman placed hungry rats in a maze with no reward for finding their way through it. He also studied a comparison group that was rewarded with food at the end of the maze. As the unreinforced rats explored the maze, they developed a **cognitive map**, a mental picture of the layout of the maze. After 10 sessions in the maze without reinforcement, food was placed in a goal box at the end of the

maze. As soon as the rats became aware of the food, they were able to find their way through the maze quickly, just as quickly as the comparison group, which had been rewarded with food all along. This is known as **latent learning**: learning that occurs but is not observable in behavior until there is a reason to demonstrate it. The underlying point is that there is more to learning than associating a response to its consequences, there is also cognition.

6.2 LEARNING BY OBSERVATION

Observational learning (modeling) is learning by observing the behavior of others, especially among humans. Bandura and his associates have done research on modeling. The researchers first let the children view one of the three types of modeling(aggressive, non-aggressive and no model condition), and then let them play in a room in which there were some really fun toys. To create some frustration in the children, Bandura let the children play with the fun toys for only a couple of minutes before taking them away. Then Bandura gave the children a chance to play with the Bobo doll. If you guessed that most of the children imitated the model, you would be correct. Regardless of which type of modeling the children had seen, and regardless of the sex of the model or the child, the children who had seen the model behaved aggressively also behaved aggressively just as the model had done. They also punched, kicked, sat on the doll, and hit it with the hammer. Bandura and his colleagues had demonstrated that these children had learned new behaviors, simply by observing and imitating others.

Figure: 6. 1. Learning from observation: This 14-month-old boy in Andrew Meltzoff's laboratory is imitating behavior he has seen on TV. In the top photo the infant leans forward and carefully watches the adult pull apart a toy. In the middle photo he has been given the toy. In the bottom photo he pulls the toy apart, imitating what he has seen the adult do.



Observational learning is useful for animals and for people because it allows us to learn without having to actually engage in what might be a risky behavior. Monkeys that see other monkeys respond with fear to the sight of a snake learn to fear the snake themselves, even if they have been raised in a laboratory and have never actually seen a snake (Cook & Mineka, 1990). As Bandura put it, the prospects for human survival would be slim indeed if one could learn only by suffering the consequences of trial and error. For this reason, one does not teach children to swim, adolescents to drive automobiles, and novice medical students to perform surgery by having them discover the appropriate behavior through the consequences of their successes and failures. The more costly and hazardous the possible mistakes, the heavier is the reliance on observational learning from competent learners. (Bandura, 1977, p. 212). We are especially likely to learn from people we perceive as similar to ourselves, successful or as admirable.

6.2.1 Mirrors and imitation in the brain:

On a 1991 hot summer day in Parma, Italy, a lab monkey awaited its researchers' return from lunch. The researchers had implanted wires next to its motor cortex, in a frontal lobe brain region that enabled the monkey to plan and enact movements. When the monkey moved a peanut into its mouth, for example, the monitoring device would buzz. That day, as one of the researchers reentered the lab, ice cream cone in hand, the monkey stared at

him. As the student raised the cone to lick it, the monkey's monitor again buzzed—as if the motionless monkey had itself moved (Blakeslee, 2006; Iacoboni, 2008). Having earlier observed the same weird result when the monkey watched humans or other monkeys move peanuts to their mouths, the flabbergasted researchers, led by Giacomo Rizzolatti (2002, 2006), eventually surmised that they had stumbled onto a previously unknown type of neuron: mirror neurons, whose activity provides a neural basis for imitation and observational learning. We will discuss mirror neurons in details.

Mirror neurons:

Frontal lobe neurons that fire when performing certain actions or when observing another doing so. The brain's mirroring of another's action may enable imitation and empathy. When a monkey grasps, holds, or tears something, these neurons fire. And they likewise fire when the monkey observes another doing so. When one monkey sees, these neurons mirror what another monkey does.

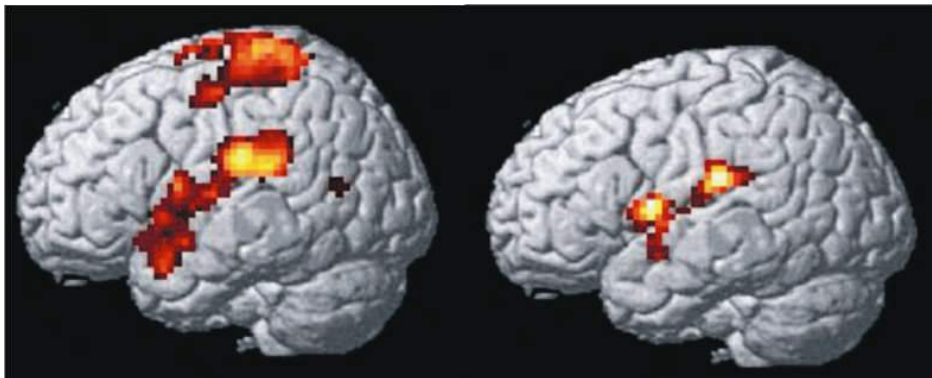
It's not just monkey business. Imitation shapes even very young humans' behavior. Shortly after birth, a baby may imitate an adult who sticks out his tongue. By 8 to 16 months, infants imitate various novel gestures (Jones, 2007). By age 12 months, they begin looking where an adult is looking (Brooks & Meltzoff, 2005). And by age 14 months (FIGURE 6.4.A.), children imitate acts modeled on TV (Meltzoff, 1988; Meltzoff & Moore, 1989, 1997). Children see, children do.

PET scans of different brain areas reveal that humans, like monkeys, have a mirror neuron system that supports empathy and imitation (Iacoboni, 2008). As we observe another's action, our brain generates an inner simulation, enabling us to experience the other's experience within ourselves. Mirror neurons help give rise to children's empathy and to their ability to infer another's mental state, an ability known as theory of mind. People with autism display reduced imitative yawning and mirror neuron activity—"broken mirrors," some have said (Ramachandran & Oberman, 2006; Senju et al., 2007; Williams et al., 2006).

For most of us, however, our mirror neurons make emotions contagious. We grasp others' states of mind—often feeling what they feel by mental simulation. We find it harder to frown when viewing a smile than when viewing a frown (Dimberg et al., 2000, 2002). We find ourselves yawning after observing another's yawn, laughing when others laugh. When watching movies, a scorpion crawling up someone's leg makes us tighten up; observing a passionate kiss, we may notice our own lips puckering. Seeing a loved one's pain, our faces mirror their emotion. But

as figure 6.3.1.A shows, so do our brains. In this fMRI scan, the pain imagined by an empathic romantic partner has triggered some of the same brain activity experienced by the loved one actually having the pain (Singer et al., 2004). Even fiction reading may trigger such activity, as we mentally simulate the experiences described (Mar & Oatley, 2008). The bottom line: Our brain's mirror neurons underlie our intensely social nature.

Figure 6.2: Pain Empathy



6.2.2 Applications of Observational Learning:

From the basis of observational learning, we learn that there are both negative and positive aspects towards observational learning. Through positive learning, pro-social models have positive effects. They are nonviolent and have a helpful influence. On the other hand, there are antisocial models that have a negative effect, arousing problems such as abuse in families and violence amongst children. We would discuss in details.

Pro-Social Behaviour:

Pro-social (positive, helpful) models can have prosocial effects. To encourage children to read, read to them and surround them with books and people who read. To increase the odds that your children will practice your religion, worship and attend religious activities with them. People who exemplify nonviolently, helpful behavior can prompt similar behavior in others. India's Mahatma Gandhi and America's Martin Luther King, Jr., both drew on the power of modeling, making the nonviolent action a powerful force for social change in both countries. Parents are also powerful models. Models are most effective when their actions and words are consistent. Sometimes, however, models say one thing and do another. Many parents seem to operate according to the principle "Do as I say, not as I do." Experiments suggest that children learn to do both (Rice & Grusec, 1975; Rushton, 1975). Exposed to a hypocrite, they tend to imitate the hypocrisy by doing what the model did and saying what the model said.

Anti-Social Behaviour:

Observational learning may have antisocial effects. This helps us understand why abusive parents might have aggressive children, and why many men who beat their wives had wife battering fathers (Stith et al., 2000). Critics note that being aggressive could be passed along by parents' genes. But with monkeys, we know it can be environmental. In study after study, young monkeys separated from their mothers and subjected to high levels of aggression grew up to be aggressive themselves (Chamove, 1980). Television is the easiest way to get influenced. Imitation is one of the main roles. Television and learning have a positive relationship. TV is a powerful source of observational learning. While watching TV, children may "learn" that bullying is an effective way to control others, that free and easy sex brings pleasure without later misery or disease, or that men should be tough and women gentle.

6.2.3 Thinking critically about: Does viewing media violence trigger violent behaviour?

The average American child watches more than 4 hours of television every day, and 2 out of 3 of the programs they watch contain aggression. It has been estimated that by the age of 12, the average American child has seen more than 8,000 murders and 100,000 acts of violence. At the same time, children are also exposed to violence in movies, video games, and virtual reality games, as well as in music videos that include violent lyrics and imagery (The Henry J. Kaiser Family Foundation, 2003; Schulenburg, 2007; Coyne & Archer, 2005). The most important thing is that India is not exception to this scenario.

It might not surprise you to hear that these exposures to violence have an effect on aggressive behavior. The evidence is impressive and clear: The more media violence people, including children, view, the more aggressive they are likely to be (Anderson et al., 2003; Cantor et al., 2001). The relation between viewing television violence and aggressive behavior is about as strong as the relation between smoking and cancer or between studying and academic grades. People who watch more violence become more aggressive than those who watch less violence.

It is clear that watching television violence can increase aggression, but what about violent video games? These games are more popular than ever, and also more graphically violent. Youths spend countless hours playing these games, many of which involve engaging in extremely violent behaviors. The games often require the player to take the role of a violent person, to identify with the character, to select victims, and of course to kill the victims. These behaviors are reinforced by winning points and moving on to higher levels, and are repeated over and over. Again, the answer is clear

playing violent video games leads to aggression. A recent meta-analysis by Anderson and Bushman (2001) reviewed 35 research studies that had tested the effects of playing violent video games on aggression. The studies included both experimental and correlational studies, with both male and female participants in both laboratory and field settings. They found that exposure to violent video games is significantly linked to increases in aggressive thoughts, aggressive feelings, psychological arousal (including blood pressure and heart rate), as well as aggressive behavior. Furthermore, playing more video games was found to relate to less altruistic behavior.

However, although modeling can increase violence, it can also have positive effects. Research has found that, just as children learn to be aggressive through observational learning, they can also learn to be altruistic in the same way (Seymour, Yoshida, & Dolan, 2009).

6.3 SUMMARY

In this unit we studied the relationship Biology, Cognition and learning. Learning is an important form of new behaviour. It involves establishing new associations and permanent change in behaviour. Putting the terms cognition and learning together gives a definition of cognitive learning. A change in the way of information is processed as result of experience a person or animal has had. In other words, due to past experiences, the significance and meaning of events have been changed, new associations have been formed and these changes have been stored in the memory for future use. Obviously, much learning is of the cognitive variety. Indeed, as you read this text, we hope you are doing some cognitive learning.

We have briefly discussed observational learning. The pioneer of the school of behavioral psychology John B. Watson, who himself was very much influenced by Ivan Pavlov's work. Questioning Wundt's attempt to analyze consciousness into all its basic parts, Watson insisted on objectivity and he considered only behaviour that consisted of observable stimuli and response to be worthy of investigations, The cognitive school of psychology was founded by Max Wertheimer who felt that, Wundt in order to produce his neat atomic chart of psychology, had lost sight of the reality of human experience.

Observational learning is learning by observing the behavior of others. Observational learning is useful for animals and for people because it allows us to learn without having to actually engage in what might be a risky behavior

Towards the end of the chapter we have discussed the effects of violence on aggression. It might not surprise you to hear that these exposures to violence have an effect on aggressive behavior. The more media violence people, including children, view, the more aggressive they are likely to be (Anderson et al., 2003; Cantor et al., 2001). It is clear that watching television violence can increase aggression. Although modeling can increase violence, it can also have positive effects. Research has found that, just as children learn to be aggressive through observational learning, they can also learn to be altruistic in the same way (Seymour, Yoshida, & Dolan, 2009).

6.4 QUESTIONS

- a) Explain the relationship between Biology, Cognition, and Learning.
- b) Explain cognition's influence on conditioning.
- c) Explain Mirror neurons and imitation in the brain
- d) What is Pro-social behaviour?
- e) What is Anti-Social Behaviour?
- f) Explain observational learning.
- g) Explain applications of observational learning.
- h) Explain the Effects of Violent TV programs on Aggression?

6.5 REFERENCES

Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013.

Baron, R. A., & Kalsher, M. J. (2008). Psychology: From Science to Practice. (2nd ed.). Pearson Education inc., Allyn and Bacon

Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.

Ciccarelli, S. K., & White, J. N. (2012). Psychology. 3rd edi. New Jersey: Pearson education.



MEMORY- I

Unit Structure :

- 7.0 Objectives
- 7.1 Introduction
- 7.2 Studying Memory
- 7.3 Memory Models – Information Processing Models
- 7.4 Building Memories - Encoding and Automatic Processing, Encoding and Effortful Processing
- 7.5 Summary
- 7.6 Questions
- 7.7 References

7.0 OBJECTIVES

After reading this unit you will be able–

- ❖ To understand the importance of studying the topic of memory
- ❖ To understand how memories are formed and stored
- ❖ To understand how memorization can be improved

7.1 INTRODUCTION

Memory is a fundamental component of daily life and life without memory would be close to impossible. Our very survival depends on our ability to remember who we are, who others are, our past experiences, our learning to cope with our environment, skills that we have learned. what is dangerous, what is safe, etc. If we don't have memory then everyone else would be a stranger to us, in fact, we will not be able to recognize ourselves also when we look into a mirror, every day every task will be new for us, every place will be new for us and living a normal routine life will be impossible. We use memory at every moment of our lives, either consciously or unconsciously. For example, right now, while typing the words I'm writing, I'm using my memory of the alphabets, words and their meanings that I have learned in my childhood. My brain is focused on the content, but while I'm doing that, I'm not recalling how to type on a conscious level. So, let us explore together this fascinating subject.

7.2 STUDYING MEMORY

David Myers (2013) refers to memory as the persistence of learning over time through the storage and retrieval of information.

Baron defined memory as “an ability of the brain to retain and later retrieve information”.

“Memory is an active system that receives information from senses, organizes and alters that information as it stores it away, and then retrieves the information from storage” Ciccarelli & Meyer (2008)

Psychologists use three ways to find out that learning has taken place and memory’s dominant role in these three ways is obvious. These three ways are –

1. **Recall:** This process involves retrieving or bringing back previously learned information, thought or idea, that is not in our immediate conscious awareness but that we had stored in our memory. For example, when you are answering an essay type of question or fill in the blank type of question in exam, you are recalling information that you have stored in memory previously.
2. **Recognition:** In recognition, you only need to identify previously learned information, e.g., while answering multiple choice questions in exam, various possible answers are given along with the question and you are merely recognizing the correct answer out of those various options. Recognition is much easier than recall.
3. **Relearning:** Relearning refers to learning something more quickly when you learn it a second time. It is a way of measuring retention of information stored in memory. For example, while preparing for exam, it may take you two hours to learn this lesson. After a gap of two months, suppose you feel that you need to learn it again as you are not able to recall it perfectly. This time, it will take you much less time to relearn it because it is already there in your memory.

Psychologists have conducted many empirical studies to understand the phenomenon of memory. For instance, psychologists have been intrigued to find that memory gets affected by biological and environmental occurrences such as stroke, accidents, traumas, etc. For instance, Myers (2013) observed that people who suffer stroke may have warm personality as before and may be able to do every day routine work, they may indulge in enjoyable recollection of past events but they can’t remember new memories of everyday happening. Such a person may not be able

to recall what he had for lunch or the name of the person whom he had met just half an hour back. Similarly, there are others, who cannot remember past events from their lives after an accident or a trauma.

Another interesting observation brought up by empirical research is that though most of the people have to put in considerable effort to learn a series of information or notes, on the other hand, there are few people, who can remember such details even by listening it or seeing it just once. Moreover, such people, might be able to recall these numbers or words, backward as easily as forward. Studies showed that such people could recall correctly the series of these numbers or words and the details of the setting in which they were first exposed to these series (such as the room layout and the clothes worn by the experimenter), even after many years.

However, even in case of people with ordinary memory, Konkle et al. (2010) reported that people who were exposed to 2800 images for only 3 seconds each, could spot the repeats with 82% accuracy. In another experiment, Mitchell (2006) found that people who had seen a picture, 17 years back, could recognize the that picture correctly even when they were shown that picture in fragmented form.

Every day, we are exposed to countless images, voices, sounds, tastes, smells, textures, places, faces, etc. The question arises, how does our brain choose information out of this vast expanse of information and store that information away for later use? How can we recollect information we have not thought about for years? How exactly memories are formed and stored? Let us try to get answers for some of these questions in the further part of this unit.

7.3 MEMORY MODELS:

Psychologists have developed memory models to explain how our brain forms and retrieves memories. Here we are going to talk about various information processing models.

Information Processing Models:

Following are the three important Information Processing models.

- Computer functioning and human memory
- Connectionism
- Richard Atkinson & Richard Shiffrin's Three Stage Model.

7.3.1 Computer functioning and human memory:

This information processing model is based on the assumption that human memory can be compared to a computer's operations. Like the computer, the human mind takes in information, performs operations on it to change its form and content, stores the information and retrieves it when it is needed. This entire operation is done in three step processes –

1. **Encoding:** The information gets in our brain in a way that allows it to be stored.
2. **Storage:** The information is held in a way that allows it to be retrieved later.
3. **Retrieval:** This refers to getting back the information at a later stage, through reactivating and recalling that information and producing it in a form similar to what was encoded.

However, there is a difference between computer functioning and human memory-

- I. Our memories are less literal, more fuzzy and fragile than a computer's. That means that computer encodes the words without assigning any meaning to them or using figures of speech.
- II. Most computers process information sequentially, even while alternating between tasks. Our dual track brain processes many things simultaneously, some of them unconsciously, by means of parallel processing. In other words, computers process one piece of data at a time, while human memory can process a lot of information at the same time.
- III. In computer, once a piece of information is stored, it will not change one bit over the years. But in case of human memory, memories will be continuously changed and reconstructed in response. Unlike a computer, we are not dealing with a physical limit of size. Humans are constantly removing some of their stored information through disuse and adding some more information as they come across new information.

7.3.2 Connectionism:

Another information-processing model is called **connectionism**. It is based on the view that memories are products of interconnected neural networks. Specific memories arise from particular activation patterns within these networks. Every time you learn something new, your brain's neural connections change, forming and strengthening pathways that allow you to interact with and learn from your constantly changing environment.

7.3.3 Richard Atkinson & Richard Shiffrin's A Three-Stage Model:

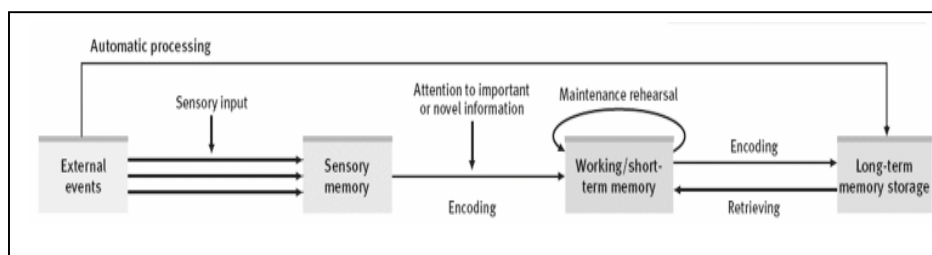
Atkinson & Shiffrin (1968) model is the most popular model based on information-processing concept explained above. According to them memory-forming process passes through a three-stage model. They proposed that information passes through three stages before it is stored. (see Fig. 7.1) These are:

Sensory Memory: We first receive information from the environment that needs to be remembered. Stimuli are recorded by our senses and held briefly in sensory memory.

Short – term Memory: Some of the information is processed into short – term memory and encoded through rehearsal.

Long- term Memory: Finally, the information is stored in long term memory after being processed in short term memory. From long term memory, it can be retrieved anytime when it is required.

Fig. 7.1



Dual -Track Memory: Atkinson and Shiffrin's model emphasized on storing information that we pay attention to or are aware of. But other psychologists pointed out that our mind works on two tracks. Some information skips conscious encoding in short term memory and directly goes into storage, that is long term memory. This automatic processing happens without our awareness. We will discuss automatic processing in detail later on in this unit.

This is a brief description of three components of this model. Now let us look at each component in detail.

Sensory Memory:

It is also called sensory register. It is the first and most immediate form of memory that you have. It refers to an initial encoding of sensory information that comes from environmental in its raw form. For any information to enter our memory, it has to be first picked up by our five senses, that is, taste, smell, sight, sound and touch. The information received from five sense organs lasts from a fraction of a second to a few seconds. It is a system of memory that holds information briefly, but long enough so that it can be processed further. However, unless we pay attention to the

information coming through our senses, the sensation will decay and be lost immediately.

Sensory memory allows individuals to retain impressions of sensory information even after the original stimulus has ceased. For example, while walking in a market and getting exposed to many faces passing by, an individual may turn around, if he feels that a familiar face has passed by, even though the image of that person from his sensory memory has already faded away, or if you look at an object and then close your eyes, an icon, or fleeting image will persist for one-half second afterwards. In other words, sensory memory holds impressions briefly, it holds them long enough so that series of perceptions are psychologically continuous. Without sensory memory, a movie will look like a sequence of still pictures.

Though this store is generally referred to as “the sensory register” or “sensory memory”, it is actually composed of multiple registers, one for each sense. Information is transferred to short term memory only when attention is given to it. But there are two types of sensory memory that are most talked about. They are:

a) Iconic Memory:

The mental representations of visual stimuli are referred to as icons (i.e., fleeting images). The sensory register that holds icons is called iconic memory. Iconic memories are accurate but last for a few tenths of a second.

George Sperling (1960) conducted an experiment to show the existence and length of iconic memory. The participants of the experiment were asked to sit in front of a screen upon which 9 letters (three rows of three letters each) appeared for only $1/20^{\text{th}}$ of a second. After the presentation, participants were asked to recall a particular row of letters. Sperling used a tone, immediately after presenting the nine letters, to indicate which row the participants should recall. A high-pitched tone meant that the participants need to recall the first row, a medium tone indicated to recall the middle row and the low tone indicated to recall the last row. Without the tone, people recalled about 50% of the letters; with the tone, recall for any of the rows was typically 100%.

However, it was found that if participants responded immediately with 0 second delay after seeing the letters, they remembered an average of nine letters. But if there was a delay of merely 0.5 seconds, they could recall only six letters and if there was a delay of 1.0 seconds, they could recall an average of only 4 letters, showing that all nine letters were momentarily available in their sensory memory.

b) Echoic Memory:

The mental representations of auditory stimuli are called echoes. Echoic memory is a form of sensory memory that holds auditory information for one or two seconds. For example, if you are watching T.V. and your mother asks you a question. You stop watching T.V. and ask, "What did you say?". The moment you say this, you realize that you can recall your mother's exact words. You can recall these words because they are still in your echoic memory. The memory traces of auditory stimuli can last for much longer than the traces of visual stimuli. Echoic memory can last for 3 to 4 seconds. Echoic memory also lets you hold speech sounds long enough to identify them as words. Yet, echoes like icons will fade with the passage of time. If they are to be retained, we need to pay attention to them. By selectively attending to certain stimuli, we sort them out from the background noise.

The main functions of sensory memory can then be described as:

- i) Sensory memory prevents us from being overwhelmed by many thousands of incoming stimuli. All incoming sensory information will vanish within seconds unless we attend to it.
- ii) Sensory memory gives us the time that we need to decide whether or not the incoming data should be processed further.
- iii) Iconic memory provides stability and makes visual world appear smooth and continuous and echoic memory allows us to play back information and recognize words.

Short-term Memory (STM):

Of the thousands of visual and auditory sensations, only a small percentage gets automatically transferred into short-term memory. Short term memory can hold a limited amount of information for a short period of time which can be lengthened if the information is rehearsed. Information held in STM is active information, that is, information to which you are paying attention.

Without rehearsal, short term memory can hold information for only 2 seconds to 30 seconds. To show this, Lloyd Peterson and Margaret Peterson conducted an experiment. Participants were asked to remember three consonant groups such as CHJ. To prevent rehearsal, the participants were asked to start at 100 and count aloud backwards by threes. Participants were then tested at various times for recall. After 3 seconds, they were asked to stop counting backward and recall the consonants that they were shown, they could recall only half of them, and after 12 seconds most memory of the consonants had decayed and could not be recalled. This clearly showed that without active processing (rehearsal) short term memory has limited life.

Short-term memory can hold about seven items, give or take two. If nothing distracts us, we can recall seven items. In other words, short term memory holds about 5-9 items at one time. The capacity differs depending upon age and other factors. Experiments have demonstrated that compared with children and older adults, young adults have more working memory capacity. That means that young adults can do multitasking more efficiently than other two groups. However, people from all age groups can do better and more efficient work when there are no distractions and they are focused on one task at a time.

Working Memory:

The terms working memory and short-term memory are sometimes used interchangeably. Working memory refers to the active, conscious manipulation of temporarily stored information. Working memory is where active thinking takes place. The term working memory emphasizes the fact that short-term memory is not merely a box into which information is placed but is a working, active system that focuses on the manipulation of information that it contains at any given moment.

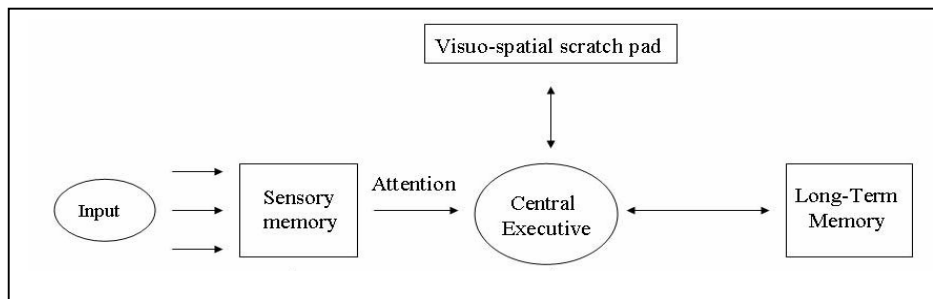
Cowan (2008) held that working memory capacity reflects intelligence level and an ability to maintain focus. People with good working memory are less likely to report than others that their mind was wandering.

Alan Baddeley et.al. (2001;2002) challenged Atkinson and Shiffrin's view of short term memory as a small, brief storage space for recent thoughts and experiences. Baddeley and Hitch (1974) developed an alternative model of short-term memory which they called working memory. They argue that the picture of short-term memory (STM) provided by the Multi-Store Model is far too simple. According to Atkinson and Shiffrin's model, STM holds limited amounts of information for short periods of time with relatively little processing. This means it is a single system or store without any subsystems.

They stated that working memory is not just a temporary shelf for holding incoming information. It is an active desktop where your brain processes information, making sense of input and linking it with long-term memories. In other words, the short-term memory is working in many ways. It holds information not just to rehearse it for storage but also to process it, for example, hearing a word problem in math, keeping it in mind and solving the problem in head. Let us take another example, the pages that you are reading right now are entering your working memory through vision. You might also repeat the information using auditory rehearsal. As you integrate this visual input with your long-term memory, your

attention is focused. Baddeley (1998,2002) called this focused processing the central executive. (See Fig. 7.2)

Fig. 7.2



According to Baddeley the central executive is the most important component of working memory. The central executive decides what working memory pays attention to. Central executive acts more like a system which controls attentional processes rather than as a memory store. Without focused attention, information often fades.

Sparrow et.al. (2011) empirically showed that people invest less energy in remembering the information if they know that information is available online. One can say, sometimes Google replaces rehearsal and mobile phone replaces remembering phone numbers of even family and friends.

Long Term Memory (STM):

Long-term memory (LTM) is the final stage of the multi-store memory model proposed by Atkinson & Shiffrin. Theoretically, the capacity of LTM is unlimited. If we are not able to recall any information, it is due to accessibility and not due to availability. Encoding in LTM, generally, can be in semantic (meaning) mode and visual (pictorial) mode but it can be in acoustic mode also.

There are three types of long term memories:

- Procedural Memory
- Semantic Memory
- Episodic Memory

Procedural memory: It is responsible for knowing how to do things. It is involved in motor skills. It is at unconscious level, automatic and declarative.

Semantic memory: It is responsible for storing information about the world and involves knowledge about the meaning of words, as well as general knowledge.

Episodic memory: It is responsible for storing information about events that we have experienced in our lives. It involves conscious thoughts and is declarative.

We have discussed LTM in detail in building memories, encoding and effortful processing, and levels of processing.

Check your Progress:

Write a short note on

- a.) Information processing models with reference to comparison with computers and as connectionism views.
- b.) Sensory memory
- c.) Short term memory
- d.) Working memory

7.4 BUILDING MEMORIES

7.4.1 Encoding and Automatic Processing:

The facts and experiences that we consciously know and declare are part of explicit memories and are called declarative memory.

The content that we retain without conscious recollection is part of implicit memories and is called non-declarative memory. Our implicit memories include:

- a.) **Procedural memory** for automatic skills such as how to swim, drive a car, eating, typing on keyboard etc.
- b.) **Classically conditioned association** among stimuli. For example, you experience fear when you visit a dentist's clinic because you automatically link a dentist's clinic with painful drill and when you visit a dentist's clinic, you have sweaty palm. You did not plan to feel fear but it happens automatically. Another example can be a pleasant smell that triggers the thoughts of a favorite place.

It has been observed that people absorb some information without paying attention to it. Some forms of processing take effort but over time and with experience, becomes automatic. Many skills are developed like this. For example, without conscious effort you automatically process information about:

- **Space:**

While reading a textbook, you often encode the place on a page where certain material appears; later, when struggling to recall information, you may visualize its location. Similarly, you

visualize a road map when you are giving directions to a person for any destination. Another example can be being able to visualize where things are after walking through a room.

- **Time:**

While going about your day, you unintentionally note the sequence of the day's events. Later, when you realize that you left your purse somewhere, you re-create the sequence of what you did that day and retrace your steps.

- **Frequency:**

You effortlessly keep track of how many times things happen, thus enabling you to realize "this is the fifth time I have come across this beggar today".

As mentioned before, we have two track mind that engages in vast information processing in a very impressive and efficient way. One track automatically stores many routine details while the other track focuses on conscious effortful processing. So, let us now look at effortful processing.

7.4.2 Encoding and Effortful Processing:

Automatic processing happens so effortlessly that it is difficult to shut off. For example, you automatically wake up at 5 O'clock in the morning, even if you forget to set up the alarm. Automatic processing does not require attention or effort. Things happen subconsciously. However, effortful processing requires conscious processing. The learning requires a lot of effort and thought so that it can be stored. Most new or complex tasks require undivided attention and utilize effortful processing. Once the task is learned, it becomes part of automatic processing. For example, consider learning to drive a car; at first, drivers intensely grip the steering wheel and pay undivided attention to the road ahead. But with experience and practice, as they get used to driving, they relegate some part of driving, such as when to press brake or how much to press accelerator to automatic processing. This helps the driver to do other tasks such as changing the music CD.

Same is true for other skills such as learning to read, write or speak a new language, singing, playing cricket, gymnastics, etc. The basic principle being that when the task is new we need to use effortful processing to put it in memory and once it is learned properly, we use automatic processing and perform that task without paying conscious effort to it.

Effortful Processing Strategies:

Committing new information to memory requires efforts just as learning a concept from a textbook. Empirical studies have shown that many strategies can be used to increase our ability to

form new memories. Whether we will be able to recall this new information from our long-term memory depends upon how successfully we have used these strategies. If these strategies are used effectively, they lead to durable and accessible memories. Let us look at some of the strategies that can be used to remember new information.

1. Chunking:

George Miller was the first one to use the concept of chunking in 1950s to increase STM. People can group information into familiar manageable units to expand their short-term memory capacity called “chunking”. In other words, chunking is a term referred to the process of taking individual pieces of information (chunks) and grouping them into larger units. A chunk is a collection of elements having strong association with elements of other chunks of information. Chunking usually occurs so naturally that we take it for granted. We can remember information best when we can organize it into personally meaningful arrangements.

Chunking can be based on:

- Language patterns, for example, RATSHOELACE can be chunked as RAT SHOE LACE. A paragraph can be chunked into phrases and sentences. To learn a song or a poem, you break it into pieces of three lines or four lines and learn it, once you have mastered each piece you link it again in proper sequence. A shopping list can be broken down into smaller groupings based on whether the items on the list are vegetables, fruits, dairy or grains.
- Random digits are best chunked into groups of about three items. The most common example of chunking occurs in phone numbers. For example, if you think of a telephone number as one large piece of information, then to easily remember this number such as 8082892988, you can break it down to 808 289 29 88

In nutshell, to use chunking technique effectively, you must use practice, look for connections, associate groups of items to things from your memory and of course use other memory strategies, such as mnemonics, along with chunking.

2. Mnemonics:

Ancient Greek scholars and orators used Mnemonics to encode lengthy passages and speeches. Mnemonics are memory aids (such as images, maps, peg – words, etc.) that use vivid imagery. We are good at remembering mental pictures. It is easier to remember concrete, visualizable words than abstract words. Human mind more easily remembers spatial, personal, surprising, physical humorous or otherwise relatable information rather than

abstract or impersonal information. Acronyms, rhyme or a jingle are other mnemonics often used.

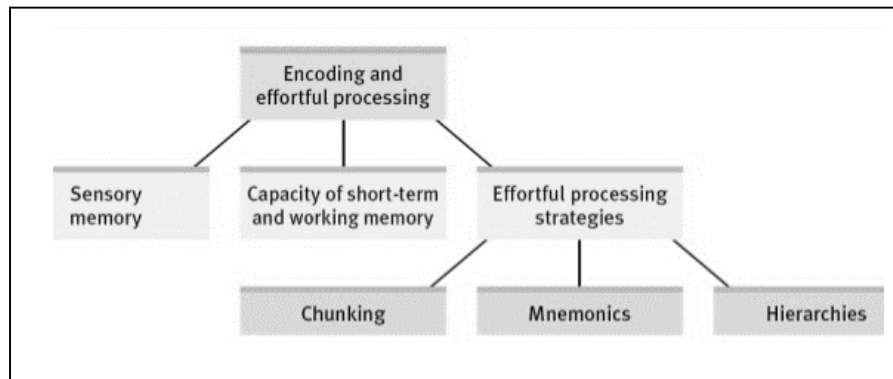
An acronym is a word formed from the first letters or groups of letters in a name or phrase. For example, UNICEF is an acronym for The United Nations Children’s Fund, OCEAN is an acronym for the big five personality traits- openness, conscientiousness, extraversion, agreeableness and neuroticism.

A rhyme is a saying that has similar terminal sounds at the end of each line. Rhymes are easier to remember because they can be stored by acoustic encoding in our brains. For example, in fourteen hundred and ninety-two Columbus sailed the Ocean Blue.

A peg word system refers to the technique of visually associating new words with an existing list that is already memorized along with numbers. A peg system is a technique for memorizing a list of words that must be recalled in a particular order. One can use several types of pegs together such as rhymes, numbers, shapes and alphabets. So, a peg is a mental hook on which you hang information. For example, to learn numbers, you associate each number with a word that rhymes with that number – one-sun, two-shoe, three-tree, four- door, five- hive, etc.

3. Hierarchies:

Fig.7.3



Hierarchy is a way of organizing information for encoding. When complex information is broken down into broad concepts and further subdivided into categories and subcategories, it is called hierarchy system. We are more likely to recall a concept if we encode it in a hierarchy. For example, see the hierarchy of the topic that we are studying right now (Fig 7.3)

Gordon Bower et.al.(1969) conducted an experiment in which words were presented either randomly or grouped in categories such as minerals, animals, clothing, and transportation. These words were presented for one minute each. It was found that

participants could recall two to three times better when words were organized in categories rather than when presented randomly.

4. Distributed Practice:

More than 300 experiments over a century have shown that we can memorize better, that is have better long - term retention, when our encoding is distributed over time rather than concentrated at one particular time. This is called **spacing effect**. The spacing effect was first noted by Herman Ebbinghaus in the late 1800s.

For memorizing any information, we use two types of practices – mass practice and distributed practice.

Mass practice: Mass practice refers to a practice schedule in which the amount of rest between practice sessions or trials is very short. Mass practice is essentially cramming. Mass practice can produce speedy short-term learning and feeling of confidence. But Hermann Ebbinghaus (1885) said that those who learn quickly also forget quickly.

Distributed Practice: Distributed practice refers to a practice schedule in which the amount of rest between practice sessions or trials is relatively long. As distributed practice takes longer in absolute terms, individuals using this technique often falsely feel that they are being less efficient.

Distributed practice is more likely to result in success; however, it takes some maturity to be able to do a little bit each day. For example, let us say there are two students preparing for exam, having similar intelligence and abilities. One student studies whole night before exam while another student has studied one hour per day over six months, the second student will do better in the exam than the one who studies for the whole night one day before exam.

However, this does not mean that you need to study every day. Memory researcher Harry Bahrick noted that the longer the time between study sessions, the better the long-term retention will be and the fewer sessions will be needed. After you have studied long enough to master the material, further study becomes inefficient. In other words, over learning or over memorizing is of no use. It is better to use that extra reviewing time a day later if you need to recall that information after 10 days or a month later if you need to recall that information after 6 months. In other words, to prepare for annual exam, it is better to study and memorize material in consistent manner over the months rather than studying in a crammed manner, in a month immediately before the exam.

In fact, Harry Bahrick along with his three family members conducted a 9-year long experiment. His conclusion was that if you spread your learning over several months, rather than over a short period, you can retain information for a life time.

Testing Effect: One effective way to distribute practice is repeated self-testing. Henry Roediger and Jeffrey Karpicke (2006) called self-testing as testing effect. They stated that it is better to practice retrieval (that is try to answer the questions about the material as in exam) than merely to reread material. Just rereading material will lull you into a false sense of mastery.

Levels of Processing:

Memory researchers believe that we process verbal information at different levels, and the depth of our processing affects our long-term retention of the information. The levels of processing can be shallow and deep processing. Let us discuss each one of them.

Shallow Processing: It encodes information at a very basic level that is memorizing the appearance or sound of words.

Deep Processing: It encodes semantically. That means it -

- Attaches meaning of the words,
- Links them to existing memories, and
- Uses self-reference effect, that is, people remember things that are personally relevant to them.

The deeper (more meaningful) the processing, the better our retention will be. Fergus Craik and Endel Tulving (1975) conducted an experiment to investigate the effects of different types of processing on recall. Participants were presented with words that either were written in capital letters (appearance) or rhymed with other words (sound) or fitted in a sentence (semantic). Results showed that processing a word deeply, by its meaning (semantically) produced better recognition of that word at a later time than the shallow processing of words by attending to their appearance or sounds. This clearly shows that deeper levels of processing based on meaning of information is better than shallower recall method. It means that learning by rote or cramming without understanding a lesson will not help in retaining it in long term. To retain it in long term, you need to understand the meaning of the material that you are studying and to related it with other information that you already have.

Making Material Personally Meaningful:

We have difficulty in processing and storing the information that does not appear meaningful to us or does not relate to our experiences. Ebbinghaus (1850-1909) believed that compared to

learning material that appears to be nonsense to us, learning meaningful material takes just 1/10th of the effort.

Wayne Wickelgren (1977) said “The time you spend thinking about material you are reading and relating it to previously stored material is about the most useful thing you can do in learning any new subject matter”.

People remember information significantly better when they process that information in reference to themselves. The more it is personalized, the better will be recall of that information. This is called the self-reference effect. This tendency of self-reference effect is especially strong in members of individualistic western cultures (Symons & Johnson, 1997).

There can be three explanations for self-reference effect –

1. Information relevant to self is processed more deeply and rehearsed more often. May be due to better elaboration, such information remains more accessible.
2. Information relevant to self leads to high arousal and that may enhance memory.
3. People have special mechanism for encoding information relevant to themselves.

Check your Progress:

Write short notes on

- a.) Automatic Processing of information
- b.) Effortful processing of information and Dual track memory
- c.) Chunking & Mnemonics
- d.) Hierarchies & Distributed Practice
- e.) Shallow processing and deep processing

7.5 SUMMARY

In this unit, we began with why it is important to understand human memory. Without memory, we cannot lead a normal life and maybe we will not be human enough. Our entire learning depends on memory. We also looked at the three methods used by psychologists to know that learning has taken place. These three methods are recall, recognition and relearning. Research studies have shown that it is easier to use recognition than recall to extract any information from memory. Similarly, while relearning if we take less time than previous attempt at learning, it shows better retention of the information.

Next, we looked at three information processing models- one compared the functioning of human memory with the functioning of computers, second one emphasized that the neural connections in brain are different from the wires connecting different parts of

computers. Whenever we learn something new, these neural connections change. In other words, this model states that human memory system is more dynamic than computers. The third model is the most popular model of understanding how memories are formed. This is Atkinson & Shiffrin's model of three stages. It emphasizes that we have three types of memory systems- first one being the sensory memory, which is the entry point of receiving information from the environment. This act of receiving information can be at the conscious level or unconscious level. If attention is paid to the information for sufficient time the information will go to short term memory and if the information is processed there also for sufficient time it will go to long term memory. However, we will be discussing long term memory in next unit.

We elaborated on sensory memory by saying that information is received through all five sense organs and we have separate memory for each sense organ. The most prominent ones are Iconic memory- information received through eyes in the form of visual stimuli, and echoic memory- information received through ears in the form of auditory stimuli. Then we discussed short term memory and working memory, emphasizing that short term memory can hold on an average only seven items at a time and that too for only 2 to 30 seconds depending upon the type of sensory information received.

Working memory is also short-term memory only, except the fact that it underlines the fact that short term memory is not merely receiving the information and passing it on to long term memory, it is actively manipulating the received information by understanding the meaning of information received and linking it to information already stored in long term memory.

Next, we talked about building memories where we said that encoding can take place either automatically or through effortful processes. Automatic processing takes place in procedural memory or through classically conditioned association among stimuli. It is also influenced by space, time and frequency.

Effortful processing is a conscious effort put in to memorize some information and the techniques that can be used for that are chunking, mnemonics, hierarchies and distributed practices.

We also discussed the levels of processing. There can be shallow processing, when you don't pay attention to the meaning of the information and there can be deep processing, when you pay attention to the meaning of the information. Research studies have shown that retention of information is better when people use deep processing and when self-reference effect takes place, that is, they get information that is related or relevant to them.

7.6 QUESTIONS

1. Explain in detail Atkinson and Shiffrin's three – stage information processing model of memory.
2. Discuss in detail short-term memory and working memory.
3. Distinguish between automatic and effortful processing of information. What are some effortful processing strategies that can help us remember new information?

7.7 REFERENCE

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



MEMORY - II

Unit Structure :

- 8.0 Objectives
- 8.1 Introduction
- 8.2 Memory Storage
- 8.3 Retrieval: getting information out
- 8.4 Forgetting
- 8.5 Memory Construction Errors
- 8.6 Improving Memory
- 8.7 Summary
- 8.8 Questions
- 8.9 References

8.0 OBJECTIVES

After reading this unit, you will be able to understand

- how explicit and implicit memories are stored in the brain
- how retrieval takes place
- the causes of forgetting
- the techniques to improve memory

8.1 INTRODUCTION

In last unit, we mentioned that it is important to study memory as it connects the present moment to what came before and is the basis for the formation of one's life story. Basically, we as a person are derived from experiences that have been stored in our long-term memory. Atkinson & Shiffrin's three stage model stated that from short term memory the information goes to long term memory- its last destination. So, let us see briefly, what are the characteristics of long- term memory. Long-term memory stores memories for years and sometimes for entire life. Its capacity is unlimited, but storing and retrieval of information depends upon changes in neuronal structure. This physical change is relatively permanent. Think of it, there is never a situation when a person says I can't learn anything anymore in my life. If people sometimes can't retrieve memories that were stored in childhood, it only means those memories are available in memory but not accessible. Non-accessibility can be for various reasons, but memories are there.

There are different types of long term memories such as explicit memories, implicit memories, flash bulb memories, etc. After this short introduction to long term memory, let us see what kind of physiological changes take place when we are processing information and storing in long term memory and where it gets stored. We will also discuss various techniques to retrieve the information and how memory can be improved.

8.2 MEMORY STORAGE

8.2.1 Retaining Information in the brain:

Initially, people believed that long term memory is like an empty room which has to be filled up with memories. It was also believed that it does not have elasticity and has limited capacity, to fill new information old information items need to be thrown out. But later on, psychologists empirically showed that our long-term memory is flexible and has endless capacity to store information.

However, we do not store information as books are stored in libraries -carefully staked in distinctly labeled racks and having precise locations. Instead, many parts of the brain interact as we encode, store and retrieve the information from our memories. Memories are not stored in any single site of the brain, instead they are stored throughout the brain. To show that memories are not stored in any single specific spot of the brain, Karl Lashley (1950) conducted an experiment in which he trained rats to find their way out of a maze. After that he surgically removed pieces of their brain's cortex and retested their memories. He found that no matter what small brain section he removed, the rats always found their way out of the maze, as they retained at least partial memory. This indicated that while storing memories various parts of brain are interacting. In fact, different parts of the brain are active in storing different types of memories. Let us look at which parts are active for implicit and explicit memories.

A) Explicit – Memory System: The Frontal Lobes and Hippocampus

Explicit or declarative memory is one of the two main types of long-term human memory. It stores facts, stories, meaning of the words, previous experiences and concepts that can be consciously recalled.

The network that processes and stores explicit memories includes frontal lobes and hippocampus.

Frontal Lobes:

The frontal lobes are important in working memory. The left and right frontal lobes process different types of memories. The left frontal lobe is more active in memorizing verbal material, e.g., when you recall a password and hold it in working memory, you are using

the left frontal lobe. The right frontal lobe is more active in recalling non-verbal material, e.g., if you are recalling a party scene, or thinking about a painting, you are using your right frontal lobe.

Hippocampus:

The hippocampus is a small, curved neural center located in the limbic system in each temporal lobe. It is involved in the formation of new memories and emotional responses. It instantly evaluates incoming data from the five senses and decides whether to store or discard the information. So, for the brain, it is equivalent to “save button” in computer. Studies have shown that explicit memories of names, images and events are laid down through the hippocampus. Therefore, damage to hippocampus disrupts recall of explicit memories. Just like humans, birds also have hippocampus in their brains. It has been found that birds, with their hippocampus intact, can store food in hundreds of places and can still find it months later when they return to these unmarked hiding places. But they can't remember, where they had stored the food if their hippocampus is damaged (Kaamil & Chang,2001). Shettleworth (1993) stated that among animals, a bird called Nutcracker can locate 6000 pine seeds during winter season which it had buried months back.

Furthermore, in case of human beings, it has been reported that people cannot remember verbal information, if their left hippocampus is damaged, but they have no difficulty in remembering visual designs and locations. They cannot recall visual designs and locations if their right hippocampus is damaged. We would not be able to remember where our house is without the work of the hippocampus.

Research has also found that different sub regions of the hippocampus itself play important roles in certain types of memory. For example, the rear part of the hippocampus is involved in the processing of spatial memories. Studies of London cab drivers have found that navigating complex mazes of big city streets is linked to the growth of the rear region of the hippocampus. (Maguire et.al.2003a) Another study reported that anterior hippocampus is active when people learn to associate names with faces (Zeineh et.al.,2003) and another part of hippocampus is active when people use spatial mnemonics (Maguire et.al.,2003b). The reason is that the left hippocampus is more involved in the memory of facts, episodes, words; it is responsible for constructing episodic memory. The right hippocampus is more involved in spatial memory.

Memories are not permanently stored in hippocampus. Events or episodes (such as its smell, feel, sound and location) are held there temporarily for a couple of days before consolidating,

moving to other parts of the brain for long-term storage. For example, Tse et.al. (2007) showed in an experiment that if a rat's hippocampus is removed three hours after it has learnt the location of some tasty food, it will not be able to locate food after the operation, because its hippocampus did not get a chance to send the information to different locations of long term memory. But if the hippocampus is removed 48 hours after the rat has learned the location of the tasty food, it could remember the location.

Much of this consolidation of memory occurs during sleep. During deep sleep, the hippocampus processes memories for later retrieval. Other studies have shown that getting a full eight hours of sleep after learning a new task, such as a finger-tapping exercise, or after studying a long list of words can boost recall the next day. Even a one-hour nap can improve performance on certain tasks. Researchers have watched the hippocampus and brain cortex showing simultaneous activity rhythms during sleep, indicating as if they are having a dialogue (Euston et.al.,2007). What happens is that when you sleep at night, your brain "replays" the day's events. During these nightly recaps, hippocampus and the neocortex, "talk" to one another and transfer day's experiences to the cortex for long-term storage. Cortex areas surrounding the hippocampus support the processing and storing of explicit memories. This transfer of information from hippocampus to cortex is called consolidation. In addition to strengthening memories, sleep can also help integrate new information, leading to creative insight. In one experiment, researchers showed how sleep restructures information to help subjects see new patterns, linking new information with prior knowledge.

B) Implicit -Memory System: The Cerebellum and Basal Ganglia –

Implicit memory is sometimes referred to as unconscious memory or automatic memory or non-declarative memory. As mentioned before, implicit memory includes skills and habits, conditioned associations, priming and perceptual learning. Even if you lose your hippocampus and frontal lobe, you will still be able to do many activities because of implicit memory.

No declarative memory is expressed through performance rather than recollection. The unconscious status of non-declarative memory creates some of the mystery of human experience. Here arise the habits and preferences that are inaccessible to conscious recollection, but they nevertheless are shaped by past events, they influence our current behavior and mental life. For example, LeDoux (1996) reported a case of a brain damaged patient who suffered from amnesia and could not form immediate memories. Every day, her doctor shook her hand and introduced himself as she could not form memories of the current events. One day when

doctor shook hand with her, she suddenly pulled her hand back with a jerk because doctor has a drawing board pin in his hand and that had pricked her. The next day, when doctor returned to introduce himself, she refused to shake his hand but she could not explain why she was refusing to shake hand. She was classically conditioned.

The **cerebellum** plays a very important role in formation and storage of implicit memories created by classical conditioning. If cerebellum is damaged, people cannot develop certain conditioned reflexes, such as associating a tone with about to come puff of air and thus do not blink in anticipation of the puff (Daum & Schugens;1996). Similarly, when researchers surgically disrupted the function of different pathways in the cerebellum of rabbits, the rabbits could not learn a conditioned eye blink response. It was also reported that if cerebellum is damaged, voluntary motor movement become slow and uncoordinated. It is clearly evident from these experiments that cerebellum plays an important part in formation of implicit memories.

A subset of implicit memory, **procedural memory**, enables us to perform many everyday physical activities, such as walking and riding a bike, without having to give it thought. A large majority of implicit memories are procedural in nature. Procedural memory primarily depends on the cerebellum and basal ganglia. The basal ganglia are deep brain structures involved in motor movements and memories of skills. The cerebellum plays a part in correcting movement and fine tuning the motor agility found in procedural skills such as painting, instrument playing and in sports such as cricket, swimming, etc. Damage to this area may prevent the proper relearning of motor skills.

The Basal Ganglia receives input from the cortex, but it does not return the inputs to the cortex for conscious awareness of procedural learning. For example, once you know how to ride a bike, you never forget this skill, thanks to your basal ganglia. You can ride the bicycle even if you can't recall having taken the lesson for this skill.

Infantile amnesia:

Implicit memory from infancy can be retained right up to adulthood, including skills and conditioned responses. However, explicit memories such as our recall of episodes, goes back to about age 3 for most people. This nearly 3 years "blank" in our memories is called infantile amnesia. For example, in an experiment conducted by Bauer et.al. (2007), the events children experienced and discussed with their mothers, when they were 3 years old, they could recollect 60% of these events at the age of 7 but could recollect only 35% of these events at the age of 9. This

demonstrated that as we grow old we can't recollect the events that took place either before or at the age of 3. The question arises, why we can't remember these events that take place in infancy stage. Psychologists have come up with two reasons for it-

1. Encoding: Some psychologists believe that explicit memories in childhood develop with language acquisition because the ability to use words and concepts helps in memory retention. It is believed that after developing linguistic skills, memories that were not encoded verbally get lost within the mind. Another explanation is that young children encode and store memory as images or feelings. In adulthood, our language dominated memories do not have retrieval cues appropriate for gaining access to the stored memory of childhood.
2. The hippocampus, that plays a significant part in explicit memories, is one of the last brain structure to mature.
3. Still other psychologists believe that children younger than 3 or 4 do not perceive contexts well enough to store memories accurately.

8.2.2 The Amygdala, Emotions, And Memory:

It is a common knowledge that generally we remember emotionally charged events better than boring ones. The brain region that is most strongly involved in emotional memory is the amygdala. The question arises how does intense emotions cause the brain to form intense memories? Psychologists say

1. Emotions can trigger a rise in stress hormones that influences memory formation. Heightened emotions (stress related or otherwise) make for stronger memories. Stress hormones make more glucose energy available to fuel brain activity. In a way, emotions trigger stress hormones telling the brain that something important just happened.
2. These hormones trigger activity in the amygdala and provoke it to increase memory-forming activity in the frontal lobes and basal ganglia and also to "tag" the memories as important. The amygdala is critically involved in calculating the emotional significance of events, and, through its connection to brain regions dealing with sensory experiences, also appears to be responsible for the influence of emotion on perception - alerting us to notice emotionally significant events even when we're not paying attention. Emotional arousal can blaze certain events into the brain, while disrupting memory of certain other neutral events at the same time. As a result, the memories are stored with more sensory and emotional details. These details can trigger a rapid, unintended recall of the memory.

3. Emotions often persist without our being consciously aware of what caused them. For instance, in an experiment, patients with damaged hippocampus (so that they could not form new explicit memory) watched a sad film and later a happy film. After the viewing, they did not consciously recall the films, but the sad or happy emotion persisted. (Feinstein et.al.,2010).
4. Stressful events can form very long-lasting memories. Especially, traumatic events such as rape, house fire, terrorist attack, etc. may lead to vivid recollection of the horrific event again and again. James Mc Gaugh (1994) noted that stronger emotional experiences make for stronger, more reliable memories. This helps in our survival also, because memory serves to predict the future and alert us to future dangers.
5. **Flashbulb memories:** These tend to be memories of highly emotional events. These events can be traumatic such as 9/11 terror attack, an earthquake, Tsunami, rape, news of a loved one, etc. or it can be a pleasant but emotionally charged event, such as first date outing. Typically, people can accurately recall-
 - Place (where they were when the event happened),
 - Ongoing activity (what they were doing),
 - Own affect (the emotion they felt),
 - Informant (who broke the news)
 - Others' Affect (how others felt)
 - Aftermath (Importance of the event)

Flashbulb memories register like a photograph. It is as if the brain commands, "Capture this". People can recall them vividly and with high confidence. However, as we relive, rehearse and discuss them, these memories may get distorted as misinformation seeps in. So, flashbulb memories are not as accurate as it was initially thought.

8.2.3 Synaptic Changes:

When people form memories, their neurons release neurotransmitters to other neurons across the synapses. With repetition, the synapses undergo **long-term potentiation (LTP)**, that is, the signals are sent across the synapse more efficiently. It is defined as a long-lasting increase in synaptic efficacy following high frequency stimulation of presynaptic neurons.

Synaptic changes include a reduction in the prompting needed to send a signal and an increase in the number of neurotransmitter receptor sites. In other words, neurons can show history- dependent behavior by responding differently as a function of prior input, and this plasticity of nerve cells and synapses is the

basis of memory. Neurons that fire together wire together. It means, through repeated pairing, there will be structural and chemical changes that will result in strengthening of active synapses forming a stronger circuit.

LTP occurs throughout the brain, but a high concentration of LTP occurs in the hippocampus and is believed to play a role in learning and memories. Many experiments have proved that LTP is a physical basis for memory. For instance –

1. Drugs that block LTP interfere with learning Lynch & Staubli (1991).
2. In an experiment, rats that were given a drug to increase their LTP learned a maze with half of the usual number of mistakes (Service, 1994).
3. When rats were injected with a chemical that could block the preservation of LTP, rats' immediate memories were erased (Pastalkova et.al.2006). After LTP has occurred, if electric current is passed through the brain, it won't disrupt old memories, but it will erase current memories. This is exactly what happens when depressed people are given electroconvulsive therapy or somebody gets hit very hard on the head. For example, football players or boxers who become temporarily unconscious after a hit by the opponent, typically have no memory of what happened before the hit (yarnell & Lynch, 1976).
4. Some pharmaceutical companies manufacture memory-boosting drugs. These drugs are consumed by people suffering from Alzheimer's disease or having mild cognitive impairment that may later on become Alzheimer's disease, or simply by people who are having age related memory decline. This memory improving drugs are of two types –
 - a.) Drugs that enhance neurotransmitter glutamate.
 - b.) Drugs that improve production of CREB, a protein that enhances the LTP process. Increased production of CREB triggers enhanced production of some other proteins that help in reshaping synapse and transfer short term- memories into long-term memories and patients who take these drugs show enhanced learning.

However, there are some people who wish to take drugs to block the memories. These are the people who have gone through traumatic experiences and do not want to go through the memories of those events. A drug that helps in erasing such memories is Propranolol. In an experiment, it was found that when victims of traumatic event such as accident or rape were given this drug for 10 days immediately after the incident, it helped them to overcome their experiences as after three months they did not show any sign of stress disorder.

The following charts shows the summary of encoding of both types of memories and how the brain stores memories in its two – track system (See Fig. 8.1 & Fig. 8.2)

Fig.8.1

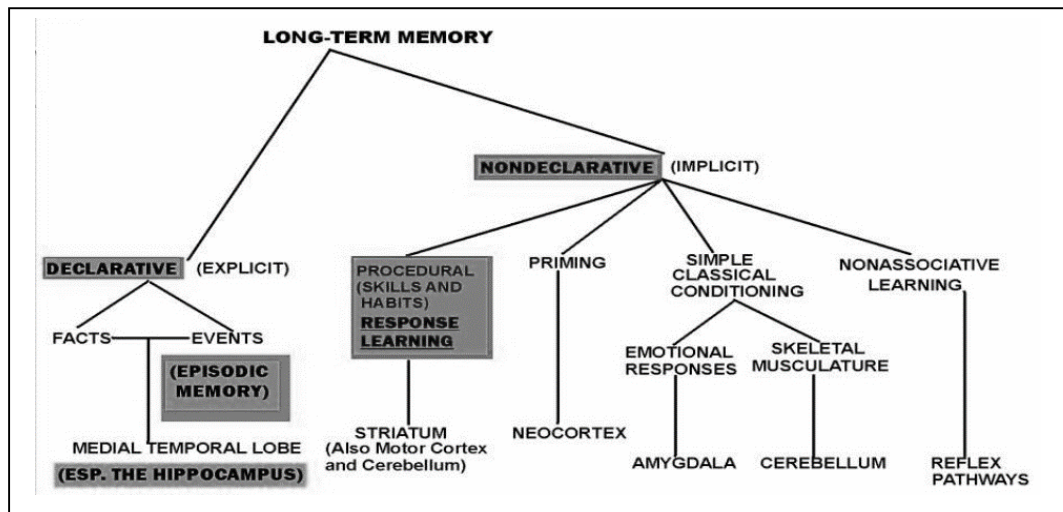
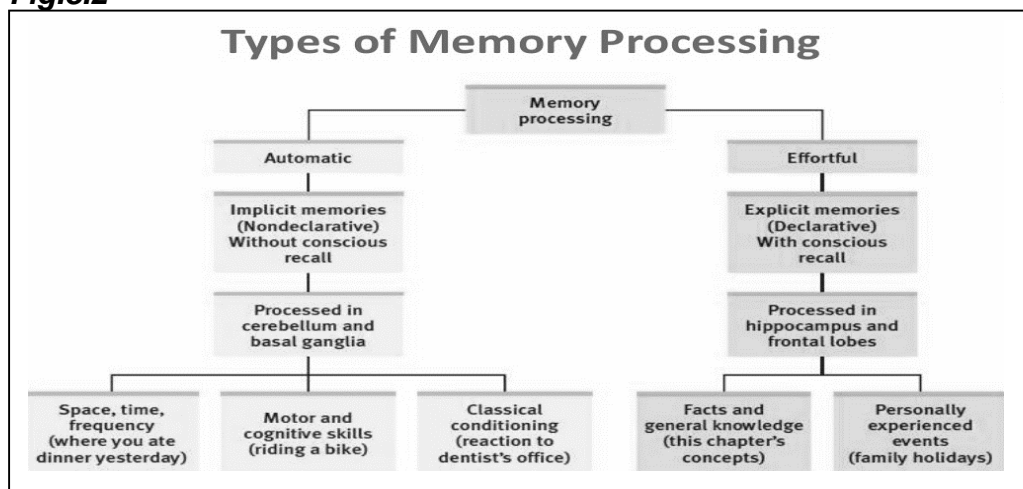


Fig.8.2



8.3 RETRIEVAL: GETTING INFORMATION OUT

Measures of Retention:

There are three measures of retention – recall, recognition and relearning speed. It is easier for us to recognize the information than to recall. Our recognition memory is impressively quick and vast. Our speed of relearning also indicates how much we have learned. Herman Ebbinghaus showed this in his learning experiments, using a nonsense syllables. He found that the more times he practiced a list of nonsense syllables on day 1, the fewer repetitions he required to retain it on day 2. Additional rehearsal (over learning) of verbal information increases retention, especially when practice is distributed over days.

Retrieval Cues:

Generally, it is believed that memory retrieval is a simple process. Information has been stored in long term memory and can be retrieved at will. But it is far from reality. Just because a memory has been fully encoded is no guarantee that it can be retrieved and applied at will, because memories are held in storage by a web of associations, each piece of information interconnected with others. These associations are like anchors that help retrieve memory. In other words, memory is not stored as a file that can be retrieved by searching alphabetically. Instead, it is stored as a web of associations – conceptual, contextual and emotional.

One process that can improve the likelihood of remembering previously learned knowledge is retrieval cues. Retrieval cues can be defined as any stimulus or words that help us remember stored memories (Goldstein, 2011).

Retrieval cues are clues or reminders which direct memory search to the appropriate part of the LTM.

The more retrieval cues you have, the better will be your chances of finding a route to your stored memory. Retrieval is good when conditions favor rich and elaborate encoding because it provides readily available retrieval cues. Retrieval cues can be external such as place, color, sound that can help you to retrieve the specific memories. For example, in various Hindi movies, we have seen the use of external retrieval cue (such as a specific shaped charm bracelet, a song learned in childhood, etc.) being used to trigger memories. Retrieval cues can be internal also such as internal such as feelings of sadness that reminds you of some unfortunate event in your life.

Priming:

Retrieval is affected by activation of our associations. Priming triggers a thread of associations that bring us to a concept,

just as a spider feels movement in a web and follows it to find the bug. Our minds work by having one idea trigger another; this maintains a flow of thought.

Priming has been called “invisible memory”, “memoryless memory” because it affects us unconsciously. Priming is an implicit memory effect in which exposure to one stimulus influences the response to another stimulus. Priming influences our behavior. For example, Joly & Stapel (2009) empirically reported that Dutch children primed with items associated with Santa Claus shared more chocolate than did other children who were not primed with Santa Claus. This is because Santa Claus is associated with kindness and generosity and children who were primed with Santa Claus were reminded of these qualities.

Priming effects are not always positive. We may have biases and associations stored in memory that also influence our choices. For example, Vohs (2006) showed that participants primed with money related words were less likely to help another person when asked to do so. Ariely (2009) explained these findings and said that in such cases, money primes our materialism and self-centeredness rather than the social norm of helping.

Context-Dependent Memory:

Part of the web of associations of a memory is the context. We retrieve a memory more easily when in the same context as when we formed the memory. For example, words learned underwater are better retrieved underwater. Students better on tests if they study in the same place where they take the test. Eyewitness can recollect better when they are taken back to the scene of crime where they saw the crime occurring. A student may go to a stationary shop and may not remember what he wanted to buy, but when he comes home and again sits on his study table, he may recollect that he wanted to buy a specific pencil from the stationary store.

When people visit their old school, they can recall memories that they believed they had forgotten. This explains why people experience the ‘flood’ of memories after revisiting their old school or house after a gap of many years. When an individual moves to a new location with different contextual information, remembering and recalling information from this new environment may interfere with the old memories and result in “forgetting”. However, when returning to the former location, the presence of contextual information “reactivates” these old memories, allowing them to be recalled, even after many years of absence. Experiments have shown that a familiar context can activate memories even in 3-month-old infants.

State- Dependent Memory:

Unlike context – dependency memory, which involves an individual's external environment and conditions, state-dependent memory applies to the individual's internal conditions. Our memories are not just linked to the external context in which we learned them. Memories can also be tied to the emotional state we were in when we formed the memory.

State-dependent memory is the phenomenon through which memory retrieval is most efficient when an individual is in the same state of consciousness as they were when the memory was formed. Alcohol-related state-dependent memory is known to occur with humans as well as with animals. Heavy drinkers may forget what they did while drunk, only to remember again the next time they drink. For instance, someone who hides money when drunk may forget the location until drunk again. Rats were taught to run a maze under the influence of a depressant drug often forgot the route through the maze if tested later without the drug. Given the drug again, they could retrieve their memory and run the maze successfully.

Similarly, emotions that accompany good or bad events become retrieval cues (Fiedler et.al. 2001). So, we can say that our memories are mood congruent. Mood-congruent memory occurs where current mood helps recall of mood-congruent material, regardless of our mood at the time the material was stored. Thus, when we are happy, we are more likely to remember happy events. If you are in gloomy mood, you may recall other bad events from your past. Research has shown that people put in a cheerful mood – either through hypnosis or through positive events of the day – recalled the world in very positive terms. They judged themselves as competent and effective and judged others as benevolent and in general were optimistic about world's future. This retrieval effect helps to explain why our moods persist. When happy, we recall happy events and therefore see the world as happy place and our happy mood prolongs and vice versa.

This clearly indicates that our moods color our thinking. When we feel happy, we think happy. We see and recall a good world. When our mood is gloomy, our thoughts switch to a different track. The bad mood primes our recollection of negative events. Our relationships seem to sour, our self-image plunges, our hopes for the future dim and other people's behavior seems sinister. As depression increases, memories and expectations dive down. It was found that currently depressed people recall their parents as having been rejecting and punitive. But formerly depressed people recall their parents in the same positive terms as do never depressed people (Lewinsohn & Rosenbaum, 1987).

Similarly, Bornstein et.al.(1991) reported that adolescents' ratings of their parental warmth differed from time to time depending upon their mood. When teens were depressed or in low mood, they rated their parents as inhuman and when their mood brightened up, they rated their parents as angels. This indicates that our perception of reality changes depending upon our changing moods. We change our judgments, memories, interpretations of a situation depending upon our moods. For instance, when we are in bad mood and we find a person is constantly looking at us, we may interpret it as a glare and feel even worse and avoid that person. On the other hand, when we are in good mood and we find a person constantly looking at us, we may interpret it as interest and feel even better and strike a conversation with him.

The serial Position Effect:

Priming and context cues are not the only factors which make memory retrieval selective. The serial position effect refers to the tendency to retrieve items at the beginning and at the end of a long list. This happens due to the primacy effect (items at the beginning of the list) and recency effect (items at the end of the list).Memory researchers explain that the primacy effect happens because information encoded earlier has more time and opportunity to be rehearsed and elaborated in short-term memory, has less competition in working memory, and has a higher chance of getting stored in long-term memory. On the other hand, the recency effect happens because information encoded later is still undergoing rehearsal in working memory, and is therefore readily available for recall.

Check your Progress:

Write short notes on

- a.) Explicit memory
- b.) Implicit memory
- c.) Synaptic changes
- d.) Infantile amnesia
- e.) Retrieval cues

8.4 FORGETTING

People often feel that it will be wonderful to have a brain that won't forget anything that it is exposed to. There will be no need to memorize anything. The question arises is it really a good idea. In fact, the research shows that forgetting has its own advantages. If we remembered everything that we came across, we could not prioritize the important memories. We might have difficulty thinking abstractly and making connections if our brain was devoted to compiling isolated bits of information. If we were unable to forget, we might not focus well on current stimuli because of intrusive

memories such as traumatic or discouraging memories. “Forgetfulness is a form of freedom.” (Khalil Gibran)

8.4.1 Forgetting and the two-track mind:

While it is true that forgetting has its own advantages as mentioned above, the fact remains that for some people memory loss can be severe and permanent affecting their day to day life. There are two types of such severe memory losses called anterograde amnesia and retrograde amnesia.

Anterograde amnesia: It refers to an inability to form new long-term declarative/explicit memories from a particular date, usually the date of an accident or operation of the brain. It is an inability to transfer new information from the short-term memory to long-term memory. The brain damage can be caused by stroke, head trauma, or surgery.

Retrograde amnesia: It is a loss of memory-access to events that occurred, or information that was learned, before an injury or the onset of a disease. People suffering from retrograde amnesia cannot recall their past – the old memories stored in long term memory that were stored before the injury, but they can form new memories and store them in long term memory. Generally, the memory loss is not for the individual’s entire lifetime. In a Hindi movie *Sadma* (1983), Shridevi competently essayed the role of a retrograde amnesia patient.

As an example of anterograde amnesia, Dittrich (2010) reported a case of Henry Molaison (called H.M. in short) who used to suffer from seizures and to stop his seizures, doctors conducted a brain surgery. After brain surgery, H.M. developed severe anterograde amnesia. He was unable to form new conscious memories, though his working memory and procedural memory were intact. His memory prior to operation was intact. He could remember much of his childhood, he knew his name and family history. He was intelligent and did daily crossword puzzles, but he forgot daily events nearly as fast as they occurred. He underestimated his own age, apologized for forgetting the names of persons to whom he had just been introduced. His doctor Corkin (2005) said “I’ve known H.M. since 1962, and he still does not know who I am”. For about 20 seconds during conversation he could keep something in mind. When distracted, he would lose what was just said or what had just occurred. So he could never learn how to use a TV remote.

Similarly, Oliver Sacks reported the case of Jimmie, who was suffering from anterograde amnesia. He had no sense of how much time has passed after he suffered his injury at the age of 19 in 1945. When he was 49 years old and doctor asked him his age,

he replied that he was 19 years old. Doctor placed a mirror before him and asked him to say what he could see. Jimmie was shocked by his appearance in the mirror and became frantic. He asked is it a nightmare, or a joke? When his attention was diverted to some children playing outside the room, his panic ended and he totally forgot about seeing himself in the mirror. Even more interesting was that when Sacks left the room and returned a few minutes later Jimmie had no memory of ever meeting the doctor.

The strange facts about patients such as H.M., Jimmie and others like them are that they can learn nonverbal tasks. They can find their way to the bathroom, but if you ask them to explain where is the bathroom, they will not be able to tell you. They can learn to read mirror image writing and solve jigsaw puzzle and many other complicated job skills. They can be classically conditioned, but they do all these things with no awareness of having learned them. That means their automatic processing ability is intact and they can form new implicit memories, but they lose their explicit memory as they cannot consciously recall learning of these new skills. These examples confirm that we have two distinct memory systems, controlled by different parts of the brain.

8.4.2 Reasons for Forgetting

Encoding Failure:

As discussed previously, whatever is not encoded and passed on to long term memory will never be remembered by us. Very often we hear people saying that with age they have become more forgetful. Research studies have also shown that with advancing age our encoding efficiency reduces. The brain areas that are instantly active when young adults encode new information become less responsive as we grow old. However, no matter what our age is, we are selective while paying attention to and encoding information that continuously keeps bombarding us. For example, we have seen many coins in our life time, we can recall their size, shape and color but if I ask you to recall what is engraved on head side and what is engraved on tail side or can you differentiate a fake coin from a real one, the chances are the most people cannot do that. But a coin collector will be able to differentiate a fake coin from a real one and will remember the details engraved on the head and tail side of the coin. This is because a coin collector will encode the important features of the coins to his memory through effortful processing. He would have paid close attention to those features and that must have facilitated in encoding that information and storing in long-term memory. Without putting effort, many potential memories are never formed.

Storage Decay:

Very often we can't recollect information despite putting effort in encoding it. For example, you must have learned certain

study material for your exam last year and must have successfully reproduce in the exam, but if I ask you to recall it now, the chances are that you will not be able to recall it. Memories are lost over time. To study the duration of stored memories, Ebbinghaus (1885) learned lists of nonsense syllables and measured how much he retained while relearning each list, from 20 minutes to 30 days later. He found that the course of forgetting was initially rapid and then leveled off with time. Harry Bahrick (1984) conducted a similar experiment with students learning Spanish in school. He found that compared to those who were just finishing school, people who passed out from school 3 years back had forgotten much of what they had learned in school but whatever they could remember at that time (after this lapse of 3 years) they could recall after 25 years later also. Their forgetting had leveled off.

One of the reasons for this leveling off in forgetting can be that physical memory traces fade gradually. Memories may be inaccessible for various reasons such as –

- a.) Some memories were never acquired/ not encoded, e.g , maybe we never paid attention to the details of the coin, or even if paid attention to it enough to get it into our working memory, maybe we still didn't bother to rehearse it and encode it into long term memory.
- b.) Some memories are discarded, that is, stored memories decay, memory encoded into long-term memory will decay if the memory is never used, recalled and re-stored.
- c.) Some memories we are not able to retrieve.

Retrieval Failure – Tip of the Tongue:

- a.) Very often forgetting takes place not because memories have faded but because we are unable to retrieve them. For example, try to recall a song that was your favorite 15 years back but after that you have not heard it again or sang it again. You will find it difficult to recall its lyrics. You feel the lyrics on the tip of your tongue but just not able to say it. You will hum the tune but not able to get the lyrics. But if somebody else gives you a clue such as first few words, you will be able to recall that song. This is called Tip-of-the-Tongue phenomenon.
- b.) To prevent retrieval failure when storing and rehearsal memories, you can build retrieval cues such as linking your memorized material to images, rhymes, categories, initials, lists, etc.

Interference:

Sometimes retrieval problem occurs due to interference. Old and new memories can interfere with each other, making it difficult to store new memories and retrieve old ones. There are two types of interference

Proactive Interference: It occurs when past information interferes (in a forward-acting way) with learning new information. You have many strong memories of a previous teacher, and this memory makes it difficult to learn the new teacher's name. Or if you change your password on your email account after a long time, your memory of old password may interfere with remembering the new password.

Retroactive Interference: It occurs when new stimuli/learning interferes with the storage and retrieval of previously formed memories. For example, if you hear a new song set on the tune of an old song, you may have trouble recalling the words of old song. Studies have shown that information presented just before the eight hours sleep is protected from retroactive interference because the chances of interference are minimized. This was first discovered by John Jenkins and Karl Dallenbach (1924) in an experiment. They asked two people to memorize nonsense syllables and then try to recall them after 8 hours of being awake or asleep at night. This exercise was for many days. It was found that forgetting occurred more rapidly after being awake and being involved in other daily activities than for those who slept after memorizing the list. This clearly shows that "forgetting is not so much a matter of the decay of old impressions and associations as it is a matter of interference, inhibition or obliteration of the old by the new." Karl Dallenbach (1924).

This, however, does not mean that you should commit information to your memory just few seconds before sleeping. Such information is not encoded. Research shows that we have very little memory for information that is played aloud in the room during sleep, although ears do register it. (Wood et.al., 1992) In both types of interference, the greater the similarity of the interfering material, the greater the interference will be.

Motivated Forgetting:

The concept of motivated forgetting was invented by Sigmund Freud. He proposed that we repress (unconsciously) or suppress (consciously) motivated painful or unacceptable memories to protect our self-concept, to prevent guilt, embarrassment, shame and to minimize anxiety. But the repressed memories linger and can be retrieved by some later cue or during therapy. Motivated forgetting is a form of self-defense mechanism.

C. Tavis and Elliot Aronson (2007) pointed out that memory is an "unreliable, self-serving historian". For example, Ross et.al. (1981) reported from their experiment that when some people were told about the benefits of frequent tooth brushing, they recalled having brushed their teeth frequently in the next two weeks than those who were not told the benefits of tooth brushing.

The concept of motivated forgetting was very popular in mid-twentieth century psychology but today, many memory researchers think repression occurs rarely. People's efforts to intentionally forget neutral material often succeed, but not when the to be forgotten material is emotional. So, we may have intrusive memories of the very traumatic experiences that we would like to forget.

8.5 MEMORY CONSTRUCTION ERRORS

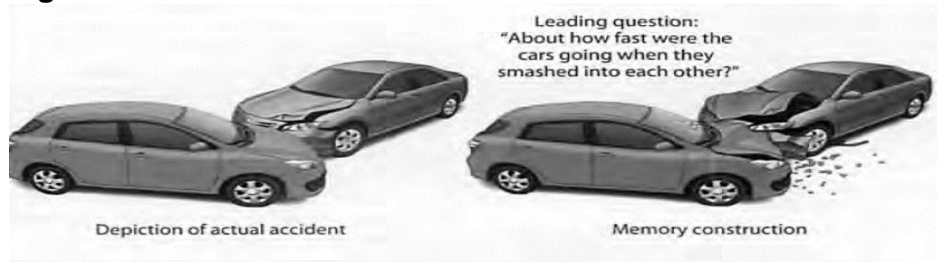
Memory not only gets forgotten, but it also gets constructed. Memory is not precise. We infer our past from stored information plus what we later imagined, selected, changed, expected, rebuilt, saw or heard. We often construct our memories as we encode them, and every time we replay a memory, we replace the original with a slightly modified version. Memory researchers call this reconsolidation. No matter how accurate and video like our memory seems, it is full of alterations, even fictions. Joseph LeDoux (2009) rightly said, "Your memory is only as good as your last memory. The fewer times you use it, the more pristine it is".

8.5.1 Misinformation and Imagination Effects: Misinformation Effect:

Generally, it is believed that people's long-term memory records events that we experience exactly as they happened. But this is not true. In reality, researchers have found that long term memory is very prone to errors and can easily be altered and molded. The inaccuracy of long term memory is enhanced by the misinformation effect, which occurs when misleading information is incorporated into one's memory after an event. For example, Elizabeth Loftus and John Palmer (1974) conducted over 200 experiments involving more than 20,000 participants. Different groups of participants saw a video of a car accident and then afterwards were questioned about what they had seen in the video.

It was found that the answers to such questions varied depending on the way the questions were worded. When asked the question "How fast were the cars going when they smashed into each other?" the answer typically involved a higher rate of speed than when the question was framed as "How fast were the cars going when they hit each other?". Additionally, when the participants were asked a week later to report whether or not there was glass at the scene of the accident, those who had heard the word 'smashed' in their initial interview were twice as likely to report broken glass, when in the video there was not any. In fact the video has not shown any broken glass. (See Fig 8.3)

Fig.8.3



Many other follow-up experiments confirmed that misinformation effect takes place. If we are exposed to misleading information, we tend to misremember. In fact, researchers said that so powerful is the misinformation effect that it can influence later attitudes and behaviors. Since we are not aware that we are being presented with misinformation, it is not possible for us to pick and remove suggested ideas out of large pool of real memories.

Filling Memory Gaps:

Our memories get influenced by not only misinformation effect, but we also tend to fill memory gaps. While describing a childhood experience to somebody, we tend to fill in the memory gaps with reasonable guesses and assumptions. After numerous times of saying the same story, we accept the guesses as real memory.

Implanted False Memories:

Just listening to a vivid retelling of an event may implant false memories. In one experiment, University students were suggested that as children, they became ill after eating spoiled egg salad. After absorbing the suggestion, many of them did not eat egg-salad sandwich, both immediately and even after four months (Geraerts et.al. 2008).

Imagining:

Even repeatedly imagining nonexistent actions and events can create false memories. For example, in another study by Elizabeth Loftus, people were asked to provide details of a incident in childhood when they had been lost in a shopping mall (which had NOT happened). By trying to picture details, most people came to believe that the incident had actually happened; they had acquired an implanted memory. In another study, Garry et.al. (1996) asked university students were asked to imagine certain childhood events, such as breaking a window with their hand or having a skin sample removed from a finger. One out of four students later recalled the imagined event as something that really happened.

Imagination Inflation:

Once we have an inaccurate memory, we tend to keep adding more imagined details. For example, in one experiment, researcher digitally altered photos from a family album to show

some family members taking a hot-air balloon ride. kids with an implanted memory of a balloon ride later added even more imagined details, making the memory longer, more vivid, with high confidence in their memories. When they were interviewed several days later, they reported even richer details of their false memories.

The question arises why these misinformation and imagination effect occurs. Gonsalves et.al. (2004) explained that misinformation and imagination effects occur because visualizing something and actually seeing it activates similar brain areas. So, imagined events also later appear to be more familiar and familiar things seem more real. The more vividly we can imagine things, the more likely they are to become memories. The human mind, it seems, comes with built-in photo shopping software.

8.5.2 Source Amnesia:

Very often, it happens that I come across a person whom I recognize as someone I know but I am unable to place where I have met this person. Jean Piaget, a famous psychologist, was surprised as an adult to learn that a vivid detailed memory from his childhood – about a nursemaid preventing his kidnapping- was totally false. He constructed this memory from a story often heard from the nursemaid. So, a person's memory for the event may be accurate, but he may forget where the story came from and attribute the source of that information to his own experiences. The information may have come from a story someone told him about his childhood (as in case of Jean Piaget), from a movie that a person has seen, or book he read, from a dream that he used to have or from a sibling's experience, etc. These all are sources for amnesia. Source amnesia or misattribution is at the heart of many of these false memories.

Source amnesia is the inability to remember where, when or how previously learned information has been acquired, while retaining the factual knowledge. This branch of amnesia is associated with the malfunctioning of one's explicit memory. Authors and songwriters often suffer from this type of amnesia. They think an idea came from their own creative imagination which in fact they have unintentionally plagiarized from something they have earlier read , heard or seen.

Source amnesia also explains déjà vu feeling that almost two third of us have experienced at some time or the other. Déjà vu refers to a feeling that you are in a situation that you have already seen or have been in before. The most common technical definition of déjà vu (French for "already seen") is "any subjectively inappropriate impression of familiarity of a present experience with an undefined past."

This can be seen as source amnesia - a memory (from current sensory memory) that we misattribute as being from long term memory. It generally happens to well-educated, well-traveled, wealthy, liberal and imaginative young adults (15 to 25 years old), especially when they are tired or stressed out. Research shows that it is more likely to occur late in the day and late in the week. People experiencing déjà vu wonder "how can I recognize a situation I am experiencing for the first time?" or they may think of reincarnation ("I must have experienced this in my previous life") or they may think that they had premonition/precognition ("I saw this scene in my mind before experiencing it").

Alan Brown and Elizabeth Marsh (2009) conducted an experiment in a laboratory to study déjà vu phenomenon. In their trials, they flashed a symbol at a subliminal level, on a computer screen, followed by a longer view of the same symbol or different symbols or no symbols. When a flash was followed by its identical symbol, participants were five times more likely to say they had seen that symbol sometime before the experiment. So, half the participants experienced déjà vu without being aware of why they are feeling this familiarity. The key to déjà vu seems to be familiarity with a stimulus without being clear where we have encountered it before.

Reasons for Déjà vu:

1. Brown and Marsh explained that it is a case of double perception that suggests that a quick glance at a scene can make it appear strangely familiar when it is fully perceived moments later. Brown said, "This is easy to imagine in today's distracted society. Let's say you enter a new museum, glancing at artwork while talking on your cell phone. Upon hanging up, you look around and sense you've been there long ago."
2. By studying patients suffering from epilepsy, neurologists believe that déjà vu occurs due to temporal lobe processing. Christopher Moulin and O'Connor studied four patients with damaged temporal lobes who suffered from chronic déjà vu. These patients greeted strangers like old friends, had no interest in watching TV or reading newspaper because they were convinced that they have seen everything before. This suggests that déjà vu may be the result of a small seizure in the part of the temporal lobe that governs our sense of familiarity. Hippocampus and frontal lobe processing is responsible for our consciously remembered details. When temporal lobe and hippocampus and frontal lobe are out of sync, we experience a feeling of familiarity without conscious recall. Then we have déjà vu as our source amnesia forces us to do our best to make sense of an odd moment.

8.5.3 Discerning True and False Memories:

False memories created due to misinformation or misattribution feel as real as true memories and they can be very persistent. False memories are often the cause of faulty eyewitness testimony and faulty eyewitness identification. Hypnotically refreshed memories may prove to be inaccurate, especially if the hypnotist asks leading questions such as “Did you hear loud noises?”

McFarland & Ross(1987) examined dating partners' evaluation of their relationship over time. People who fell more in love after their initial evaluation retrospectively exaggerated the intensity of earlier reports of love; those who broke up the relationship underestimated their original reports of caring for their partners. Similarly, when people were asked what was their view about marijuana or gender issues 10 years ago, recalled attitudes that were similar to their current views rather than the views they had actually reported 10 years back.

8.5.4 Children's Eyewitness Recall:

One interesting question faced by psychologists is how reliable are children's eyewitness descriptions. The credibility of children's testimony is often questioned due to their underdeveloped frontal lobes and memory capacity. Ceci & Bruck's(1993,1995) have researched the theme of children's eyewitness recall many times. In 1993 and 1995, using anatomically correct dolls they asked 3-year-old children to indicate where the pediatrician had touched them. 55% of the children who had not received genital or anal examinations indicated that they had been touched in their private parts. In a different experiment, Ceci & Bruck (1999,2004) found that by using suggestive questioning techniques most preschoolers and even many older children could be induced to report false events, like seeing a thief stealing food at their daycare.

In another study, Ceci & Bruck had children choose from a deck of cards with possible events on them such as getting a mousetrap on your finger and going to the hospital. Once the card was chosen by a child, an adult would read to that child and ask “Think real hard, and tell me if this ever happened to you...”. The same adult repeatedly asked children to think about many real and fictitious events during the interviews. After 10 weeks, a new adult asked the same questions and 58% of preschoolers produced false stories with vivid details about one or more events they had never experienced. Because the stories were so vivid and seemed so authentic, psychologists could not tell the difference between real and imagined memories and neither could some of the children.

Similarly, in another experiment, when preschoolers merely overheard an erroneous remark that a magician's missing rabbit had gotten loose in their classroom, 78% of children recalled actually seeing the rabbit in their classroom.

In the light of these studies, the question arises, can we trust children as eyewitnesses? The answer is yes, if we question children about the events in neutral words that they understand, children can often recall accurately what happened and who did it. Children are especially accurate when they have not talked with an involved adult prior to the interview and when their disclosure is made in a first interview with a neutral person who asks non-leading questions.

8.5.5 Repressed or Constructed Memories of Abuse?

Many psychotherapists believe that early childhood sexual abuse results in repressed memories. But other psychologists believe that such memories may be constructed.

Myers said that two types of tragedies happen when an adult recollects childhood abuse:

- 1.) Disbelief of those who come forward. Trauma survivors may not be believed when telling their secrets.
- 2.) Falsely accusing the innocent. While trying to dig up supposed lost child-abuse memories, therapists use techniques like hypnosis, drugs and guided imagery and thus create the memories that they are trying to discover. Patients exposed to such techniques may form an image of a threatening person and with further visualization, the image grows more vivid. The patient ends up stunned, angry and ready to confront or sue the remembered abuser. The equally stunned and devastated parent or relative, who has been accused, vigorously denies the accusation.

So, while the therapists have noble intention of uncovering the truth, they unintentionally trigger false memories that damage innocent adults. Psychologists have criticized the therapists' use of "memory work" techniques such as guided imagery, hypnosis and dream analysis to recover memories. The use of such techniques and creation of false memories has devastated and broken many families. On the other hand, therapists have accused these critics to be adding to the trauma of victims and helping child molesters. To overcome this memory war among psychologists, many professional bodies of psychology have issued public statements as given below.

People who are committed to protecting abused children and to protecting wrongly accused adults agree on following points –

1. Sexual abuse happens: It is too common but there is no characteristic “survivor syndrome”- no group of symptoms that can allow us to identify the victims of sexual abuse.
2. Injustice happens: Sometimes the guilty walk free and the innocent are charged.
3. Forgetting happens: The person may simply have been too young to remember or may not have understood the meaning of his/her experience.
4. Recovered memories are commonplace: When cued, it is common to dig up old memories. But memories that surface on their own are more reliable than cued ones.
5. Memories of things happening before the age 3 are unreliable.
6. Memories recovered under hypnosis or the influence of drugs is especially unreliable: Under hypnosis, people will incorporate all kinds of suggestions into their memories, even memories of “past lives”.
7. Memories, whether real or false, can be emotionally upsetting: Both the accuser and the accused may suffer when what was born of mere suggestion becomes like an actual trauma that drives bodily stress.

Richard McNally and Elke Geraerts (2009) stated that victims of childhood sexual abuse do not repress their abuse, they simply stop devoting thoughts and emotions to it and letting go of the memory is most likely when

- The experience, when it occurred was strange, uncomfortable and confusing rather than being severely traumatic
- The abuse only once or only a few times
- Victim have not spent time thinking about the abuse, either because of their own resilience or because no reminders are available.

8.6 IMPROVING MEMORY

Now lastly let us see how we can use this knowledge of memory to improve our memory, so that you can prepare better for your exams.

- a.) **Study Repeatedly:** To master any material, use distributed practice. Give yourself many separate study sessions. Take advantage of little breaks such as travelling to college/office, taking a lunch break, etc. Thomas Landauer (2001) advises that to memorize specific facts and figures, rehearse the name or number that you are trying to memorize, wait for a few seconds and then rehearse again, wait a little longer, rehearse again, then wait still longer and then rehearse again. The wait should

be as long as possible without losing the information. Use recall method to determine how much you have memorized. Reading complex material with minimal rehearsal will result in little retention. Rehearsal and critical reflection helps more. It pays to study actively. Avoid cramming and establish regular study sessions.

- b.) **Make the Material Meaningful:** You can do this by building up a network of retrieval cues. Apply the concept to your own life, form images, understand and organize information, relate to what you already know or have experienced, put it in your own words instead of mindlessly repeating someone else's words. Previous knowledge helps understanding and understanding improves memory, so the more that you know about a topic the easier it is to learn new, related facts. Making sense of what you are studying is essential to maximize learning. Relating new information to familiar information helps, even when the link is otherwise unimportant. Because you've generated the links, you're likely to remember them, and they will cue the new information. When encountering names, we normally ignore the meaning of the words, but if you use that meaning and link it to the person, it will help you remember their name.
- c.) **Activate retrieval Cues:** Mentally recreate the situation and the mood in which your original learning took place. We have better retrieval when it occurs in the same situation in which we learned the material.
- d.) **Use Mnemonic Devices:** Associate items with peg words. Make up a story that incorporates vivid images of the items. The best mnemonics are those that utilize positive imagery, humor, or novelty. You might come up with a rhyme, song, or joke to help remember a specific segment of information. Chunk information into acronyms. Create rhythmic rhymes.
- e.) **Minimize interference:** Study before sleep. Do not study topics one after the other that are likely to interfere with each other. For example, studying subjects like English, Hindi, Marathi one after the other.
- f.) **Adequate Sleep:** Get enough sleep so that when you awake you feel fresh. As mentioned before, during sleep the brain reorganizes and consolidates information for long-term memory. Sleep deprivation disrupts this process and information does not get stored in long term memory.
- g.) **Test Your Own Knowledge:** Test Your Own Knowledge, both to rehearse it and to find out what you don't know: Don't get carried away into overconfidence by your ability to recognize information. Test your recall using the retrieval method. Take practice tests.

Check your Progress:

Write short notes on:

- a.) Forgetting and two tracks- mind
- b.) Encoding failure, storage decay and retrieval failure
- c.) Interference and motivated forgetting
- d.) Misinformation and imagination effects
- e.) Source Amnesia
- f.) Children's eyewitness recall and repressed/constructed memories
- g.) Techniques to improve memory

8.7 SUMMARY

In this unit, we talked about why it is important to understand the functioning of human memory. While discussing the memory storage, we said there are two types of memory - explicit and implicit. In brain, frontal lobes and hippocampus play a major role in formation of explicit memory. If left side of hippocampus is damaged, we cannot retain verbal information, though we can retain spatial information because rear part of hippocampus is involved. It was also emphasized that much of consolidation of explicit memory occurs during sleep, because hippocampus processes memories for later retrieval.

The cerebellum and basal ganglia are responsible for implicit memory. Implicit memory includes skills and habits, conditioned associations, priming and perceptual learning. Infantile amnesia is part of implicit memory. Infantile amnesia refers to the fact that children can't remember events of up to 3 years of age but retain their procedural memory, that is, whatever skills they have learned in the first three years remain intact but not the memory for the events. The amygdala is responsible for memory of emotions. Emotionally charged events are stored much better in our memory than boring events. That is why we can remember details of a three-hour movie but not of the one-hour lecture. Flashbulb memories are the memories of a highly emotional event and may trigger with/ without any cue. These memories can be pleasant/unpleasant. It has also been found that synaptic changes also take place if we are exposed to same stimuli repeatedly and these changes help in improved learning and storing memories. Once the memories are stored, the next question is how do we know whether memories were stored or no and if they are stored, how to retrieve them. The research has shown that there are three methods that indicate whether memory is stored or no. These are recall, recognition and relearning. Memories can be retrieved with the help of retrieval cues. Retrieval cues can be priming, context-dependent memory, state-dependent memory and the serial position effect.

Next, we look at what is forgetting and why do people forget previously stored information. Psychologists are of the opinion that our brain does not function like computer, it is much more than that. We have two track mind which works simultaneously. They talked about two types of amnesia- anterograde and retrograde amnesia. Both types of amnesia can take place due to injury, stroke or disease. In anterograde amnesia we cannot form new memories from the day we suffer from injury/accident and in retrograde amnesia, we cannot recall the past events that took place before the injury/accident. Some of the reasons for forgetting are encoding failure, storage decay, retrieval failure, interference, motivated forgetting.

Apart from that we can have memory construction errors such as misinformation and imagination effect, source amnesia. This brings us to the question of how to differentiate between true and false memories and can we rely on children's eyewitness testimony. It also raises questions about whether child abuse memories are repressed or constructed memories.

Lastly, we talk about how memory can be improved. Though there are many methods to improve memory, here we talk about few of them such as repetition, making material meaningful, activating retrieval cues, using mnemonic devices, minimizing interference, having sufficient sleep, and testing our own knowledge repeatedly by using recall method.

8.8 QUESTIONS

1. How do external cues, internal emotions and order of appearance influence memory retrieval?
2. Define forgetting. Elaborate on any two reasons for forgetting
3. Write a detailed note on memory construction errors.
4. Discuss in detail how memory can be improved.

8.9 REFERENCE

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



THINKING, LANGUAGE AND INTELLIGENCE - I

Unit Structure :

- 9.0 Objectives
- 9.1. Introduction: Thinking
 - 9.1.1. How People Think?
 - 9.1.2. Thinking or Cognition
- 9.2. Concepts
 - 9.2.1. Mental Imagery
 - 9.2.2. Prototypes
- 9.3 Problem Solving Strategies and Obstacles
 - 9.3.1. Problem Solving Strategies
 - 9.3.2. Obstacles in Problem Solving
- 9.4 Forming Good and Bad Decisions and Judgments
- 9.5. Thinking Critically About the Fear Factor
 - 9.5.1 Why We Fear the Wrong Things
- 9.6. Do Other Species Share Our Cognitive Skills?
- 9.7 Summary
- 9.8 Questions
- 9.9 References

9.0 OBJECTIVES

After studying this unit you should be able to:

- Understand how people think.
- Understand the meaning of thinking, mental imagery and concepts.
- Understand problem solving and decision making and the methods people use to solve problems and make decisions.
- Comprehend the various barriers to problem solving.
- Understand the Decision Making.

9.1. INTRODUCTION: THINKING

Most of our waking hours, and even when we are asleep and dreaming, we are thinking. It is hard not to think. As you read these words you are thinking, and even if you stop thinking about what

you are reading, your thoughts wander off to something else- perhaps to what you are going to do tomorrow- you will still be thinking. What do we do when we think? Loosely speaking, we might say that we mentally, or cognitively, process information. There are different definitions of thinking. We would discuss in briefly.

Thinking consists of the cognitive rearrangement and manipulation of both information from the environment and the symbols stored in long-term memory. From another viewpoint, thinking is the form of information processing that goes on during the period between a stimulus event and the response to it.

In other words, thinking is the set of cognitive processes that mediate, or go between, stimuli and responses. To illustrate, suppose you are trying to make a decision about buying a new mobile. The seller presents several mobiles in your price range (the stimuli), and you eventually purchase one of them (the response). Before making the response, however, you consider the advantages and the disadvantages of the several mobiles; you process the information you have about them. Your thinking about the mobiles - thus mediates between the mobiles as stimuli and your eventual response of buying one of them.

The general definition of thinking given above encompasses many different varieties of thought. For instance, some thinking is highly private and may use symbols with very personal meanings. This kind of thinking is called as autistic thinking; dreams are an example of autistic thinking. Other thinking is aimed at solving problems or creating something new; this is called directed thinking. Directed thinking is the kind you were engaged in when you solved (or tried to solve) the problem.

9.1.1. How people think?

One of the most complex and highest forms of human behaviour is thinking. The topic of thinking came within the purview of psychology only in the 1960s with the growth of cognitive psychology. Behaviorists were not in favour of the study of thinking as according to them thinking was covert in nature and not empirically observable. Thinking is closely related to learning, memory, intelligence, decision making and language development. We would discuss these topics in this as well as the next unit.

9.1.2. Thinking or Cognition:

The terms thinking and cognition are often used synonymously. There is considerable difference between them. The term cognition is much broader in scope as compared to thinking. According to one definition, thinking is a symbolic mediation or a symbolic bridge that fills the gaps between a situation and the

response we make to it. According to Watson, 'thinking' is 'sub-vocal speech'. Thinking is also defined as "mental activity that goes on in the brain when a person is processing information such as organizing it, understanding it, and communicating it to others." Thinking is not only verbal in nature but also involves the use of mental images or mental representation. The three most important elements involved in thinking are mental images (also called as mental imagery), concepts and prototypes.

9.2 CONCEPTS

Concepts are an important class of language symbols used in thinking. A concept is a symbolic construction representing some common and general features of object or events. Some natural, or basic, concepts are easily acquired and appear in thinking early in life. Other concepts are acquired by discriminative learning by seeing examples of the concept in different context, and by definition. There are different types of concepts. We would discuss these in detail.

1) Superordinate Concept:

It is the most general type of a concept, such as "bird" or "vegetable" or "fruit".

2) Basic level Type:

A basic level type of concept is one around which other similar concepts are organised, such as Mango or apple or watermelon, as there can be many different types of mangos such as alphonso, dusseri, badami, payri, langda, etc.

3) Subordinate Concept:

It is the most specific type of a concept. Such as "Crackle Cadbury chocolate" or the name of your dog or a "Kashmiri apple", etc.

4) Formal Concept:

Formal concepts refer to those concepts which have a strict definition. These concepts are defined by specific rules or features and are very rigid. Formal concepts are generally taught in schools and colleges as a part of academic activity.

5) Natural Concept:

Natural concepts are those concepts which people form as a result of their experiences in the real world. Unlike formal concepts, natural concepts are not well defined. Is tomato a vegetable or fruit? Is duck a mammal or a bird? What about whale, is it a fish or a mammal? We form concepts about these as a result of our

experiences in the outside world. Natural concepts help us to understand our surrounding in a less structured and rigid manner.

Becoming a human being involves the attainment of concepts: much human thinking uses them. It is therefore of some practical value to discover what helps or hinders concept attainment. One factor in concept attainment is transfer. A second factor is the degree to which the common elements are isolated, grouped, or otherwise made conspicuous. This may be called as distinctiveness. A third factor is ability to manipulate the materials involved in the concept. Rearranged, rewarding, or reorganized materials containing the common properties helps people to discover the concept. Another factor is the instructional set people have. Finally, people usually learn concept faster if they have all the relevant information available at the same time, instead of being given only a piece of information at a time.

9.2.1. Mental Imagery:

Mental imagery is also called as visual imagery or imagery and is an important component of human thought or cognition. Mental imagery refers to the representations that stand for objects or events and have a picture-like quality. Mental imagery is used by most people in their everyday life. Considerable degree of research on mental imagery has been done by Allan Paivio, Kosslyn and others.

Research studies by Kosslyn and his colleagues (1990) have shown that most of our imagery is visual. They did some pioneering studies on mental rotation of visual images. Kosslyn also found that when we form a mental image our experience seems much like seeing something in our mind. It seems a lot like vision. When we form a mental image we seem to be able to manipulate them and we seem to be solving problems some times by means of manipulating them. Mental images can be quite detailed but they tend to be less detailed than actual perception. Kosslyn's research has demonstrated the following with respect to imagery and size.

- People take longer to make judgements about the characteristics of small mental images than of the large mental images.
- It takes longer time to travel a large mental distance than when images are different.

Research shows that visual imagery is a powerful strategy for enhancing memory. Research has also shown that memory is most effective when the items must be recalled are shown interacting with each other (Begg 1982).

9.2.2. Prototypes:

Prototype is another important element of thinking. It can be defined as an example of a concept that closely matches the defining characteristics of a concept. Prototypes can be defined as mental models of the typical qualities of members of some group or category. Concepts simplify our thinking. We can't think of life without concepts. Without concepts, we would need a different name for every person, vents, objects and ideas. For example, suppose we ask a child to "throw a ball", a child will not understand if he has no concept of ball or throw. So we can say that concepts such as ball gives us much information with little cognitive efforts.

Prototypes can be defined as mental frame- work for e.g., we have prototypes for Indian political leaders, certain film stars, criminals, etc. Prototypes describe the truly typical member of such categories. The prototypical model helps us to compare new persons we meet in order to determine if they do or do not fit into the category. When they fit quite well, we can readily place them in various categories. When they do not, the situation is more puzzling. For example, suppose you meet a young woman who told you that she reads books as a hobby, likes to do social work and who was dressed in simple clothes. When you discovered that she was a film actress you would probably be surprised. The reason is simple: she does not seem to fit well with the prototype of film actress that you have built up through past experience. Prototypes also exert important effects on social thought and social behaviour. The prototype for objects and events varies from culture to culture and from region to region. For e.g., In an Indian family it is customary to touch the feet of elders. However, such a custom does not exist in many other cultures. Similarly, prototype of fruits or drink varies from region to region depending upon what fruit or drink is commonly available in a given region or culture. For e.g., someone who lives in a tropical area will have a different prototype for fruit as compared to one who stays in Northern Hemisphere. For e.g., someone who grew up in an area where there are many coconut trees, for e.g., Kerala might think of coconut as the most typical fruit as compared to a person who comes from Kashmir where apples are found in plenty. It has also been noted that people who are familiar or have knowledge about given objects and events will have a different prototype about these objects and events as compared to persons who are not knowledgeable or lack information about such objects and events. Thus, many factors influence the development and formation of prototypes. Some common factors are as follows:

- Geographical Region
- Culture
- Information and Knowledge
- Experience

One's thinking is considerably influenced by the prototype that one develops or holds. They also aid in the process of problem solving and decision making. Eleanor Rosch (1973) has done considerable research work with respect to prototypes. The prototype approach has had an important impact on cognitive psychology and other related disciplines.

9.3 PROBLEM SOLVING STRATEGIES AND OBSTACLES

In general, a problem can be any conflict or difference between one situation and another situation we wish to produce our goal. In trying to reach the goal of problem solution, we use information available to us from long term memory and from our here-and-now perception of the problem situation before we process this information according to rules that tells us what we can and cannot do. In other words, many instances of problem solving can be considered a form of rule-guided, motivated information processing (Newell & Simon, 1972).

9.3.1. Problem Solving Strategies:

Many of the rules used in solving problems concern the changes that are permissible in going from one situation to another. Four major types of such rules are algorithm, heuristics, trial and error and insight.

1) Algorithm:

An algorithm is a set of rules which, if followed correctly, will guarantee a solution to a problem. For instance, if you are given two numbers to multiply, you immediately start thinking of all the rules for multiplication you have learned and you apply these algorithm to the problem. If you follow the rules correctly, you will solve the problem. Algorithm is a step-by-step procedure that guarantees a solution. But it can be laborious and frustrating experience.

2) Heuristics:

Heuristic are simpler thinking strategies, usually based on our past experience with problems, that are likely to lead to a solution but do not guarantee success. One common strategy, or heuristic, is to break the problem down into smaller sub problems, each a little closer to the end goal.

3) Trial and Error:

This is the most commonly used method in problem solving. It is used when a person does not have any well thought out strategy for solving a problem or when he is incapable of thinking about his problem systematically. In other words, he does not know about the rules to help him solve the problem. He goes on trying

one thing after another till somehow the problem gets solved by chance – an abrupt, true seeming and often satisfying solution. Insight strikes suddenly with no prior sense of ‘getting warmer’ or feeling close to a solution.

Mechanical solutions also involve solving by rote or a learned set of rules. Many problems in life can be solved by merely applying certain rules mechanically. If the rules are applied correctly the solution is sure to be found. Many problems in everyday life and in school and college situations involve mechanical application of the facts or knowledge that we have acquired. The strategy involving use of algorithms and heuristics is representatives of this method.

4) Insight:

This is another important method of solving a problem. For some problems, solutions occur suddenly. Insight occurs when the problem solver suddenly ‘sees’ the relations involved in a task and is immediately able to solve the problem. It was Kohler who first suggested that learning takes place by insight. An instance of insight is found in the example of Archimedes who ran naked out of his bathtub, shouting ‘Eureka’, when he found an answer to a problem that had troubled him for a long time. Most creative problems are solved through insight. When human beings solve the problem through insight they experience a good feeling called as ‘aha’ experience. Thus, insight occurs when the learner ‘suddenly sees’ the solution involved in a task and is immediately able to solve the problem. When he suddenly gets the solution, he is said to have got insight.

9.3.2. Obstacles in Problem Solving:

Problem solving is not an easy task, it is filled with considerable difficulties or obstacles that are involved in the process of problem solving. Some problems are difficult to solve as compared to others. Human beings commit errors or have limitations that come in the way of solving problems. The three most common barriers to solving a problem are as follows:

1. Functional Fixedness
2. Mental Set
3. Confirmation bias.
4. Using incomplete or incorrect representations
5. Lack of Problem specific knowledge or expertise

We will discuss each of these briefly.

1. Functional Fixedness:

Functional Fixedness means that the functions or uses we assign to objects tend to remain fixed or stable. Functional fixedness is a cognitive bias that that limits a person to using an

object only in the way it is traditionally used. Karl Duncker defined functional fixedness as being a "mental block against using an object in a new way that is required to solve a problem." This "block" then limits that ability of an individual to use the components given to them to make a specific item, as they cannot move past the original intention of the object. When people develop functional fixedness, they recognize tools only for their obvious function. For example, an object is regarded as having only one fixed function. The problem-solver cannot alter his or her mental set to see that the tool may have multiple uses. To overcome functional fixedness, we need to think flexibly about other ways that objects can be used. To overcome functional fixedness, we have to realize that an object designed for one particular function can also serve another function. The history of technology offers numerous examples of overcoming functional fixedness. For instance, the steam engine was used for a century to pump water out of mines before an inventor realized that it could be used as a source of locomotive power (Gellatly, 1986).

2. Mental Set:

Mental set is a tendency to adopt a certain framework, strategy or procedure or more generally, to see things in certain ways instead of others. Mental set is analogous to perceptual set, the tendency to perceive an object or pattern in a certain way on the basis of your immediate perceptual experience. Mental set is one type of functional fixedness. Mental set directs the thinking process to solving problems in the same way. When problem solvers have mental set, they keep trying the same solution they have used in previous problems, even though the problem could be approached via other, easier ways. Mental sets involve a kind of mindless rigidity that blocks effective problem solving (Langer, 1989). A mental set often works against us in our everyday experiences too. A number of research studies have been carried out to study how mental set effects problem-solving behavior. The three major studies using different problems are as follows: i) Luchin's study using water Jar problem. ii) Nine-dot problem iii) Six match stick problem. Luchin (1942) in one of the earliest studies on mental set demonstrated that 75 percent of the students were blind to easy solution and continued to solve the problem in the same fashion as they did in the practice problem.

3. Confirmation bias:

Confirmation bias is one of the barriers to logical thinking. Confirmation bias refers to a type of selective thinking whereby one tends to notice and to look for what confirms one's beliefs, and to ignore, not look for, or undervalue the relevance of what contradicts one's beliefs. Confirmation bias is a phenomenon wherein decision makers have been shown to actively seek out and assign more weight to evidence that confirms their hypothesis, and ignore or

under weigh evidence that could disconfirm their hypothesis. Confirmation bias is one of the hurdles in objective evaluation of a theory. In this a researcher overemphasizes data supporting the theories they favour and tend to ignore or downplay data which are inconsistent with their views.

4. Using incomplete or incorrect representations:

Irrelevant information hinders problem solving as it slows the process down, can cause confusion or misunderstandings.

5. Lack of Problem Specific Knowledge or Expertise:

If we don't have problem specific knowledge or expertise, we can't solve problem. Even if we are going to solve problem it can create difficulties in solving problem.

9.4 FORMING GOOD AND BAD DECISIONS AND JUDGMENTS

Decision-making is a kind of problem solving in which a person must choose among several alternatives. In choosing among alternatives that involve certain amounts of risk, we are often guided by heuristic rules. There are two types of heuristics.

- 1) Availability Heuristics
- 2) Representative Heuristics

We would discuss each of these heuristics briefly.

1) Availability Heuristics:

Availability heuristics is a mental shortcut that helps us make a decision based on how easy it is to bring something to mind. In other words, we often rely on how easy it is to think of examples when making a decision or judgment. For instance, in 2011, what percentage of crimes do you suppose involved violence? Most people are likely to guess a high percentage because of all the violent crimes - murder, rape, robbery, and assault - that are highlighted on the news. Yet the FBI reported that violent crimes made up less than 12% of all crimes in the United States in 2011. So, anything that makes information 'pop up' into mind- its vividness, recency or distinctiveness can make it seem common place. We often fear the wrong things. For example, we fear flying because we play in our head some air disaster.

2) Representative Heuristics:

A mental shortcut that helps us make a decision by comparing information to our mental prototypes. For example, if someone was to describe an older woman as warm and caring with a great love of children, most of us would assume that the older woman is a grandmother. She fits our mental representation of a grandmother, so we automatically classify her into that category.

These rules include judging on the basis of representativeness, using the available information to decide which outcome is more likely, and using adjustment to arrive at an estimate of the probability of a certain outcome. Each of these heuristics introduces bias into the decision-making process.

Heuristics are simple decision-making rules we often use to make inferences or draw conclusions quickly and easily. Heuristics are strategies, usually based on our past experiences with problems, that are likely to lead to a solution but do not guarantee success. We make use of many mental heuristics in our effort to think about and use social information. Two most important heuristics approaches in solving a problem are as follows:

- 1) The Means-Ends Analysis
- 2) The Analogy Approach.

1) The Means-Ends Analysis:

It is a problem solving strategy in which the solver compares the goal to the current state, and then chooses a step to reduce maximally the difference between them. In other words this strategy involves figuring out the “ends” you want and then figuring out the “means” you will use to reach those ends. The means-ends analysis concentrates the problem solver’s attention on the difference between the current problem state and the goal state. Very often, it so happens that in order to reach a goal state certain preconditions have to be fulfilled. These preconditions constitute sub goals. Through the creation of sub goals, the task is broken down into manageable steps, which help us to reach a final goal state. Newell and Simon developed a computer program called General Problem Solver or GPS, which is a program whose basic strategy is means-ends analysis.

2) The Analogy Approach:

In an analogy, we use a solution to an earlier problem to help with a new one. Analogies pervade human thinking. Whenever we try to solve a new problem by referring to a known, familiar problem, we are using an analogy (Halpern et al., 1990).

Bad Decisions:

a.) **Overconfidence:** Sometimes our judgments and decisions go wrong simply because we are more confident than correct. In many tasks, people tend to overestimate their performance. For example, many overconfident students expect to finish preparing for exam ahead of schedule. In fact, the preparation takes more time than what they predict. Similarly, many people do not realize that there can be a potential for error in their thinking and believe that they will have more money next year and merrily take loans and later on find

it difficult to pay back as they may not get as much pay raise as they expected.

However, overconfidence has an adaptive value. Research studies have shown that people who make mistakes in judgment due to overconfidence live more happily. They make tough decisions more easily, and they seem to be more credible than others. The wisdom to know when we know a thing and when we don't know is born from experience.

b.) Belief Perseverance: Just like we have problem of overconfidence, we also have problem of belief perseverance - our tendency to cling to our beliefs in the face of contrary evidence. Belief perseverance often leads to social conflicts. The more we come to appreciate why our beliefs might be true, the more tightly we cling to them. For example, once we have explained to ourselves why we believe a child is 'gifted' or has a 'learning disability', we tend to ignore evidence undermining our beliefs. Once beliefs form and get justified, it takes more compelling evidence to change them than it did to create them.

To control this tendency, a simple trick is to consider the opposite. When people are asked to imagine and ponder over opposite findings, they become much less biased in their evaluation of the evidence.

c.) The Effects of Framing: Framing refers to the way we present an issue, sways our decisions and judgments. For example, imagine that two different surgeons are explaining a surgery risk to a patient. One surgeon says that 10% people die during this surgery, while the other surgeon says that 90% people survive this surgery. The information is same but the effect will be different. Patients report that risk seems greater when they are told that 10% people die during this surgery.

Framing can be a powerful persuasion tool. If rightly framed arguments are presented, it can persuade people to make decisions that could benefit them or society as a whole.

9.5. THINKING CRITICALLY ABOUT THE FEAR FACTOR

"Most people reason dramatically, not quantitatively," said Oliver Wendell Holmes. After 9/11, many people feared flying more than driving. (In a 2006 Gallup survey, only 40 percent reported being "not afraid at all" to fly.) Yet Americans were mile for mile—230 times more likely to die in an automobile crash than on a commercial flight in the months between 2003 and 2005 (National

Safety Council, 2008). In a late-2001 essay, we calculated that if because of 9/11—we flew 20 percent less and instead drove half those unflown miles, about 800 more people would die in traffic accidents in the year after 9/11 (Myers, 2001). In checking this estimate against actual accident data (why didn't I think of that?), German psychologist Gerd Gigerenzer (2004) found that the last three months of 2001 did indeed produce significantly more U.S. traffic fatalities than the three-month average in the previous five years. Long after 9/11, the dead terrorists were still killing Americans. As air travel gradually recovered during 2002 through 2005, U.S. commercial flights carried nearly 2.5 billion passengers, with no deaths on a major airline big jet (McMurray, 2006; Miller, 2005). Meanwhile, 172,000 Americans died in traffic accidents. For most people, the most dangerous aspect of airline flying is the drive to the airport.

9.5.1 Why we fear the wrong things:

Figure: 9.1 Dramatic deaths in bunches breed concern and fear: The memorable South Asian tsunami that killed some 300,000-people stirred an outpouring of concern and new tsunami-warning technology. Meanwhile, a “silent tsunami” of poverty-related malaria was killing about that many of the world’s children every couple months, noted Jeffrey Sachs, the head of a United Nations project aiming to cut extreme poverty in half by 2015 (Dugger, 2005).



Why do we judge terrorism to be a greater risk than accidents—which kill nearly as many per week in just the United States as did terrorism (2527 deaths worldwide) in all of the 1990s (Johnson, 2001)? Even with the horror of 9/11, more Americans in 2001 died of food poisoning (which scares few) than of terrorism (which scares many). Psychological science has identified four influences on our intuitions about risk. Together they explain why we sometimes fret over remote possibilities while ignoring much higher probabilities.

First, we fear what our ancestral history has prepared us to fear. Human emotions were road tested in the Stone Age. Our old brain prepares us to fear yesterday's risks: snakes, lizards, and spiders (which combined now kill just about no one in developed countries). And it prepares us to fear confinement and heights, and therefore flying.

Second, we fear what we cannot control. Driving we control, flying we do not.

Third, we fear what is immediate. Threats related to flying are mostly telescoped into the moments of takeoff and landing, while the dangers of driving are diffused across many moments to come, each trivially dangerous. Similarly, many smokers (whose habit shortens their lives, on average, by about five years) fret openly before flying (which, averaged across people, shortens life by one day). Smoking's toxicity kills in the distant future.

Fourth, we fear what is most readily available in memory. Powerful, available memories—like the image of United Flight 175 slicing into the World Trade Center—serve as our measuring rods as we intuitively judge risks. Thousands of safe car trips have extinguished our anxieties about driving.

Dramatic Death in Bunches:

Vivid events also distort our comprehension of risks and probable outcomes. We comprehend disasters that have killed people dramatically, in bunches. But we fear too little those threats that will claim lives un-dramatically, one by one, and in the distant future. As Bill Gates has noted, each year half million children worldwide—the equivalent of four 747s full of children every day—die quietly, one by one, from rotavirus, and we hear nothing of it (Glass, 2004). Dramatic outcomes make us gasp; probabilities we hardly grasp. The point to remember: It is perfectly normal to fear purposeful violence but smart thinkers will remember this: Check your fears against the facts and resist those who serve their own purposes by cultivating a culture of fear. By so doing, we can take away exaggerated fear.

9.6 DO OTHER SPECIES SHARE OUR COGNITIVE SKILLS?

Other species cognition research examines the processes used to generate adaptive or flexible behavior in species. In the context of animal cognition research, cognition research usually focuses on questions about the mechanisms involved in specific capacities, such as learning, memory, perception, or decision-making. Researchers also investigate animal concepts, beliefs, and

thoughts. While the representational theory of mind is a common assumption among animal cognition researchers, there is also the investigation into the role perception plays in animal learning, and interest in how much explanatory work can be done by non-conceptual content, sometimes inspired by work in embodied cognition (e.g. Barrett 2011). Yes, other species share our cognitive skills to some extent. They don't share our all cognitive skills as it is. For example, dogs that understand commands or birds that can "talk"? Dogs can be trained to follow certain commands such as 'sit', 'come' and 'roll over', but does this mean they understand language and therefore can use it as well? Dogs are known to be experts at reading their owners intentions and that they do not respond to actual words but the tone in which it is said. So, if you say "bad dog" in a cheerful tone, the dog will wag its tail. If you say "good dog" in a harsh tone, the dog will put his tail in between his legs. Birds that are in captivity are known to be able to "talk"- it is believed that it does not mean anything to them and they are merely copying sounds they hear. There is no doubt that animals communicate with each other to one degree or another in response to different stimuli such as hunger or fear. Human language is creative and consists of unique characteristics that give us the ability to engage in abstract and analytical ways.

9.7 SUMMARY

In this unit we began by explaining the concept of thinking. We then explained the concept, mental imagery and prototypes, which are the three elements of thinking. Following this, the concept of problem solving was discussed. In Problem solving concept we have studied briefly problem solving strategies and problem solving obstacles. We explained the four methods of problem solving which included: Algorithms, Heuristics, Trial & Error and Insight. We also discussed the five most common problems in the process of solving a problem i.e. Functional Fixedness, Mental Set and Confirmation bias, Using incomplete or incorrect representations, Lack of Problem specific knowledge or expertise. We have also studied decision making in briefly. We have also studied thinking critically about: the fear factor and why we fear the wrong things. Towards the end of the unit we have discussed about other species and cognitive skills.

9.8 QUESTIONS

- a) What is thinking?
- b) What is Mental Imagery?
- c) What is Concepts?
- d) What is Prototypes?

- e) Discuss in detail about Problem Solving.
- f) Discuss in detail about Decision Making.
- g) Explain the different Methods people use to solve problems and make decision?
- h) What are the different barriers in Problem Solving?

9.9 REFERENCES

Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013.

Feldman, R.S. (2013). Psychology and your life. Publications 2ndedi. New York: McGraw Hill

Feldman, R.S. (2013). Understanding Psychology. publications 11thedi. New York: McGraw Hill

King, L.A. (2013). Experience Psychology.nd publications 2ndedi. New York: McGraw Hill
Lahey, B. B. (2012). Psychology: An Introduction. 11thedi. New York: McGraw-Hill Publications



THINKING, LANGUAGE AND INTELLIGENCE - II

Unit Structure :

- 10.0 Objectives
- 10.1 Introduction: Language
 - 10.1.1 Language structure
 - 10.1.2 Language development
 - 10.1.3 Close Up: Living in a silent world:
 - 10.1.4 The brain and language
 - 10.1.5 Do other species have language?
- 10.2 Thinking and Language
 - 10.2.1 Language influences thinking
 - 10.2.2 Thinking in images
- 10.3 Summary
- 10.4 Questions
- 10.5 References

10.0 OBJECTIVES

After studying this unit you should be able to:

- Understand the Language structure
- Know the nature of Language development
- Study the relationship between thinking and language.
- Study language and related topics
- To know how Language influences thinking
- Understand the concepts of emotional intelligence

10.1 INTRODUCTION: LANGUAGE

Language is a system of communication that is governed by a system of rules (a grammar) and can express an infinite number of propositions. Language gives us the ability to communicate our intelligence to others by talking, reading, and writing. As the psychologist Steven Pinker puts it, language is the jewel in the crown of cognition (Pinker, 1994).

It is important to define language precisely and particularly to distinguish between language and communication. Although

language is often used as a communication system, there are other communication systems that do not form true languages. For example, many bees use elaborate dances to tell other bees about a new found source of food. Although this dance communicates where the food is, it can only communicate that kind of message- the dance can't inform the bees about an interesting sight to see along the way to the food source. A natural language has two essential characteristics.

1) Regular and Productive:

It is regular (governed by a system of rules, called grammar), and it is productive, meaning that infinite combinations of things can be expressed in it.

2) Arbitrariness and Discreteness:

Other characteristics of human languages include arbitrariness (the lack of necessary resemblance between a word or sentence and what it refers to) and discreteness (the system can be subdivided into recognizable parts, for example- sentences into words (Hockett, 1960)).

10.1.1 The Structure of Language

When you have conversation, you first have to listen to the previous sounds the speaker directs at you. Different languages have different sounds (called phonemes). **Phoneme** is the smallest distinctive sound unit of a language. The study of the ways in which phonemes can be combined in any given language constitutes the study of phonology. Next you put the sounds together in some coherent way, identify the meaningful unit of the language, an aspect known as morphology. Word ending prefix, tense markers and the like are critical part of each sentence. Some of the **morphemes** (smallest unit that carry meaning in a given language) are words, and you also need to identify this and determine the role each word plays in sentence. To do so, you need to determine the syntax, or structure, of the sentence. A syntactically correct sentence does not by itself make for a good conversation.

The sentence must also mean something to the listener. Semantics is the branch of linguistics and psycholinguistics devotes to the study of meaning. Finally, for the conversation to work there must be some flow of given- and-take. Listeners must pay attention and make certain assumptions, and speakers must craft their contributions in ways that will make the listener's job feasible. This aspect of language, pragmatics, will conclude our discussion on the Structure of language. Keep in mind throughout that although the various aspects of language will be discussed separately, in actual conversation they must work together.

We will repeatedly bring forth the ideas of the different linguistic rules (such as phonological rules, syntactic rules) in this section. These rules make up the grammar of the language and, taken together, define the ways language works. It is important that linguists and psychologists used the term grammar in the very restricted sense, here, meaning “the set of rules for language”. In particular, grammatical in this context has nothing to do with the “rules” of “good English” such as “Don’t use ain’t” or “Use punctuation at the end of the statement.” To a linguist or a psycholinguist, the sentence “I ain’t going happily to it” is perfectly meaningful and “legal”—that is, it follows the “rules” of English that native speakers observe - and is therefore grammatical. (You understand it perfectly well, right?). Here grammar refers not to polite ways of speaking but to ways of speaking that form intelligible phrases or utterances recognizable as examples of language that a native speaker of the language might produce. Starting with the basic sound of speech, spoken language can be broken down into these elements: phonemes, syllables, morphemes, word, Phrase, and sentence. Apart from this there are many concepts in this topic. We would discuss all these concepts in details.

➤ **Phoneme:**

Speech sounds, or phonemes, are made by adjusting the vocal cords and moving the tongue, lips, and mouth in wonderfully precise ways to produce vibrations in the airflow from the lungs. While hundreds of speech sounds can be distinguished on the basis of their frequency (the number of vibrations per second), their intensity (the energy in the vibrations) and their pattern of vibrations over time.

To illustrate phonemes, consider the k phoneme in the word key and cool. Say these words to yourself, and you will realize that the k sound is different in two words: simply notice the position of your lips when you are saying them and the “sharper” sound of the K phonemes in the word key here, they are two different phonemes, but either K sound can be used in the word key without changing the meaning of the word; the same can be said for cool. English speakers do not notice the difference in these k sounds and, therefore, since they make up no difference in the meaning of the words and can be substituted for the one another, they can be grouped together as a single phoneme.

➤ **Morpheme:**

In a language, the smallest unit that carries meaning; may be a word or a part of a word (such as a prefix). Although syllables are the unit of speech perception, and some syllables have meanings, other language elements are the perceptual units carrying the meaning of speech. These elements, morphemes, are the smallest units of meaning in the speech perception. Consider

the word distasteful. It is composed of three morphemes, each of which has meaning. The morphemes in this example are dis, taste, and ful. Dis means “negation” taste is a meaningful word, ful and means “quality”. Thus, morphemes can be prefixes, words, or suffixes. Each is composed of syllables, of course, but what makes them morphemes is that they convey meaning. Morphemes are discovered by asking people to break words up into the smallest unit that have meaning for them.

➤ **Semantics:**

The set of rules by which we derive meaning from morphemes, words, and sentences in a given language; also, the study of meaning.

➤ **Syntax:**

The rules for combining words into grammatically sensible sentences in a given language.

➤ **Grammar:**

In language, a system of rules that enables us to communicate with and understand others. Words are combined by the rules of grammar into clauses, and clauses are formed into sentences. A clause consists of a verb and its associated nouns, adjectives, and so on. Evidence indicates that clauses, and not individual words or whole sentences, are the major units of perceived meaning in speech. When we hear a sentence with more than one clause, we tend to isolate the clauses, analysing the meaning of each (Bever, 1973).

10.1.2 Language Development

Childhood is the best time for language, no doubt about it. Young children, the younger the better, are good at it; it is child’s play. It is a onetime gift to the species. (Lewis Thomas, *The Fragile Species*, 1992). Language development is a process starting early in human life. Anyone who has tried to master a second language as an adult knows the difficulty of language learning. And yet children learn languages easily and naturally. Children who are not exposed to language early in their lives will likely never learn one. Case studies, including Victor the “Wild Child, who was abandoned as a baby in France and not discovered until he was 12, and Genie, a child whose parents kept her locked in a closet from 18 months until 13 years of age, are (fortunately) two of the only known examples of these deprived children. Both of these children made some progress in socialization after they were rescued, but neither of them ever developed language (Rymer, 1993). This is also why it is important to determine quickly if a child is deaf and to begin immediately to communicate in sign language. Deaf children who are not exposed to sign language during their early years will likely never learn it (Mayberry, Lock, & Kazmi, 2002).

Milestones in Language development?

Receptive Language:

Children's language development moves from simplicity to complexity. Infants start without language (infantis means "not speaking"). Yet by 4 months of age, babies can discriminate speech sounds (Stager & Werker, 1997). They can also read lips: They prefer to look at a face that matches a sound, so we know they can recognize that ah comes from wide open lips and from mouth with corners pulled back (Kuhl & Meltzoff, 1982). This period marks the beginning of the development of babies' receptive language, their ability to comprehend speech – what is said to them or about them. At seven months and beyond, babies grow in their power to do what you and I find difficult when listening to an unfamiliar language: segmenting spoken sounds into individual words. Moreover, their adeptness at this task, as judged by their listening patterns, predicts their language abilities at ages 2 and 5 (Newman et al., 2006).

Productive Language:

Babies' productive language is their ability to produce words, matures after their receptive language.

Stages of Language Development:

There are mainly five stages of language development. We would discuss in details all the stages-

1) Babbles Stage:

Beginning at about 04 months. It consists of babbles, many speech sounds. Yet by 4 months of age, babies can discriminate speech sounds (Stager & Werker, 1997). Many of these spontaneously uttered sounds are consonant -vowel pairs formed by simply bunching the tongue in the front of the mouth or by opening or closing the lips.

Beginning at about 10 months, babbling changes and a trained ear can identify various sounds related to the household language. Without exposure to other languages, babies lose their ability to hear and produce sounds and tones found outside their native language. Babbling is not an imitation of adult speech - it includes sounds from various languages, including the one not spoken at home. Deaf infants who observe their deaf parents signing begin to babble more with their hands.

2) One-word stage:

Beginning at about 12 months. The stage in speech development, during which a child speaks mostly in single words. They have already learnt that sounds carry meanings. They now begin to use sounds - usually only one recognizable syllable such as ma or da. But family members quickly learn to understand.

Across the world, baby's first words are often nouns that label objects or people. This one-word stage may equal a sentence.

3) Two-word, telegraphic speech:

At about 18 months, children's words learning explodes from about a word per week to a word per day. By their second birthday, most have entered the two-word stage. They start uttering two-word sentences in telegraphic speech: Like the old-fashioned telegrams (TERMS ACCEPTED. SEND MONEY), this early form of speech contains mostly nouns and verbs (Want juice). Also like telegrams, it follows rules of syntax; the words are in a sensible order. English-speaking children typically place adjectives before nouns—big doggy rather than doggy big.

4) Language develops rapidly into complete sentences:

Once children move out of the two-word stage, they quickly begin uttering longer phrases (Fromkin & Rodman, 1983). If they get a late start on learning a particular language, for example after receiving a cochlear implant or being an international adoptee, their language development still proceeds through the same sequence, although usually at a faster pace (Ertmer et al., 2007; Snedeker et al., 2007). By early elementary school, children understand complex sentences and begin to enjoy the humour conveyed by double meanings: "You never starve in the desert because of all the sand-which-is there."

Table 10.1.: Summary of Language development

Sr. No.	Month (Approximate)	Stage
1	4	Babbles many speech sounds
2	10	Babbling resembles household language.
3	12	One-word stage.
4	24	Two-word, telegraphic speech.
5	24+	Language develops rapidly into complete sentences.

Explaining Language Development:

Noam Chomsky argued that all languages do share some basic elements which he called universal grammar. For example, all human languages have nouns, verbs and adjectives as grammatical building blocks. Chomsky believed that we human beings are born with a built-in predisposition to learn grammar rules, that is why preschoolers pick up language so readily and use grammar so well. It happens naturally. But no matter what language

we learn, we start speaking it mostly in nouns rather than in verbs and adjectives.

Further, research shows that 7 month olds can learn simple sentence structures. In an experiment, after repeatedly hearing syllable sequences that follow one rule, infants listened to syllables in a different sequence. They could detect the difference between two patterns later on. This suggested that babies come with a built in readiness to learn grammatical rules.

Childhood seems to represent critical(sensitive) period for mastering certain aspects of language before the language learning window closes. People who learn a second language as adults usually speak it with the accent of their native language and have difficulty in mastering the second language. The window on language learning closes gradually in early childhood. By about age 7, those who have not been exposed to either a spoken or a signed language gradually lose their ability to master any language.

Language communication:

A language is said to communicate when others understand the meaning of our sentences, and we, in turn, understand their communications, of course, this is not limited to language. We convey much information to others nonverbally by gesture. When we speak one of the thousands of languages of the world, we draw on our underlining knowledge of the rules governing the use of language. This knowledge about language, or linguistic competence, as it is called, is used automatically and almost effortlessly to generate and comprehend meaningful speech. Linguistic competence seems to be universal human species-typical ability.

10.1.3 Close Up: Living in a silent world:

The discussion so far has been about the use of vocal speech symbols, or verbal language, in thinking. Can other language system be used as tools of thought? Studies of the deaf provide an approach to this question. Deaf children with little verbal language ability score in the normal range on standardized tests of cognitive performance (Vernon, 1967), and their cognitive and thinking abilities develop relatively normally (Furth, 1971). Such findings have been interpreted as indicating that language plays little or no role in the thinking or cognitive development of the deaf. But many of the deaf are taught sign language, and, even if they are not explicitly taught such language, it has been found that deaf children will develop their own (Goldin& Feldman, 1977). This may indicate that there is an innate human program for language be it verbal or gestural.

The standard visual-gestural sign languages learned by the deaf have many features in common with auditory languages. For example, just as the auditory-vocal languages use combinations of small number of basic sounds, or phonemes, as they are called to generate meaningful language, so, too, do the visual-gestural languages of the deaf make use of a relatively small number of basic movement combinations for communication. Thus, from combinations of the basic gestures, an infinity of ideas can be expressed in the visual-gestural languages. Some studies suggest that deaf children who know sign language are better at a variety of cognitive and thinking tasks than are those without this language (Vornon & Koh, 1971; Stuckless & Birch, 1966). Thus, those deaf people whose verbal languages skills are minimal seem to have a nonverbal language tool of thought.

The challenge of life without hearing may be greatest for children. Unable to communicate in customary ways, signing playmates find it difficult to coordinate their play with speaking playmates. Their school achievement may suffer because academic subjects are rooted in spoken languages. Adolescents may feel socially excluded with a resulting low self-confidence.

10.1.4 The brain and language:

We process complex language information with amazing speed is an understatement. Caplan (1994), reported, for example, that people typically recognize spoken words after about 125 milliseconds (about one eighth of a second) that is, while the word is still being spoken. Normal word production, estimated over a number of studies, requires us to search through a mental "dictionary" of about 20,000 items, and we do so at the rate of three words per second.

Obviously, the brain architecture to support this rapid and complex cognitive processing must be sophisticated indeed. Neuropsychologists have been trying to understand what the underlying brain structures involved with language are, where they are located, and how they operate. In this topic, we will see two important language disorders which are related to brain and language.

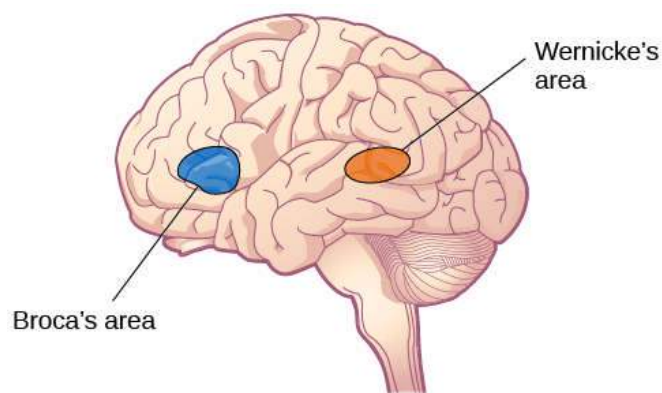
Adults whose hearing becomes impaired later in life also face challenges. When older people with hearing loss must expend efforts to hear words, they have less remaining cognitive capacity available to remember and comprehend them. It has been found that people with hearing loss, especially those not wearing hearing aid, have reported feeling sadder, being less socially engaged and more often experiencing others' irritation. They may also experience a sort of shyness. Henry Kisor (1990) very aptly said, "we can be self-effacing and diffident to the point of invisibility."

Sometimes this tendency can be crippling. I must fight it all the time". Helen Keller, both deaf and blind, also noted that "Blindness cuts people off from things. Deafness cuts people off from people".

Broca's Aphasia:

Interest in localizing language function in the brain dates back at least to the 1800s, when a French physician with interests in anthropology and ethnography, Pierre Paul Broca, read a paper in 1861 at the meeting of the society Anthropologist in Paris. The paper reported on a patient, nicknamed "Tan" because he had lost the ability to speak any word save for tan. Shortly after the patient died, his brain was examined and found to have a lesion in the left frontal lobe. The very next day, Broca reported this exciting (for science, not for the patient or his family, probably) finding (Posner & Raichle, 1994). The area of the brain, henceforth known as Broca's area, is shown in the figure 10.7.A. It is also called expressive aphasia. A Broca's aphasia appeared to leave language reception and processing undisturbed. In 1865, Broca reported that after damage to an area of the left frontal lobe a person would struggle to speak words while still being able to sing familiar songs and comprehend speech.

Fig. 10.1: Brain structure involved with languages.



Wernicke's Aphasia:

About 13 years later, in 1874, a German neurologist Carl Wernicke identified another brain area that, if damaged by a small lesion (often result of a stroke), left patients with extreme difficulty in comprehending (but not producing) spoken language (Posner & Raichle, 1994). (Not surprisingly, this area has come to be called Wernicke's area, and it is also shown in figure 10.7.A. It is also called receptive aphasia. People could speak words and sentences (although the language was often gibberish). Damage to Wernicke's area also disrupts understanding.

But today, Functional MRI scan shows that different neural networks are activated by nouns and verbs, or objects and actions,

by different vowels and by reading stories of visual vs. motor experiences. It was also found that jokes that play on meaning are processed in a different area of the brain than jokes that play on the words. The main point is that in processing language, the brain operates by dividing its mental functions – speaking, perceiving, thinking, remembering into sub functions. Localized trauma that destroys one of these neural work teams may cause people to lose just one aspect of processing.

10.1.5 Do other species have language?

Language is considered to be a very complex form of communication that occurs among the human race. It is a set of verbal and non-verbal conventions that humans use to express their ideas and wants. Humans use words while talking to express their needs and wants and they cry, slouch and make faces when they want to express feelings. Animals, or in other words non-humans also show signs of communication such as a dog wagging its tail when excited or a bird singing a song to attract the opposite sex. However, do animals have their language? Researchers say that animals or non-humans, do not have a true language like humans. However, they do communicate with each other through sounds and gestures. Animals have a number of in-born qualities they use to signal their feelings, but these are not like the formed words we see in the human language. Human children show these same forms of communication as babies when crying and gesturing. But they slowly learn the words of the language and use this as form of communication.

If human children were separated at birth away from humans they would not learn the words of the language and would not be able to communicate with other humans. They would resort to sounds and gestures as their primary form of communication. However, in the animal kingdom if they are reared alone from birth they are still able to behave and communicate in the same way as other species of their kind.

So what about animals such as dogs that understand commands or birds that can “talk”? Dogs can be trained to follow certain commands such as ‘sit’, ‘come’ and ‘roll over’, but does this mean they understand language and therefore can use it as well? Dogs are known to be experts at reading their owners intentions and that they do not respond to actual words but the tone in which it is said. So if you say “bad dog” in a cheerful tone, the dog will wag its tail. If you say “good dog” in a harsh tone, the dog will put his tail in between his legs. Birds that are in captivity are known to be able to “talk”- it is believed that it does not mean anything to them and they are merely copying sounds they hear. There is no doubt that animals communicate with each other to one degree or another in response to different stimuli such as hunger or fear. Human

language is creative and consists of unique characteristics that give us the ability to engage in abstract and analytical ways.

10.2 THINKING AND LANGUAGE

Philip Dale very correctly said that thinking is more than language and language is more than thinking, but thinking and language are related and in this topic we will describe some of the ways in which they are related.

Every day we use language in our thinking. For many people, much of the time, a good deal of thinking involves the use of word symbols and the rules of grammar to join the words into phrases and sentences. The words, their meanings and rules for joining them together are stored in our semantic long term memories. When we think with language, we draw on this store of information to use language as tool of thought.

Some theories take a more extreme view of the role language in thinking; they claim that language can actually determine the thoughts we are capable of having. But this linguistic relativity hypothesis, as it is called, has been under increasing attack in recent years.

Because so much thinking involves language, the idea arose in psychology that thinking was actually a kind of inner speech, a kind of “talking to yourself under your breath.” According to this idea, people make small movement of the vocal apparatus when they think and carry on their thinking by talking to themselves. A number of experiments have indicated that movements of the vocal apparatus may indeed accompany thought, but other experiments have made it clear that such movements are not necessary for thinking (Smith et al., 1947). In one heroic experiment, the subject, a physician, was completely paralyzed by means of a drug. He literally could not move a muscle, and his breathing was done for him by an iron lung. The paralyzing drug, however, did not affect the way his brain worked; it merely acted on the drug, the subject was given certain verbal problems to solve; he could not answer, of course, because the muscles necessary for speaking were paralyzed. There is no way to be certain that, thinking while under the influence of the drug, but all indications are that he was unable to do so because after the paralysis was removed by a counteracting drug, he clearly remembered what had taken place while he was drugged and promptly gave the answer to problems.

10.2.1 Language influences thinking:

There are at least 5,000 living languages in the world about 140 of them are spoken by a million or more people. Is a particular

language merely a convenient set of symbols for the communication of our thoughts? According to the linguist Benjamin L. Whorf, the answer is no. Whorf argued that the higher levels of thinking require language and that the characteristics of particular language actually shape the way that users of the language think about things. There are two ideas here. One is that thinking requires language, the other has come to be called the **linguistic relativity hypothesis**. Most of the interest has focused on this hypothesis. In its strongest form, it says that the particular language people used determines how they see the world.

Whorf based his hypothesis on studies of North American Indian languages, but his hypothesis is said to hold for all languages. He found many differences between these languages and European ones and argued that such differences predispose their users to think in different ways. For example, the grammar of a language dictates how people describe changes in the environment. Since the basic unit of English grammar are nouns and verbs, English-speaking people commonly think in terms of “things” and “actions” Whorf found that people using other languages do not necessarily divide situation up this way. Furthermore, all languages have some words for which no equivalents can be found in any other language. The German word *weltanschauung* for instance, means something like “a general world view, or a general philosophy of the world”. There is no word with this precise meaning in English. In addition, languages categorize events in various ways. Eskimos are said to use some four different words for snow, while English has only one. According to the linguistic relativity hypothesis. Eskimos can think about snow with greater precision than English speaking can people and have different conception of what snow is, the Hopi language has single word for all flying objects their than birds. The hypothesis states that Hopi speakers thinks differently about flying objects than do speakers of languages that do not categorize the world in this way. The Hanno people of the Philippine, islands are said to have names for 92 varieties of rice, but all 92 varieties are, for the English speaker, simply rice(Con, 1954 cited in brown, 1965).

The linguistic relativity hypothesis is controversial. Many linguistic have argued that the hypothesis is circular Whorf found that languages differ in their grammar and in the concepts they can express from the hypothesized that thinking must also differ among the users of this different languages. However, the differences in the thinking are themselves assessed by the way of the language is used. What is hidden are ways of assessing conceptions of the word independently of language. The few experiments that have attempted this have had inconclusive results. Perhaps it is not so much a matter of what can be thought about by users of a language as it is of how easy it is to think about certain things. English-

speaking thinkers can think about the concept of the “world view” even if they do not have a convenient word for it. English speakers can think about different kinds of snow, even have to use more words to describe it.

More recently, interest has shifted away from relativity to universals in thinking perhaps the basic thought processes in thinking are similar, even though languages differ widely. Colour perception provides an example of the possible universality of thinking despite the different ways in which different languages designate colours. It has been found that certain “focal” colours—a maximum of 11—are chosen from a colour chart by speakers of widely differing languages. Furthermore, it has been shown that thinking can be influenced by these focal colours even when the language does not have names for them. This is contrary to what might be expected from the linguistic relativity hypothesis. For example, Eleanor Rosch has done experiments with the Dani people of the New Guinea. The Dani have only “black” and mola for “white”. The Dani subjects in these experiments studied a colour chart arbitrary names were assigned to eight of the focal colours and eight of the non-focal colours on the chart. The Dani learn the names assigned to the focal colours more rapidly and remembered them better than they did those given to the other colors. Thus even though the Dani do not have names for the focal colors in their language, their thinking is influenced by them.

10.2.2 Thinking in images

To a large degree, the availability of the symbols that we use in thinking are often words and language, and therefore thinking and language are closely related. A language makes available hundreds of thousands of potential language symbols is what makes human thinking so much more sophisticated than the thinking of other animals. Although language is a powerful tool in human thought, as when we “talk to ourselves” internally, images are another important type of symbol used in thinking.

People vary remarkable in how much they use images in their thinking. A few report that they almost never use mental pictures, so they must be doing their thinking with words, or verbally; others that most of their thinking is done in image form. When we use images to think, they are not usually complete “pictures in the head”. They are usually incomplete. Consider the imagery you use, if you use it at all, in solving the following problems (Huttenlocher, 1973). Imagine that you are standing on a certain street corner in a section of a city you know well. How would you walk or drive from this point to some other part of the city?

Here is another problem in which you might use imagery: from where on earth could you walk first 1 mile south, then 1 mile

east, then 1 mile north, and end up exactly where you began? Did you use imagery in trying to solve this problem? If so, what was your imagery like?

When solving problems like these, most people report that their images are incomplete. To solve the first problem, people usually make a visual map, but it is a strange one. Although it shows turns, the lines connecting the turns are of no particular length. In solving the second problem (the answer is the north pole), people imagine a globe- but not the whole globe, only the polar region. Such problem-solving images contain only a few details- say, of sidewalks, roads, buildings, or color-although some people may imagine snow when they think of the north pole. In general, the images are abstractions of certain features from previous experience.

The incomplete, abstract images most of us use in thinking seem to be constructed from elements stored in long term memory. The constructive process involved in imagery has been studied by means of experiment in which people were asked to form images of various sizes. For example, an elephant might be imaged as the size of a mouse, or mouse imaged as the size of an elephant. Variations of this sort in the sizes of images indicate that images are constructions. Even more interesting, however, are studies indicating that the ease with which information is found in an image depends on the size (and other aspects) of the image constructed (Kosslyn, 1983).

10.3 SUMMARY

In this unit we began by explaining the concept of language and its structure. We then explained how language developed in human beings. We have also studied the stages of language development. We explained the relationship between thinking and language and how language influences thinking. The concept of thinking in images and association between brain and language was also explained. In “brain and language” topic we studied two important language disorders (Broca’s aphasia and Wernicke’s aphasia). Following this we discussed about living in a silent world and do other species have language.

10.4 QUESTIONS

- A) Write long answers:
- a) Discuss in detail about language structure.
 - b) Discuss about Language development.
 - c) Explain how language influences thinking?

B) Write short notes:

- a) The brain and language.
- b) Do other species have language?
- c) Thinking and Language.
- d) Thinking in images.

10. 5 REFERENCES

1. Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
2. Whorf, B.L. (1956). Language, thought and reality New York: Wiley.
3. Slobin, D. I (1979). Psycholinguistic (2d edi) Gien-view , IL : Scott, foresman.
4. Rasch. E (1973). Natural Categories. Cognitive psychology, 4,328-350.
5. Lahey, B. B. (2012). Psychology: An Introduction. 11th edi. New York: McGraw-Hill Publications
6. Feldman, R.S. (2013). Understanding Psychology.th publications 11edi. New York: McGraw Hill



THINKING, LANGUAGE AND INTELLIGENCE – III

Unit Structure :

- 11.0 Objectives
- 11.1 Introduction
- 11.2 Is intelligence one general ability or several specific abilities?
Is intelligence neurologically Measurable.
- 11.3 The origins of intelligence testing
- 11.4 Assessing Intelligence.
- 11.5 Modern Tests of Mental Abilities: Binet Mental Ability Test,
Stanford Binet and IQ, The Wechsler Tests.
- 11.6 Intelligence and creativity:
- 11.7 Emotional intelligence:
- 11.8 Principles of test construction:
- 11.9 Summary
- 11.10 Questions
- 11.11 References

10.0 OBJECTIVES

After studying this unit you should be able to:

- Know the nature of intelligence and some important concepts of intelligence.
- Understand the origins of intelligence testing and Assessment of Intelligence.
- Understand the various tests that are used to measure intelligence.
- Understand the relationship between Intelligence and creativity
- Understand the concepts of emotional intelligence.
- Understand the Principles of test construction.

11.1 INTRODUCTION: WHAT IS INTELLIGENCE?

In this unit, we will discuss numerous topics related to intelligence such as determinants of intelligence and is intelligence one general ability or several specific abilities. We will also be discussing neurological measurement of intelligence, mental

retardation and giftedness. We would discuss in detail about the origins of intelligence testing and different ways to assess intelligence. After this, we would briefly discuss modern tests of mental abilities such as Binet Mental Ability Test, Stanford Binet and The Wechsler Tests. It should be remembered that Intelligence is one of the most important and unique ability that human beings possess. The term intelligence was popularized by Sir Francis Galton, Alfred Binet and others. Intelligence refers to the cognitive ability of an individual to learn from experience, to reason well, and to cope with the demands of daily living. Some important concepts and topics related to intelligence such as emotional intelligence, Intelligence and creativity, the nature v/s nurture controversy and the bell curve would also be discussed in brief. Towards the end of the unit we would study principles of test construction.

Intelligence is a key construct employed to know how individuals differ from one another. It also provides an understanding of how people adapt their behaviour according to the environment they live in. In this chapter, we would learn about intelligence in its various forms.

Definition:

Psychological notion of intelligence is quite different from the common notion of intelligence. If you watch an intelligent person, you are likely to see in her/him with attributes like mental alertness, ready wit, quickness in learning and ability to understand relationships. Intelligence is not a quality like height or weight, which has the same meaning for everyone around the globe. People assign the term intelligence to the qualities that enable success in their own time and in their own culture. There are different definitions of intelligence given by different psychologist, some of which are given below.

- Alfred Binet was one of the first psychologist who worked on intelligence. According to him, Intelligence is the ability to judge well, understand well and reason well (Alfred Binet, 1973).
- According to Wechsler, Intelligence is the global and aggregate capacity of an individual to act purposefully, to think rationally and to deal effectively with his/her environment. (Wechsler, 1950).
- Other psychologists such as Gardner and Sternberg have defined intelligence as well. Intelligent individual not only adapt to their environment but also actively modifies or shapes it (Gardner & Sternberg).

In simple words, intelligence is synthesis of one's abilities. Binet assumes intelligence as a general capacity for comprehension and reasoning that manifests itself in various ways, another psychologist, Charles Spearman, proposed that all

individuals possess a general intelligence factor in varying amounts. In contrast to Spearman, Louis Thurstone felt that intelligence could be broken down into a number of primary abilities. Rejecting all these theories, Guilford states that many aspects of intelligence tends to be ignored when items are lumped together to form tests.

**Important Concepts in Intelligence:
Individual Differences in Intelligence:**

It is often said that no two individuals are exact duplicates; they differ from each other in some way or the other. Hence the job of the psychologist is to identify and understand this uniqueness in individuals. Such a similarity or difference between persons reveals individual differences. It happens in our day-to-day life when we see people around us. A question comes to mind; how and why people appear similar or different to each other? For example, when we think about their physical appearance, we often ask ourselves why some people have dark or fair complexion, why some people are tall and some are short, why some are thin and why some are very fat. When we think about their psychological characteristics we often come across people who are very talkative or less talkative, some laugh too much whereas others take much time even to smile and some are very friendly whereas some prefer to be alone. In psychology, these are called individual differences referring to the extent and kind of variations or similarities among people on some of the important psychological aspects such as intelligence.

When we speak Individual differences in terms of intelligence, individual difference occur due to interaction of genetic and environmental factors. We inherit certain characteristics from our parents through genetic codes. The phenotype or the expressed forms of our characteristics depend on contributions of the socio-cultural environment. This is the reason why we are not exactly like our parents and our parents not exactly like our grandparents. We do share similarities with our parents in respect of many physical attributes like height, colour of eyes, shape of nose etc. We also inherit certain cognitive, emotional and other characteristics from our parents like intellectual competence, love for sport, creativity etc. However, our own characteristics develop largely by the support from the environment in which we live.

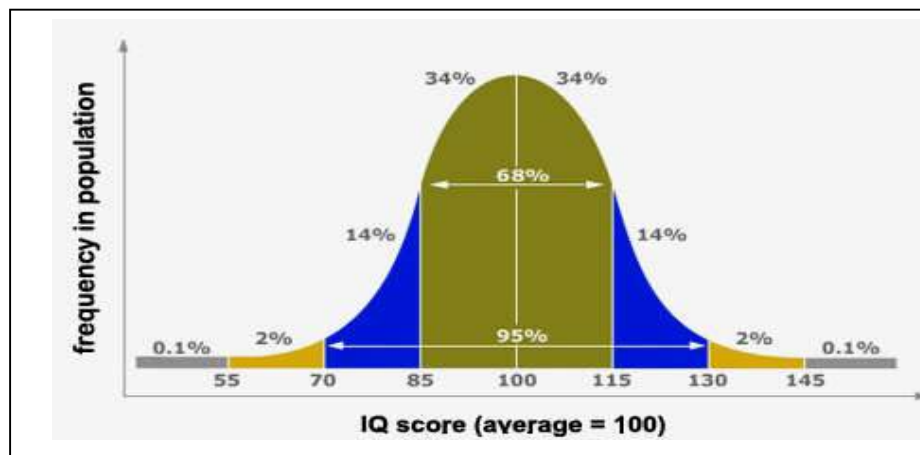
Extremes of Intelligence: Retardation and Giftedness:

The results of studies assessing the measurement of intelligence show that IQ is distributed in the population in the form of a normal distribution curve, which the pattern of scores is usually observed in a variable that clusters around its average. In a normal distribution, the bulk of the scores fall toward the middle, with many fewer scores falling at the extremes. The normal distribution of

intelligence (Figure 11.2. Distribution of IQ Scores in the General Population") shows that on IQ tests, as well as on most other measures, the majority of people cluster around the average (in this case, where IQ = 100), and fewer are either very smart or very dull. Because the standard deviation of an IQ test is about 15, this means that about 2% of people score above an IQ of 130 (often considered the threshold for giftedness), and about the same percentage score below an IQ of 70 (often being considered the threshold for mental retardation).

The normal distribution of IQ scores in the general population shows that most people have about average intelligence, while very few have extremely high or extremely low intelligence.

Figure 11.1: Normal Distribution Curve of Intelligence: Bell Curve



➤ **Retardation:**

One cause of mental retardation is Down syndrome, a chromosomal disorder leading to mental retardation caused by the presence of all or part of an extra 21st chromosome. The incidence of Down syndrome is estimated at 1 per 800 to 1,000 births, although its prevalence rises sharply in those born to older mothers. People with Down syndrome typically exhibit a distinctive pattern of physical features, including a flat nose, upwardly slanted eyes, a protruding tongue, and a short neck.

Societal attitudes toward individuals with mental retardation have changed over the past decades. We no longer use terms such as mad, idiot to describe these people, although these were the official psychological terms used to describe degrees of retardation in the past. Laws such as the Person with Disabilities Act (PWD) have made it illegal to discriminate on the basis of mental and physical disability, and there has been a trend to bring the mentally retarded out of institutions and into our workplaces and schools.

➤ **Giftedness:**

Having extremely high IQ is clearly less of a problem than having extremely low IQ, but there may also be challenges to being particularly smart. It is often assumed that schoolchildren who are labeled as gifted may have adjustment problems that make it more difficult for them to create social relationships. To study gifted children, Lewis Terman and his colleagues (Terman & Oden, 1959) selected about 1,500 high school students who scored in the top 1% on the Stanford-Binet and similar IQ tests (i.e., who had IQs of about 135 or higher), and tracked them for more than seven decades (the children became known as the termites and are still being studied today). This study found, first, that these students were not unhealthy or poorly adjusted but rather were above average in physical health and were taller and heavier than individuals in the general population. The students also had above average social relationships for instance, being less likely to divorce than the average person (Seagoe, 1975).

As you might expect based on our discussion of intelligence, kids who are gifted have higher scores on general intelligence (g). But there are also different types of giftedness. Some children are particularly good at math or science, some at automobile repair or carpentry, some at music or art, some at sports or leadership, and so on. There is a lively debate among scholars about whether it is appropriate or beneficial to label some children as gifted and talented in school and to provide them with accelerated special classes and other programs that are not available to everyone. Although doing so may help the gifted kids (Colangelo & Assouline, 2009), it also may isolate them from their peers and make such provisions unavailable to those who are not classified as gifted. There is IQ classification given by Wechsler for understanding of IQ range. Classification of IQ range is given below.

No.	IQ Range	IQ Classification
1.	130 and Above	Very Superior
2.	120-129	Superior
3.	110-119	Above Average Intelligence
4.	90-109	Average Intelligence
5.	80-89	Below Average Intelligence
6.	70-79	Borderline Intelligence
7.	55-69	Mild Mental Retardation
8.	40-54	Moderate Mental Retardation
9.	25-39	Severe Mental Retardation
10.	24 and Below	Profound Mental Retardation

Figure11.1.A: Classification of Intelligent Quotient by Wechsler

Nature v/s Nurture Controversy:

Intelligence has both genetic and environmental causes, and these have been systematically studied through a large number of twin and adoption studies (Neisser et al., 1996; Plomin, DeFries, Craig, & McGuffin, 2003). These studies have found that between 40% and 80% of the variability in IQ is due to genetics, meaning that overall genetics plays a bigger role than does environment in creating IQ differences among individuals (Plomin & Spinath, 2004). The IQs of identical twins correlate very highly ($r = .86$), much higher than do the scores of fraternal twins who are less genetically similar ($r = .60$). And the correlations between the IQs of parents and their biological children ($r = .42$) is significantly greater than the correlation between parents and adopted children ($r = .19$). The role of genetics gets stronger as children get older. The intelligence of very young children (less than 3 years old) does not predict adult intelligence, but by age 7 it does, and IQ scores remain very stable in adulthood (Deary, Whiteman, Starr, Whalley, & Fox, 2004).

But there is also evidence for the role of nurture, indicating that individuals are not born with fixed, unchangeable levels of intelligence. Twins raised together in the same home have more similar IQs than do twins who are raised in different homes, and fraternal twins have more similar IQs than do non-twin siblings, which is likely due to the fact that they are treated more similarly than are siblings. The fact that intelligence becomes more stable as we get older provides evidence that early environmental experiences matter more than later ones. Environmental factors also explain a greater proportion of the variance in intelligence for children from lower-class households than they do for children from upper-class households (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). This is because most upper-class households tend to provide a safe, nutritious, and supporting environment for children, whereas these factors are more variable in lower-class households.

Social and economic deprivation can adversely affect IQ. Children from households in poverty have lower IQs than do children from households with more resources even when other factors such as education, race, and parenting are controlled (Brooks-Gunn & Duncan, 1997). Poverty may lead to diets that are under-nourishing or lacking in appropriate vitamins, and poor children may also be more likely to be exposed to toxins such as lead in drinking water, dust, or paint chips (Bellinger & Needleman, 2003). Both of these factors can slow brain development and reduce intelligence. If impoverished environments can harm intelligence, we might wonder whether enriched environments can improve it. Government-funded after-school programs such as Head Start are designed to help children learn. Research has found

that attending such programs may increase intelligence for a short time, but these increases rarely last after the programs end (McLoyd, 1998; Perkins & Grotzer, 1997). Intelligence is improved by education; the number of years a person has spent in school correlates at about $r = .6$ with IQ (Ceci, 1991).

It is important to remember that the relative roles of nature and nurture can never be completely separated. A child who has higher than average intelligence will be treated differently than a child who has lower than average intelligence, and these differences in behaviors will likely amplify initial differences. This means that modest genetic differences can be multiplied into big differences over time.

The Bell Curve:

Richard Herrnstein and Charles Murray in 1994 published an important book called as "The Bell Curve" which has become highly controversial and had made certain conclusion concerning intelligence, race and genetics. According to Herrenstein and Wilson (1994) intelligence is an important asset in a modern society. The demand for intelligence in modern society has created two groups in society. One group consists of highly intelligent individuals who hold good jobs and earn more. Due to their high intelligence, they are paid more and they progress economically as well as socially. On the other hand, are individuals, who, because of their low intelligence, hold low status jobs and are paid less. Consequently, their economic and social status is also low. Thus, according to Herrenstein and Murray (1994) one's intelligence determines one's occupational success and one's social status. Its central point is that intelligence is a better predictor of many factors including financial income, job performance, unwed pregnancy, and crime than parents' Socioeconomic or education level. Also, the book argued that those with high intelligence, which it called the "cognitive elite", are becoming separated from the general population of those with average and below-average intelligence and that this was a dangerous social trend.

Thus, in The Bell Curve, Herrnstein and Murray set out to prove that American society was becoming increasingly meritocratic, in the sense that wealth and other positive social outcomes were being distributed more and more according to people's intelligence and less and less according to their social backgrounds.

The Bell Curve has become highly controversial. The Bell Curve is not a scientific work. It was not written by experts, and it has a specific political agenda. According to experts the book has many statistical errors and ignored the effects of environment and culture in determining his/her success in life.

Social Determinants & Biological Determinants of Intelligence:

There are two basic factors which influence the human intelligence. These two factors are biological and social. The heredity-environment issue, debated in regard to many aspects of human behaviour, has focused most intensely on the area of intelligence. Few experts doubt that there is some genetic basis for intelligence, but opinion differ as to the relative contribution of heredity and environment.

Most of the evidence bearing on the inheritance of the intelligence comes from studies correlating IQs between person of various degree of genetic relationship. The average correlation between the IQs of parents and their natural children is 50; between parents and their adopted children the correlation is about 25. Identical twins, because they develop from a single egg. Share precisely the same heredity; the correlation between their IQs very high –about 90. The IQs of fraternal twins (who are genetically no more alike than ordinary siblings, since they develop from separate eggs) correlated higher, .75, than those of fraternal twins reared together.

Note that being reared in the same home situation tends to increase IQ similarity, even for individual who are unrelated. Although adopted children resemble their natural parents on the basis of their natural parent's ability (Skodak and Skeels, 1949).

Racial Differences:

After discussing generic contribution to intelligence, it is obvious that there are racial differences in intelligence. Because of the recent issue on the question of whether blacks are innately less intelligent than whites. In view of the heated controversy centered on this issue and its significance for social policy, it is important that we examine the available evidence. On standard intelligence tests black Americans, as a group, score 10 to 15 IQ points lower than while Americans, as a group. This fact is not a debate but revolves around how to interpret the difference. Some possible explanations should be apparent from what we have already said about the nature of IQ tests and the influence of environmental factor on tested intelligence. For example, most intelligence have been standardized on white populations. Since black and whites generally grow up in quite different environments and have different experiences, the contents of such tests may not be appropriate for blacks. And a black child may react differently to being tested (particularly if he or she is being tested by a white examiner) than a white child. Thus, the whole issue of estimating black intelligence is complicated by the questions of whether the tests are appropriate and whether the data obtained by white testers represent an unbiased measure of IQ.

11.1.1 Is intelligence one general ability or several specific abilities?

In the early 1900s, the French psychologist Alfred Binet (1857–1914) and his colleague Henri Simon (1872–1961) began working in Paris to develop a measure that would differentiate students who were expected to be better learners from students who were expected to be slower learners. The goal was to help teachers better educate these two groups of students. Binet and Simon developed what most psychologists today regard as the first intelligence test, which consisted of a wide variety of questions that included the ability to name objects, define words, draw pictures, complete sentences, compare items, and construct sentences.

Binet and Simon (Binet, Simon, & Town, 1915; Siegler, 1992) believed that the questions they asked their students, even though they were on the surface dissimilar, all assessed the basic abilities to understand, reason, and make judgments. And it turned out that the correlations among these different types of measures were in fact all positive; students who got one item correct were more likely to also get other items correct, even though the questions themselves were very different.

On the basis of these results, the psychologist Charles Spearman (1863–1945) hypothesized that there must be a single underlying construct that all of these items measure. He called the construct that the different abilities and skills measured on intelligence tests have in common the general intelligence factor (g). Virtually all psychologists now believe that there is a generalized intelligence factor, g, that relates to abstract thinking and that includes the abilities to acquire knowledge, to reason abstractly, to adapt to novel situations, and to benefit from instruction and experience (Gottfredson, 1997; Sternberg, 2003).

Although there is general agreement among psychologists that g exists, there is also evidence for specific intelligence (s), a measure of specific skills in narrow domains. One empirical result in support of the idea of "s" comes from intelligence tests themselves. Although the different types of questions do correlate with each other, some items correlate more highly with each other than do other items; they form clusters or clumps of intelligences.

Theory of Multiple Intelligence:

According to American psychologist Howard Gardner (1983) we do not have one underlying general intelligence, but instead have multiple intelligences. The nine types of intelligence identified by Howard Gardner are as follows:

- **Linguistic Intelligence:** Children with this kind of intelligence enjoy writing, reading, telling stories or doing crossword puzzles. Linguistic intelligence involves aptitude with speech and language and is exemplified by poet T. S. Eliot.
- **Logical-Mathematical Intelligence:** Children with lots of logical intelligence are interested in patterns, categories and relationships. They are drawn to arithmetic problems, strategy games and experiments. Physicist Albert Einstein is a good example of this intelligence.
- **Spatial Intelligence:** It is used to perceive visual and spatial information and to conceptualize the world in tasks like navigation and in art. Painter Pablo Picasso represents a person of high spatial intelligence.
- **Musical intelligence:** It is the ability to perform and appreciate music, is represented by composer A. R. Rahman and Rahul Dev Burman (R.D. Burman).
- **Bodily-kinaesthetic intelligence:** It is the ability to use one's body or portions of it in various activities, such as dancing, athletics, acting, surgery, and magic. Martha Graham, the famous dancer and choreographer, is a good example of bodily-kinaesthetic intelligence. It is the type of ability shown by the gifted athletes, dancers or super surgeons who have great control over their body, hand and finger movements.
- **Interpersonal intelligence:** It involves understanding others and acting on that understanding. It is the type of ability shown by those who can easily infer other people's mood, temperaments, or intentions and motivations.
- **Intrapersonal intelligence:** It is the ability to understand one's self and is typified by the leader Mohandas Gandhi. It is the ability shown by someone who has great insight into his/her own feelings and emotions.
- **Naturalist Intelligence:** the ability to recognize and classify plants, animals, and minerals. Naturalist Charles Darwin is an example of this intelligence. Naturalistic Intelligence is defined as the ability to observe and/or interact with diverse species in nature. The type of ability shown by biologists or environmentalist
- **Existentialist:** It is the ability to see the "big picture of the human world by asking questions about life, death and the ultimate reality of human existence.

11.1.2 Intelligence and creativity:

One important debate in understanding the variations in creativity has been the relationship of creativity with intelligence. Let us take an example of two students in a class. Savita is regarded by her teacher as an excellent student. She does her work on time, scores the highest grades in her class, listens to instructions with care, grasps quickly, reproduces accurately but she rarely comes out with ideas which are her own. Rima is another student who is just average in her studies and has not achieved high grades consistently. She prefers to learn on her own. She improvises new ways of helping her mother at home and comes up with new ways of doing her work and assignment. The former is considered to be more intelligent and the latter as more creative. Thus, a person who has the ability to learn faster and reproduced accurately may be considered intelligent more than creative unless she/he devises new ways of learning and doing.

Terman, in the 1920s, found that persons with IQ were not necessarily creative. At the same time, creative ideas could come from persons who did not have a very high IQ. Other researchers have shown that not even one of those identified as gifted, followed up throughout their adult life, had become well-known for creativity in some field. Researchers have also found that both high and low level of creativity can be found in highly intelligent children and also children of average intelligence. The same person, thus, can be creative as well as intelligent but it is not necessary that intelligent ones, in the conventional sense, must be creative. Intelligence, therefore, by itself does not ensure creativity.

Researchers have found that the relationship between creativity and intelligence is positive. All creative acts require some minimum ability to acquire knowledge and capacity to comprehend, retain and retrieve. Creative writers, for example, need facility in dealing with language. The artist must understand the effect that will be produced by a particular technique of painting, a scientist must be able to reason and so on. Hence, a certain level of intelligence is required for creativity but beyond that intelligence dose not correlate well with creativity. It can be concluded that creativity can take many forms and blends. Some may have more of intellectual attributes, others may have more of attributes associated with creativity. Yet there is more to creativity than what intelligence tests reveal. Intelligence tests require convergent thinking while creativity tests require divergent thinking. Injury to certain areas of the frontal lobes can leave reading, writing and arithmetic skills intact but destroy imagination. Sternberg et.al. have identified 5 components of creativity-

1. **Expertise** – a well-developed base of knowledge- furnishes the ideas, images and phrases we use as mental building blocks. The more blocks we have, the more chances we have to combine them in novel way.

2. **Imaginative Thinking Skill**– It provides the ability to see things in a novel way, to recognize patterns, and to make connections. Having mastered a problem's basic elements, we redefine or explore it in a new way.

3. **A Venturesome Personality** – A venturesome personality seeks new experiences, tolerates ambiguity and risk, and perseveres in overcoming obstacles. For example, Wiles said he labored in near-isolation from the mathematics community partly to stay focused and avoid distractions.

4. **Intrinsic Motivation** – Intrinsic motivation is being driven more by interest, satisfaction and challenge than by external pressures. Creative people focus less on extrinsic motivators such as meeting deadlines, impressing people, or making money – than on the pleasure and stimulation of the work itself. When Newton was asked how he solved such difficult problems, he said by thinking about them all the time.

5. **A Creative Environment** sparks, supports, and refines creative ideas. After studying the careers of 2026 famous scientists and inventors, Dean Keith Simonton (1992) concluded that most of these men were mentored, challenged and supported by their colleagues. Many had the emotional intelligence needed to network effectively with peers. Creativity -fostering environments support innovation, team building and communication. They also support contemplation.

11.1.3 Emotional intelligence:

Most psychologists have considered intelligence a cognitive ability, people also use their emotions to help them solve problems and relate effectively to others. Emotional intelligence refers to the ability to accurately identify, assess, and understand emotions, as well as to effectively control one's own emotions (Feldman-Barrett & Salovey, 2002; Mayer, Salovey, & Caruso, 2000).

This concept was first introduced by Salovey and Mayer. According to them, Intelligence is the ability to monitor one's own and others emotions, to discriminate among emotions and to use the information to guide one's thinking and actions. The idea of emotional intelligence is seen in Howard Gardner's interpersonal intelligence (the capacity to understand the emotions, intentions, motivations, and desires of other people) and intrapersonal intelligence (the capacity to understand oneself, including one's emotions).

Emotional Quotient (EQ):

Emotional Quotient (EQ) is used to express emotional intelligence in the same way as Intelligent Quotient (IQ) is used to express intelligence. Emotional Quotient (EQ) is a ratio concept and is a score of emotional intelligence obtained by dividing chronological age by emotional age and multiplying by 100. The formula of Emotional Quotient (EQ) is given below.

$$\text{Emotional Quotient (EQ)} = \frac{\text{Emotional Age}}{\text{Chronological Age}} \times 100$$

Emotional intelligence is a set of skills that underlie accurate appraisal, expression and regulation of emotions. It is the feeling side of intelligence. A good IQ and scholastic record is not enough to be successful in life. You may find many people who are academically talented but are unsuccessful in their own life. They experience problems in their life, workplace and interpersonal relationships. What do they lack? Some psychologists believe that the source of their difficulty may be lack of emotional intelligence. In simple words, emotional intelligence refers to the ability to process emotional information accurately and efficiently. There are some characteristics of emotional intelligent person. Person who are high on emotional intelligence who possess following characteristics.

Characteristics of Emotional Intelligent Person:

- Perceive and be sensitive to your feelings and emotions.
- Perceive and be sensitive to various types of emotions in others by noting their body language, voice, tone and facial expressions.
- Relate your emotions to your thoughts so that you take them into account while solving problems and taking decisions.
- Understand the powerful influence of the nature and intensity of your emotions.
- Control and regulate your emotions and their expressions while dealing with self and others.

Daniel Goleman, an American author and journalist, popularized the concept in his book Emotional Intelligence (1995). He expanded the concept to include general social competence. The importance of emotional intelligence has been very well brought out in the following words by Daniel Goleman "Emotional Intelligence is a master aptitude, a capacity that profoundly affects all other abilities, either facilitating or interfering with them. According to Daniel Goleman the term encompasses has following five characteristics and abilities:

- 1) **Self-Awareness:** Knowing your emotions, recognizing feelings as they occur, and discriminating between them.
- 2) **Mood Management:** Handling feelings so they're relevant to the current situation and you react appropriately.
- 3) **Self-Motivation:** Gathering up your feelings and directing yourself towards a goal, despite self-doubt, inertia, and impulsiveness.
- 4) **Empathy:** Recognizing feelings in others and tuning into their verbal and nonverbal cues.
- 5) **Managing relationships:** Handling interpersonal interaction, conflict resolution, and negotiations.

Thus, emotional intelligence is not same as self-esteem and optimism. Rather emotionally intelligent people are both social and self-aware. Those scoring high on managing emotions enjoy higher-quality interactions with friends (Lopes et.al.2004). They avoid being hijacked by overwhelming depression, anxiety or anger. Being sensitive to emotional cues, they know what to say to soothe a grieving friend, encourage a colleague and manage conflict.

Emotional intelligence is less a matter of conscious efforts and more of one's unconscious processing of emotional information. (Fiori,2009). Across many studies in many countries, those scoring high on emotional intelligence showed somewhat better job performance. They could also delay gratification in pursuit of long-term rewards, rather than being overtaken by immediate impulses. They were emotionally in tune with others and therefore often succeeded in career, marriage and parenting.

11.1.4 Is intelligence neurologically Measurable?

Using today's neuroscience tools, we might link differences in people's intelligence test performance to dissimilarities in the heart of smarts—the brain? Might we anticipate a future brain test of intelligence?

More recent studies that directly measure brain volume using MRI scans do reveal correlations of about +.33 between brain size (adjusted for body size) and intelligence score (Carey, 2007; McDaniel, 2005). Moreover, as adult's age, brain size and nonverbal intelligence test scores fall in concert (Bigler et al., 1995). One review of 37 brain-imaging studies revealed associations between intelligence and brain size and activity in specific areas, especially within the frontal and parietal lobes (Jung & Haier, 2007). Sandra Witelson would not have been surprised. With the brains of

91 Canadians as a comparison base, Witelson and her colleagues (1999) seized an opportunity to study Einstein's brain. Although not notably heavier or larger in total size than the typical Canadian's brain, Einstein's brain was 15 percent larger in the parietal lobe's lower region—which just happens to be a center for processing mathematical and spatial information. Certain other areas were a tad smaller than average. With different mental functions competing for the brain's real estate, these observations may offer a clue to why Einstein, like some other great physicists such as Richard Feynman and Edward Teller, was slow in learning to talk (Pinker, 1999).

If intelligence does modestly correlate with brain size, the cause could be differing genes, nutrition, environmental stimulation, some combination of these, or perhaps something else. Recall from earlier chapters that experience alters the brain. Rats raised in a stimulating rather than deprived environment develop thicker, heavier cortexes. And learning leaves detectable traces in the brain's neural connections. "Intelligence is due to the development of neural connections in response to the environment," notes University of Sydney psychologist Dennis Garlick (2003). Postmortem brain analyses reveal that highly educated people die with more synapses—17 percent more in one study—than their less-educated counterparts (Orlovskaya et al., 1999). This does not tell us whether people grow synapses with education, or people with more synapses seek more education, or both. But other evidence suggests that highly intelligent people differ in their neural plasticity—their ability during childhood and adolescence to adapt and grow neural connections in response to their environment (Garlick, 2002, 2003).

The neurological approach to understanding is currently in its heyday. Will this new research reduce what we now call the *g* factor to simple measures of underlying brain activity? Or are these efforts totally wrongheaded because what we call intelligence is not a single general trait but several culturally adaptive skills? The controversies surrounding the nature of intelligence are a long way from resolution.

11.2 ASSESSING INTELLIGENCE

11.2.1 The origins of intelligence testing:

In 1904, French government officials asked psychologist Alfred Binet to help them decide which students were most likely to experience difficulty in school, since they needed a way to identify and help these youngsters. (Primary school education was mandatory in France). Binet asked a colleague, Theodore Simon, to help him create a test with questions focusing on practical

matters such as attention, memory and problem solving, things the children were not taught in school. Some children were able to answer more advanced questions than their age group, and so, based on these observations, the now classical concept of mental age came into being. Their test, the Binet - Simon scale, was the first standardized IQ test.

By 1916, Stanford University psychologist Lewis Terman had taken the Binet-Simon scale and adapted it to the American public. The Binet-Simon Scale (adapted) was named the Stanford-Binet Intelligence Scale and soon became the standard intelligence test for several decades in the United States. The Stanford-Binet, as it is called, used a single number known as IQ (Intelligence Quotient) to represent an individual's score on the test.

During World War I, several tests were developed by the United States Army with an eye to screening recruits and determining eligibility for certain military jobs. The Army Alpha was a written test and the Army Beta was administered only in cases where the recruits were illiterate.

These and other IQ tests were eventually used for a less than admirable purpose, screening new immigrants as they entered the United States from Ellis Island. IQ test results were inappropriately used to make sweeping generalizations and to verify the claim of "surprisingly low intelligence" of Jewish and Southern European immigrants. These test results and outlandish claims led to a then popular proposal by the "racially motivated" psychologist H.H. Goddard and others (1920)—to enable Congress to enact restrictions in immigration. Despite the fact that the tests administered were in English only and the vast majority of the immigrants could not understand that language, the United States government deported many thousands of worthy individuals whom they unfortunately labeled as "unfit" or "undesirable." And this took place a full decade or so before the news began to trickle in from Nazi Germany about Adolph Hitler's new eugenics. This is, indeed, a sad chapter in the history of the United States of America.

In 1955, the Wechsler Adult Intelligence Scale made its debut. The WAIS, as it is called, was psychologist Robert Wechsler's first test, and the WISC (Wechsler Intelligence Scale for Children) and the Wechsler Preschool Primary Intelligence Scale of Intelligence (WPPSI) were developed later. The adult version has since gone through three revisions: WAIS-R (Revised, 1981), the WAIS-III (1997), and, in 2008, the WAIS - IV made its first appearance in the United States. Thus, psychologist started to develop psychological tests scientifically.

Measurement of intelligence is a topic that has interested psychologists since last more than 100 years. It was Alfred Binet and his team in France who developed some of the earliest tools for measuring Intelligence. Let us understand the concept of Intelligent Quotient (IQ).

Intelligent Quotient (IQ):

The concept of IQ was for the first time introduced by William Stern in 1912 and employed in 1916 Stanford Binet Scale. IQ is a ratio concept and is a classic score of intelligence obtained by dividing chronological age by mental age and multiplying by 100.

$$\text{Intelligent Quotient (IQ)} = \frac{\text{Mental Age}}{\text{Chronological Age}} \times 100$$

Originally, IQ was calculated with the formula A 10-year-old who scored as high as the average 13-year-old, for example, would have an IQ of 130 ($13/10 \times 100$). With the help of IQ, children of different chronological ages can be directly compared. IQs that are over 100 indicate that the person is more intelligent than the average.

11.2.2 Modern Tests of Mental Abilities:

There are many different ability tests developed in the world of psychology. We would discuss only some of these test such as Binet's mental ability test, Stanford - Binet test and The Wechsler test.

1. Binet's Mental Ability Test:

Alfred Binet along with his colleague Theodore Simon developed one of the first known Intelligence test, which came to be called as Binet - Simon scale. This test was revised in 1908 and 1911. Binet believed that intelligence should be measured by tasks that required reasoning and problem solving. According to Binet the slow learner child was similar to a normal child except for the fact that the mental growth of the slow child was retarded. On the test of intelligence, a slow learner would perform just like a normal child but his/her performance will be equivalent to that of a young child. He developed the concept of mental age. Alfred Binet assumed that intellectual abilities improved with age during childhood. Alfred Binet arranged the test items of his intelligence tests in order of increasing difficulty. The score obtained on Binet's Intelligence Test is equal to the number of questions answered correctly, but it is expressed in terms of the age of the child for which that score is the average. For e.g. if the child correctly answered 9 items and the average number of items answered by the children 4 years and 3 months in age was 9 then the score would be expressed as "4 years and 3 months." Binet called this score as the mental age.

2. Stanford - Binet Test:

The Stanford–Binet Intelligence Scales is an individually administered intelligence test that was revised from the original Binet-Simon Scale by Lewis M. Terman, a psychologist at Stanford University. After Binet's death in 1911 his tests were revised and used extensively in America. The most widely used revision was called as Stanford-Binet tests. One of the first Stanford Binet Scale was developed in 1916. This test was revised in 1937 1960, 1972 and 1986 and 2003. The Fifth edition of Stanford-Binet, revised in 2003, (SB5) is the most updated and revised version of the Stanford-Binet tests. The Stanford Binet Scale is one of the most widely used and scientifically well developed tests of Intelligence to measure the intelligence of school children.

3. The Wechsler Tests:

The Wechsler intelligence scales were developed by Dr. David Wechsler, a clinical psychologist with Bellevue Hospital. David Wechsler developed a series of test initially to measure adult intelligence and later on he developed tests of intelligence to measure intelligence of children and preprimary school children. His tests have been periodically revised and updated. David Wechsler felt that the Binet scales were too verbally loaded for use with adults, so he designed an instrument with sub-tests to measure both verbal and nonverbal abilities, largely borrowing from many other tests, such as the US Army Alpha test.

The first Wechsler scale, called as the Wechsler Bellevue scale was constructed in the year 1939 to measure adult intelligence. However, this scale had a number of technical difficulties, which were corrected in the 1955 scale, which has become famous as WAIS. The 1955 WAIS was revised in 1981 and is called as WAIS-R. He further revised this test which is today called as WAIS – IV. He has also developed Wechsler Intelligence Scale for Children (WISC – IV) and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI – III).

These tests differ from that of Stanford-Binet in the sense that they give three different types of IQ: Verbal Scale IQ, Performance Scale IQ and Full Scale IQ. All of the Wechsler scales are divided into six verbal and five performance subtests. The following table gives a brief overview of the different types of subtests in the WAIS test.

Sr. No.	Verbal Subtests	Performance Subtests
1	Information.	Picture Completion
2	Digit Symbol	Picture Arrangement
3	Comprehension	Block Design
4	Arithmetic	Digit Span
5	Similarities	Object Assembly
6	Vocabulary	

11.2.3 Principles of Test Construction:

Test construction is a scientific process and is concerned with development of new tests, revising existing tests and issues relating to test administration and interpretation. Development of intelligence test is a difficult process. Some important characteristics of good test construction include: Reliability, Validity, Standardization of Tests and Norms.

Reliability:

Reliability is one of the most important characteristics of a given scientific test. Reliability can be defined as the extent to which a test yields consistent results. Reliability refers to consistency of scores obtained by the same individual on the same test or equivalent forms of the test, which is administered after some period of time. It refers to the scores obtained by the same person when re-examined with the same test on different occasions or with different sets of equivalent form. In order to determine reliability we actually measure correlations between two sets of scores on the same test (also called as test retest reliability) obtained by the same individual after some period of time. If instead of the same test an equivalent form is used then the reliability is termed as equivalent or alternate form of reliability. When two examiners obtain score by administering the same test to an individual then the correlation between the scores obtained by the two examiners is called as scorer reliability or inter-rater agreement or inter-judge reliability.

Validity:

Validity is an important characteristic of intelligence test. It means the extent to which a test measures what it is supposed to measure. Validity is concerned with the following question: Does a test measure what it wants to measure and how well it measures what it wants to measure. Validity of a test is generally assessed by correlating it with some external criteria. This criterion can be obtained either along with the test score or just prior or immediately after the test score was obtained. Thus, validity of a given test is determined by correlating the scores obtained by the individual on a test as well as scores obtained on some external criteria.

Standardization of Tests:

The number of questions you answer correctly on an intelligence test would tell us almost nothing. To evaluate your performance, we need a basis for comparing it with others' performance. To enable meaningful comparisons, test-makers first give the test to a representative sample of people. When you later take the test following the same procedures, your scores can be compared with the sample's scores to determine your position relative to others. This process of defining meaningful scores relative to a pretested group is called standardization. Standardization is basically concerned with uniformity. By a standardized test we mean a test which is uniform and will remain uniform for all the conditions and subjects. Uniformity should be in the areas of administering, scoring and interpretation of a test.

Norms:

Norms are the scores from the standardization group. Norms are standards (created by the scores of a large group of individuals) used as the basis of comparison for scores on a test. Norms are developed on the basis of empirical data by using a sample (called as normative sample). Norms tell us what is a good or of poor performance. Norms help us to set standards against which we judge an individual's performance on a given test.

11.3 SUMMARY

In this unit we had defined intelligence and discussed the different concepts of intelligence. We have also studied different types of Intelligence Tests. There are three types of tests that we briefly discussed, Binet Mental Ability Test, Stanford Binet and IQ, The Wechsler Tests. Research studies have revealed that there is Individual Differences in Intelligence. Two important components of intelligence were discussed i.e. Mental Retardation and Giftedness. Some important concepts and issues related to intelligence were also discussed such as Emotional Intelligence, Nature v/s Nurture Controversy and The Bell Curve, Is intelligence one general ability or several specific abilities, origins of intelligence testing. Neurologically Measurement of Intelligence were also discussed in brief. Towards the end of this unit we have discussed some Principles of Test construction. Principles of Test construction is a scientific process. Some important topics related to Principles of test construction such as validity; reliability, standardization and norms were discussed in brief.

11.4 QUESTIONS

- a) Explain Intelligence in details.
- b) Is intelligence one general ability or several specific abilities?
- c) Discuss in detail about Intelligence and creativity.
- d) Explain emotional intelligence in detail.
- e) Discuss in detail about the origins of intelligence testing.
- f) Discuss in detail about Modern Tests of Mental Abilities.
- g) Explain different Principles of test construction.

Short Notes:

- a) Measuring Intelligence.
- b) Neurologically Measurement of Intelligence.
- c) Binet Mental Ability Test
- d) Stanford Binet Test
- e) The Wechsler Tests.

11.5 REFERENCES

1. Myers, D. G. (2013). Psychology. 10th Edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013.
- 2.. KumarVipan (2008), General Psychology, Himalaya Publishing House, Chapter 06.
3. Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology(Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.
4. Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian subcontinent adaptation). New Delhi: Dorling Kindersley (India) pvt. Ltd.



MOTIVATION AND EMOTION – I

Unit Structure :

- 12.0 Objective
- 12.1 Introduction
- 12.2 Motivation Concept
 - 12.2.1 Instincts and evolutionary psychology
 - 12.2.2 Drives and incentives
 - 12.2.3 Optimum arousal
 - 12.2.4 Hierarchy of motives
- 12.3 Hunger
 - 12.3.1 The Physiology of Hunger
 - 12.3.2 The psychology of Hunger
 - 12.3.3 Obesity and weight control;
 - 12.3.4 Close-up: Waist management
- 12.4 Summery
- 12.5 Questions
- 12.6 References

12.0 OBJECTIVES

After reading this unit you will be able to understand:

- The concept of motivation.
- Various approaches/theories related to the concept of motivation.
- How hunger motivates human beings
- Why people become obese (fat) and how to control weight

12.1 INTRODUCTION

In this unit, we will discuss about motivation. Before explaining the concept of motivation, let's ask you some questions that will help you to understand the concept of motivation.

Have you ever wondered why some people regularly go to gym or take part in Marathon even if they are senior citizens or have physical disability? In fact, such people might have been discouraged by their family members. They do not expect to receive any reward or recognition and yet take part with great

enthusiasm. Similarly, the question arises why do people observe fast or go on pilgrimage even though it causes lot of physical discomfort? Why do some people enjoy activities like hiking, playing football while others like to sit down in a corner, with a novel or watch a movie on television?

We can continue raising question “Why” for almost each and every situation in everyday life. By raising the question “why” we are trying to understand the reason or motivation behind the behavior that we observe.

Different people may have different motives for same behavior.

For example, a student may take up a course in Psychology because he likes the subject and wants to enhance his knowledge, while another may take up a course in Psychology because this may brighten his career prospects, a third student may take up a course in Psychology because his parents has insisted on it or because of peer pressure.

Different people with same motive may behave in different manner. For example, a person who is hungry may decide to have his lunch to satisfy his hunger while another person may satisfy his hunger by eating a burger or any other junk food.

The motivation issue becomes more complex with the fact that the **same person showing same behavior may have different motives at different stages of life.** For example, a lady who dislikes mathematics, may study mathematics to pass her school exam, but later on, she may study mathematics again with lot of zeal to help her child to cope up with this subject.

These examples highlight the fact that all human behavior takes place in response to some form of internal or external motives /needs or desires. It also shows that motivation is a complex issue and yet necessary to understand so that we can deal with them in much more meaningful and effective way. Now let us try to understand what is motivation.

Definition of Motivation:

The word motivation comes from a Latin word ‘movere’ which means to move or to energize. **Steers and Porter (1987)** believe that “When we discuss motivation, we are primarily concerned with (1) what energizes human behavior; (2) what directs or channels such behavior and (3) how this behavior is maintained or sustained.”

Thus, in another way motivation can be defined as an internal state or condition that activates and gives direction to our thoughts, feelings and actions, and maintains our activity till our goal is achieved.

Characteristics of Motivation:

On the basis of above mentioned definitions and explanation we can deduce following characteristics of motivation.

1. Motivation is Inferential: An important characteristic of motivation is that we cannot see it directly. We can only infer it to explain others' behavior. For example, we cannot see hunger, but if we see a person eating food hungrily, we can infer that his behavior is guided by hunger motivation.

2. Motivation Predicts Behaviour: Motivation helps us to make predictions about our own or others' behavior. If we understand the motive behind a person's present behavior, we might be in a better position to predict how that person will behave in future.

3. Motivation is goal directed behavior: Motivated individuals keep working until they reach their goal.

4. Multiple motives - People can have multiple causes for same behavior. For example, a person may take part in adventure sport due to need to risk taking motive, social motivation, escape from boredom, need to overcome fears, need for achievement, etc.

5. Motivation varies in the type and strength – People differ in the type and strength of their motives from time to time. Studies have shown that there are two types of motivation that can influence a person. Primary motives and Secondary Motives. Primary motives cater to our need for self-preservation. For example, need for hunger, thirst, warmth, avoidance of pain, etc. Secondary motives are mainly learned motives, and they differ from one person to another. In many ways, they involve a person's own sense of values and priorities in life. Secondary motivation is influenced by socio-cultural factors.

6. A person may be aware of his motives or may not be aware of his motives that guide his behavior. Usually a person may automatically respond to primary motives without being conscious of them and may be fully aware of his secondary motives and meticulously plan to achieve them.

12.2 MOTIVATIONAL CONCEPTS

The question, why people behave as they do, has intrigued psychologists for more than a century and has generated lot of research. There is no single answer. Motivation can be triggered by biological, cognitive and social factors. Mayer (2013) aptly suggested that motivation arises from the interplay between nature (the bodily “push”) and nurture (the “pull” from our thought processes and culture). However, the complexity of motivation has led different psychologists to develop various conceptual approaches or theories of motivation over the years. Many of these theories of motivation differ in the amount of emphasis they place on either biological, cognitive or social factors but most of them include some level of both (some nature, some nurture).

We will elaborate here on four most prominent theories that have received lot of attention over the years.

Theories of Motivation

12.2.1 Instincts and Evolutionary Theories:

Instincts refer to inborn patterns of behavior that are biologically determined, have a fixed pattern throughout a species, and are not learned behaviors. Early in the 20th century, psychologists were highly influenced by Charles Darwin’s evolutionary theory and sought to explain the motivation behind all kinds of behavior in terms of instincts. For example, if people criticized themselves, they explained it in terms of “self-abasement instinct”.

Instinct theory argued that people try to survive, and that any quality that increases survival will eventually become genetically based. Psychologists believed that people and animals are born with preprogrammed set of behaviors that are necessary for their survival. These instincts give them the energy that channels their behavior in appropriate direction. For example, sex can be explained as a response to an instinct for reproduction.

William McDougal (1908) viewed instincts as behavior patterns that are unlearned, uniform in expression and universal in a species. For example, within a species of bird, all the members may build identical nests and work in the same ways. This is true even for those birds of that species born and raised in captivity and isolation, and thus could not have learned the appropriate nest building behavior from other, experienced role model birds. McDougal carried it a step further by stating that humans are the same and have instincts for behaviors such as: parenting, submission, jealousy, mating, and more.

Criticism of this perspective:

1. Instead of explaining human behavior, this theory was simply naming them or labeling them in terms of instincts. For example, submissive people possess the instinct of submission. To name a behavior is not same as explaining it.
2. According to it all instincts occur impulsively and therefore people have no control over their behavior. It does not recognize the role of free will.
3. There is a circular argument. The cause (instinct) explains the behavior, but the behavior is proof for its cause.
4. There is no agreement on what, or even how many primary instincts are there. William McDougall (1908) suggested that there are 18 instincts. Other theorists came up with even more. One sociologist scanned 500 books and compiled a list of 5759 supposed to be human instincts.

12.2.2 Drives and Incentives:

After rejecting instinct theory, psychologists proposed **drive - reduction theory**. Let us first understand what is the meaning of drive.

Drive:

A Drive is an internal state of tension/ an unpleasant state that causes us /energizes behavior to do something to reduce or remove that tension. A drive is an arousal that in order to fulfill some need. For example, biological needs arising within our bodies create unpleasant states of arousal – the feelings of hunger, thirst, fatigue, etc. The moment this drive/ arousal or tension takes place, we become active to reduce it or eliminate it.

So, the physiological aim of drive reduction is homeostasis. **Homeostasis** is the body's natural tendency to maintain a steady internal state - a state of physiological equilibrium. For example, our body's temperature regulation works like a room thermostat. If our body's temperature cools, blood vessels constrict to conserve warmth, and we feel driven to put on more clothes or seek a warmer environment. On the other hand, if the body temperature increases, we start perspiring to cool the body and seek to remove extra clothing and seek cooler environment, which finally leads to the restoration of equilibrium.

Basic kinds of drives, such as hunger, thirst, sleepiness, stable body temperature, etc. are called **Primary drives**. According to drive theory, motivation is basically a process in which these primary drives **push (drive)** us to action designed to satisfy these needs. Behaviors that helps us to reduce the appropriate drive are

strengthened and tend to be repeated and those behavior that fail to bring the equilibrium /homeostasis will not be repeated when that drive occurs once again.

Criticism:

1. Drive reduction theory works well to explain the actions people take to reduce tension created by needs, but it does not explain all human motivation. For example, it does not explain why we eat even when they are not hungry?

2. It could not explain behavior in which the goal is not to reduce a drive, but rather to maintain or even to increase a particular level of arousal. For example, some people seek thrills through activities such as racing cars, etc. The question arises why would people do things like these if it does not reduce some need or restore homeostasis? In such cases the concept of homeostasis seems irrelevant.

3. Though, in its original form, drive theory focused primarily on biological needs and the drives they produce. But later on, psychologists realized that motivation may exist without a drive /arousal and therefore extended this model to cover other forms of behavior that was not clearly linked to basic needs, such as drive for stimulation, status, achievement, power, and forming stable social relationships. These are called **secondary drives**. The needs involved in secondary drives are created by prior experience and learning.

Psychologists recognized the fact that we are not only pushed by our need to reduce drive, but we are also **pulled by incentives**.

Incentives:

Incentives are positive or negative stimuli that attract or repel us. Incentives are influenced by an individual's personal experiences or learning in the past. Here we can see a move away from biological influence toward the environment and its influence on behavior. In incentive approach, behavior is explained in terms of external stimulus and its rewarding or repelling properties. The rewarding or repelling properties exist independently of any need or level of arousal and can cause people to act only upon the incentive. Thus incentive theory is actually based on the principle of learning.

For example, if in the past, a person has enjoyed the taste and aroma of freshly made coffee, then while passing outside a coffee shop, the aroma of freshly made coffee can motivate his behavior and he may get pulled (attracted/tempted) towards the coffee shop. When there is both a need and an incentive, we feel

strongly driven. For instance, if you are hungry and you get the aroma of freshly baked bread, you will feel strong hunger drive. The aroma of baking bread becomes a compelling incentive. So, for each motive, we can ask, “How is it pushed by our inborn physiological needs and pulled by incentives in the environment?” In other words, drive reduction theory accepted that our past learning and environment also plays a major role along with physical internal drives in motivating our behavior.

12.2.3 Optimum Arousal:

With more research in the area of motivation, when it became clear to psychologists that we are much more than homeostasis system and people sometimes seek to increase rather than reduce existing drives, another theory of motivation known as “arousal theory” was proposed. This theory focuses on arousal, our general level of activation. After all our biological needs are satisfied, we feel driven to experience stimulation and we hunger for information. Neuroscientists, Irving Biederman and Edward Vessel (2006) said we are “**infovores**”, after they identified brain mechanism that rewards us for gaining information. For example, toddlers explore every nook and corner of the house, children love to break their toys to investigate the mechanism inside the toys, people love to travel to new places just to explore what those places look like, etc.

Arousal levels vary throughout the day, from low levels during sleep to much higher levels when we are performing strenuous tasks or activities that we find exciting. The theory suggests that what we seek is not less or more arousal but **optimal level of arousal – the level that is best suited to our personal characteristics and to whatever activity we are currently performing**. If our stimulation and activity levels become too high, it creates stress for us and we try to reduce them. On the other hand, if the levels of stimulation and activity are too low, we feel bored and try to reduce boredom by seeking stimulation and activity. Even though the average person might require an average level of arousal to feel content, there are some people who need less arousal and some who need more. The person who needs more arousal is called a sensation seeks. Sensation seekers seem to need more complex and varied sensory experiences than do other people.

12.2.4 Maslow’s Need Hierarchy:

Abraham Maslow proposed that human beings are driven by different factors/needs at different times. When a single need is fulfilled humans seek to satisfy the next need, and so forth. Maslow introduced his theory based on personal judgment and his theory is generally known as the need hierarchy theory. He believed that if people grow up in an environment in which their needs are not met,

they will be unlikely to function as healthy individuals or well-adjusted individuals.

Maslow believed that all needs vary in priority. Some needs have to be satisfied first while the satisfaction of other needs can be delayed. He described these priorities as a hierarchy of needs and arranged them in a pyramidal form to indicate which needs have more priority. The journey of satisfying these needs before graduating to other needs starts from the bottom of the pyramid.

Originally Maslow's (1943,1954) hierarchy of needs pyramid had only five needs – up to self-actualization, but later on it was expanded to include cognitive and aesthetic needs (Maslow, 1970a) and later transcendence needs (Maslow, 1970b). Maslow explained that throughout our life we are dominated by some need or the other. There is not a single moment in our daily life when we are not dominated by some need or the other. Now let us see what these needs are.

1. **Physiological Needs** - These needs include the need for food, water, rest, air, temperature regulation, etc. If these needs are not met, the organism can't survive. Thus, these are the most basic and most important needs. Maslow classified these needs as part of deficiency needs. If these needs are not satisfied, the human body cannot function properly and will ultimately fail. Therefore, once any of these needs is aroused it demands immediate gratification without any delay and a person cannot think of anything else unless and until that particular need is satisfied.

2. **Safety Need**—Once the physiological needs are satisfied, then we get concerned about our safety. These needs refer more to the long-term survival than day to day needs. In other words, we are faced with the question that just as today we have been able to satisfy our physiological needs and survived peacefully, can we survive in future also.

a. People want physical safety – freedom from threat of war, natural disaster, family violence, childhood abuse. They want order and do not want to live in a world that is not filled with chaos and danger.

b. People want economic safety - For example, all saving schemes, insurance schemes work on the basis of this need only. We choose jobs where we can have job security; we try to improve our qualifications today to ensure that our future is not endangered. We fix safety doors, grills, and cc cameras in our homes, offices to satisfy this need only. People seek out grievance procedures for protecting themselves from unilateral authority and arbitrary decisions.

3. **Belongingness and love** –Once our safety need is satisfied, then we pay attention to other people in our surroundings. People seek out love and affection from family members, friends, and lovers. People long to get into steady long term relationships. It is the need to be loved and to love, to belong and be accepted; need to avoid loneliness and separation.

4. **Esteem** - Once individuals' physical, safety and belongingness needs are satisfied, they look at ways to satisfy their need for developing positive feelings of self-worth and self-esteem, and act to foster pride in their work and in themselves as people. At this level, people are concerned with achievements, mastery, independence, status, dominance, prestige, responsibilities, etc. both at work place as well as in their social circle.

5. **Cognitive** - Needs at this level are based on acquiring knowledge and understanding of the world, people, behavior, etc. If you are in college to learn (not simply to get a degree) then you are attempting to fulfill your cognitive needs. This need also includes curiosity, exploration, need for meaning and predictability. This need is typical of an academician who learns for the sake of gathering knowledge.

6. **Aesthetic** - Aesthetic need includes appreciation and search for beauty, balance and order in life. Humans need beautiful imagery or something new and aesthetically pleasing to continue up towards Self-Actualization. Aesthetics refers to the quality of being creatively, beautifully, or artistically pleasing; aesthetic needs are the needs to express oneself in pleasing ways. Decorating your living room, wrapping birthday presents attractively, washing and waxing your car, and keeping up with the latest styles in clothing are all ways of expressing your aesthetic sense. This need is typical of artistic people.

7. **Self-actualization** - The growth of self-actualization refers to the need for personal growth and discovery that is present throughout a person's life. In self-actualization, a person comes to find a meaning to life that is important to them. As each individual is unique the motivation for self-actualization is satisfied in different ways by different people. For example, people can achieve self-actualization through creating works of art or literature, through sport, in the classroom, or within a corporate setting. This is the highest and most difficult level to reach. In fact, according to Maslow, very few people actually reach this level. Self-actualization is the need to fulfill one's own potential, capacities and talents. As Maslow stated, "What a man can be, he must be."

According to Maslow self-actualizing persons have some common characteristics such as they are - able to look at life

objectively, problem-centered (not self-centered). They are independent and nonconformist. They are democratic, fair and non-discriminating, concerned for the welfare of humanity, accept themselves and others as they are and do not try to change people. They have deep appreciation of basic life-experiences, establish deep satisfying interpersonal relationships with a few close intimate friends rather than many surface relationships. They have unusual sense of humour directed at oneself or the human conditions in general. They are spontaneous, creative, inventive and original, excited and interested in everything, and have strong moral values.

8. Transcendence Needs: Maslow later divided the top of the triangle to add self-transcendence which is also sometimes referred to as spiritual needs. Spiritual Needs are a little different from other needs, accessible from many levels. This need when fulfilled, leads to **feelings of integrity** and take things to another level of being. Transcendence involves helping others to achieve their full potential.

Criticism of the theory:

1. There is little scientific support for this theory. Maslow developed this theory based on his personal observations rather than on any empirical research.
2. There have been many anecdotal evidences indicating that lower needs need not be satisfied before moving over to higher needs. For example, while preparing for an upcoming exam, a student may not eat / sleep a day before exam.
3. Maslow's theory is based on his study of Americans. Cross-cultural research shows that the order of needs in the hierarchy does not always hold true in other cultures.

Check your Progress:

1. Define motivation. What are the characteristics of motivation.
2. Elaborate on any two motivational concepts
3. Write short notes on Instinct theory and Optimal arousal theory of motivation.
4. Write a detailed note on Drives and incentives.
5. Explain the theory of Motivation which is purely based on biological approach.
6. Discuss in detail Maslow's hierarchy of needs.

12.3 HUNGER

Introduction: Hunger as a Motive

Hunger motivation – an urge to eat food is one of the most powerful biological motivation. The power of hunger motivation was very aptly demonstrated by Aneel Keys et.al. (1950) in their experiment. In their experiment, 36 male volunteers went through semi starvation and researchers studied their behavior. Semi-starvation had physical and psychological impact on these men. Without thinking about it, they began conserving their energy; appeared listless and apathetic. They became food obsessed. They talked, day dreamed about food, collected recipes, read cookbooks, and stared at forbidden food. In other words, unsatisfied hunger motivation hijacked their consciousness.

Hunger motivation and eating habits of people today have become a major concern and has been extensively studied. The question arises why do we feel hungry? Research has shown that hunger is a much more complex phenomenon and there are various aspects to it.

12.3.1 Physiological Components of Hunger:

Generally, we know that hunger takes place due to empty stomach. But this is not the only cause. There are other causes also that activate hunger.

a) **Hunger Pangs/ Stomach Contraction:** In an earlier experiment, Canon(1912) believed that the source of the hunger motivation was hunger pangs or stomach contractions. When the stomach is empty, contractions occur and are sensed and they are the signals for feelings of hunger. Canon believed that the presence of food in the stomach would stop the contractions and appease the hunger drive. But it was found that in many cases, empty stomach is not the only deciding factor. Recent research studied showed that people reported feeling hungry and ate food even after their stomach was removed.

b) **Body Chemistry and the Brain:** Human beings and other animals automatically regulate their caloric intake to prevent energy deficits and to maintain a stable body weight. Body does this automatic regulation of calories intake through '**Glucose**' or '**Blood sugar**'. Pancreas in our body produce hormones called **insulin and glucagon** that control the levels of fats, proteins and carbohydrates in the whole body, including blood sugar. Insulin reduces the level of glucose in the blood stream while glucagons increase the level blood glucose levels. When glucose drops below a certain level, our brain triggers the feeling of hunger and people eat. When the glucose level in the blood exceeds a certain point,

they feel satiated and stop eating. If your blood glucose level drops, you may not consciously feel this change. But your brain, which is automatically monitoring your body's internal state, will trigger hunger. This is the reason why dieticians ask a person to take low-carbohydrate diet. Low carbohydrate will control the insulin reaction and prevent hunger cravings.

c) **Hypothalamus:** Brain receives the messages from stomach, intestine and liver about glucose level in body and accordingly triggers hunger. However, stomach and pancreas are not the only factors influencing our hunger. The hypothalamus in our brain also plays a significant role in controlling the hunger. The hypothalamus has two parts that control our eating behavior. These two parts are–

1. **The Ventromedial Hypothalamus (VMH)**
2. **The Lateral Hypothalamus (LH).**

1. **The ventromedial hypothalamus (VMH)** is involved in stopping the eating response **when glucose levels in the blood go up**. For example, in one experiment, rats whose VMH areas were damaged could not stop eating. They kept eating until they were quite overweight (looked almost like a football).

2. **The Lateral Hypothalamus (LH)** influences the onset of eating behavior when **insulin levels go up in the blood**. If this area of hypothalamus is damaged, rats stop eating to the point of starvation. They would eat only when they are force fed. Blood vessels connect the hypothalamus to the rest of the body, so it can respond to our current blood chemistry and other incoming information. One of its task is to monitor the levels of appetite hormone such as ghrelin, a hunger arousing hormone secreted by an empty stomach. During bypass surgery for severe obesity, doctors seal off part of the stomach. The remaining stomach then produces less ghrelin, and the person's appetite lessens. Other appetite hormones are leptin, PYY and orexin. Orexin triggers hunger while the other two reduce hunger.

Weight Set Point and Basal Metabolic Rate:

Hypothalamus affects the particular level of weight that the body tries to maintain. This is called weight set point. When semi starved rats fall below their normal weight, the weight thermostat (that is complex interaction between appetite hormones and brain activity) signals the body to restore the lost weight. Hunger increases and energy expenditure decreases. If body weight rises, as it happened when rats were force fed, hunger decreases and energy expenditure increases. This stable weight toward which semi starved and overstuffed rats return is their weight set point.

Metabolism – the rate at which the body burns available energy for maintaining basic body functions when the body is at rest. When

people don't get enough food for a long time, to maintain their set point, they reduce their energy expenditure, partly through inactivity and partly by dropping basal metabolic rate. Metabolism and exercise also play a part in the weight set point.

Some researchers, however, doubt that our bodies have a preset tendency to maintain optimum weight. They point out that slow, sustained changes in body weight can change one's set point and that psychological factors also influence our feeling of hunger. With unlimited access to a wide variety of food, people as well as animals, tend to overeat and gain weight. Therefore, researchers have given up on the idea of biologically fixed set point and now they prefer the term settling point. Settling point indicates the level at which a person's weight settles down in response to caloric intake and expenditure, which is influenced by biology and environment both.

The rate at which the body burns energy when a person is resting is called the basal metabolic rate (BMR) and is directly tied to the set point. If a person's BMR decreases, that person's weight set point increases. The BMR decreases more dramatically as the age of the person increases. Adolescents can eat far more than an adult of the same size and not gain weight. In adulthood, the BMR begins to decline. If the eating habits of the teenage years are maintained, adult will gain excessive weight in no time.

12.3.2. The Psychology of Hunger:

The question arises is hunger controlled and regulated by biological factors only or whether psychological, cultural and situational factors can also influence the feeling of hunger and eating behavior? The answer is, along with biological factors, all these factors mentioned above also play a very significant role in driving and regulating the feeling of hunger.

A) Eating is a learned Behavior:

People often eat even when they are not hungry. Many of them eat breakfast, lunch and dinner at certain times just because it is the convention, that is, it is lunch/dinner time. A large part of this convention is result of our classical conditioning. The body becomes conditioned to respond with the hunger reflex at certain times of the day, through association with the act of eating at those times of the day. For example, a person who has just had late breakfast will still feel hungry at noon, simply because the clock says it's time to eat.

B) Memory:

Cognitive factors too play a part in eating behavior. For example, Rozin et.al.(1998) conducted an experiment to show that apart from internal cues from our bodies, memories about when

we last ate can influence whether we decide to eat and how much we eat at a given time. For their experiment, they tested two patients with amnesia, who could not remember recent events - events occurring more than a minute ago. Both patients were offered lunch at lunch time and after 20 minutes they were again offered lunch, which they readily consumed. 20 minutes after their second lunch they were again offered lunch, a third time. One of them ate part of the third meal also. They were asked to rate their hunger before and after the meal. Both of them had rated their hunger less after having first meal than before it. Yet, in spite of not being hungry, they went ahead and had second meal and partly the third meal also because they could not remember that they had just eaten.

C) Taste Preference:

Very often, you must have noticed that a person enjoying dinner at a wedding party comments that he has over eaten and now he cannot consume another morsel, but while passing in front of dessert counter he gets tempted by the sight of his favorite ice-cream and gulps down a large helping of that ice-cream. The reason is that biological and cultural factors play a significant role in our taste preference.

Biological Factors: It has been observed that people crave to have starchy, high in carbohydrate food especially when they are tense or depressed. Carbohydrates help boost levels of the neurotransmitter serotonin, which has calming effects on our nerves. Though preferences for sweet and salty taste are genetic and universal but other taste preferences are conditioned. If people are given highly salted food from childhood, they develop a liking for excess salt. Same is true for spicy food. People who become sick due to food (food poisoning) develop an aversion to it and avoid to eat that food in the future that caused them food poisoning.

Culture also affects the taste preference: Indian children are used to eating spicy food and like it that way while European kids are used to bland non-spicy food and can't tolerate even the smell of spicy curries from the neighborhood.

Taste preferences are adaptive. For example, the spices are used in hot climate countries, especially in non-vegetarian dishes because meat spoils quickly in hot climate and spices inhibit the growth of bacteria. Pregnancy related nausea and food aversions peak during the 10th week of pregnancy because the developing embryo is most vulnerable to toxins at that time.

Both human beings and animals avoid unfamiliar food, especially animal based foods. Sociobiology explains that this dislike of things unfamiliar was adoptive for our ancestors. It

protected them from potentially harmful/toxic substances. So, there is biological wisdom to our taste preference. Cultural trends can also influence the human genetics that affect their diet and taste. For example, where milk is available in abundance, survival patterns have favored people with lactose tolerance.

D) Situational and Cultural Factors Influence Eating Behavior:

People eat more when they eat with others. This is the reason why after participating in celebrations, we realize that we have over eaten.

Cultural factors also play a major role in determining what, when, and how much we eat. Andrew Geier et.al. (2006) conducted a research to show cultural influence on eating habits. They observed that French people offer foods in smaller portion sizes. That is why they are much slimmer than Americans. Their research found that when people are offered large size portions, they consume that entire large size portion and gain more calories. They called this **unit bias**.

Food Variety: We tend to eat more when there is more variety of food to choose from. From biological point of view, this tendency makes sense. When food is available in plenty and in variety, eating all types of food provides vitamins and minerals and produce fat that used to protect our ancestors in winter or famine when food was not available. But, now when food is available in abundance, if a person wants to control his waistline, he needs to follow certain rules as follows –

- Before eating with others, they should decide how much they wish to eat
- Make sure to take small size portions of the food
- Not to go for second helpings.
- Food should be served with smaller bowls, plates and utensils.
- Variety should be limited and
- Appealing food should be kept out of sight.

Check your Progress

1. Define hunger. What are the physiological causes of hunger?
2. Define hunger. What are the psychological causes of hunger?
3. Write short notes on the following:
 - a) Role of Hunger Pangs and Blood Glucose in regulating hunger
 - b) Role of Hypothalamus in regulating hunger
 - c) Weight Set Points
 - d) Hunger influenced by classical conditioning and memory
 - e) Taste Preference and Eating Behavior
 - f) Food Variety and situational factors influencing eating behavior
 - g) Cultural influence and gender differences in eating behavior

12.3.3 Obesity and Weight Control:

Being overweight and obesity is a growing problem all over the world and it has taken the shape of an epidemic. In a survey conducted in 2007 by World Health Organization, it was estimated that worldwide more than one billion people are overweight and out of that three million are obese - that is they had body mass index of 30 or more.

The question arises why being overweight is alarming for us? If we look back at folk wisdom, in earlier centuries, being thin was considered bad and unattractive while people used to find heavier bodies attractive. Obesity was a symbol of affluence and social status. It was believed that our bodies store fat for good reasons. Fat is an ideal form of stored energy – a high calorie fuel reserved to carry the body through periods when food is scarce. Scarcity of food was a common occurrence in our prehistoric ancestor's time. So the convention was to consume when they found energy rich fat or sugar. However, in present times, in most parts of the world food is available in abundance and this convention has now become dysfunctional.

A) Impact of being overweight or obese:

a) Biological: Being overweight has become a health hazard. Studies have shown that obesity increases the risk of diabetes, high blood pressure, heart disease, gallstones, arthritis and certain types of cancer and shortens life expectancy.

b) Cognitive: Recent research has linked women's obesity to their risk of deteriorating cognitive abilities, including Alzheimer's disease and loss of brain tissues, in late life. Gunstad et.al. (2011) found in their experiment that memory performance improved for severely obese people, 12 weeks after they went through weight loss surgery and lost significant weight.

c) Social: Obesity can be socially toxic. It affects the way you are treated by others and how you feel about yourself. The stereotype of obese people is that they are lazy, slow, undisciplined, less sincere, less friendly, meaner and extremely unpleasant.

Gortmaker et.al. (1993) conducted a longitudinal study on 370 obese women and found that even after 7 years two third of them were still obese and were earning less money than an equally intelligent group of non-obese women and they were less likely to get married. Similarly, Regina Pingitore et.al. (1994) studied the impact of discrimination based on weight. They found that when the same person appeared as overweight applicant he/she was considered as less worthy of hiring than when he/she appeared as normal weight person. Weight bias was especially strong against women.

Weight discrimination is worse than race and gender discrimination. It occurs at every stage of employment. Overweight people (especially women) have less chance of getting hired and promoted, they are paid less and chances of their getting punished for indiscipline and getting sacked from the job are much higher. The prejudice against weight appears early in life. Children show contempt and disdain towards fat children and even towards normal weight friends of fat children. Obese children are bullied more.

d) Psychological Well-Being: Obesity is linked to lower psychological well-being, especially among women. Obese women are more likely to suffer depression, body dissatisfaction and low self-esteem.

B) The Causes of Obesity:

1) Biological Factors:

- I. Set Point and Metabolism:** People become fat because they consume more calories than they expend and to reduce weight they go on diet. That means they reduce their food/ calorie intake. In most of the cases dieting does not help. Why? This is because once we become fat, we require less food to maintain our weight than we did to attain it. Fat has a lower metabolic rate than does muscles. That means fat takes less food energy to maintain itself. So when an overweight person's body drops below its previous set point/settling point, the person's hunger increases and metabolism slows down. The body adapts to starvation by burning off fewer calories. Bray (1969) reported that in a month-long experiment, obese patients' daily food intake was reduced from 3500 calories to 450 calories but they lost only 6% of their weight. The reason was that their metabolic rate dropped by 15% only as a result of starvation.
- II. Physical Activity:** In another experiment, Levine et.al. (1999) overfed volunteers an extra 1000 calories a day for 8 weeks. They found that those who tended to spend their extra calorie energy by fidgeting more, gained least weight. Lean/slim people have a natural tendency to move around much more rather than sitting at one place for long time.
- III. The Genetic Factors:** Studies have shown that genes influence body weight. For example, it was found that –
 - i.** In a family, if two children are adopted, then in spite of sharing same family meals, their body weights are not similar to each other and are not similar to their adoptive parents also. Their body weights are similar to their biological parents' body weight.

- ii. Another study reported that identical twins have closely similar weights even when they are reared apart.
 - iii. It was also found that if parents are obese then the chances of a boy being obese are 3 times more and the chances of girl being obese are 6 times more, compare to children of normal weight parents.
 - iv. Scientists have identified many different genes that influence body weight. For instance, a variant of a gene called FTO nearly doubles the risk of becoming obese.
- IV. Hormonal Factors:** Scientists now believe that a hormone called leptin plays a key role in appetite control. Leptin is a protein that is secreted as a hormone by the fatty tissues of the body. Leptin enters the bloodstream from the fat cells, traveling to the hypothalamus in the brain and causes the hypothalamus to signal the body to either stop eating or to eat more. When enough food is consumed, high levels of leptin are produced that cause the appetite to decrease. A low level of leptin signals a condition of starvation and increases the urge to eat. Scientists conducted experiments on obese rats by giving them a high dosage of leptin and expected it to decrease the appetite and result in weight loss for the mice. However, it was found that certain obese mice initially responded to leptin as it was expected but later on did not lose weight when leptin levels were increased. They developed a resistance to leptin, suggesting that their bodies can respond only to certain levels of leptin, and when the level goes too high, the body stops responding, allowing appetite to remain out of control. The studies are suggesting that once we have gained a significant amount of weight, our sensitivity to leptin actually decreases.

2) Environmental Factors:

I. Sleep Loss: Studies in Europe, Japan and the United States indicate that those who suffer from sleep loss tend to be obese because with sleep deprivation, the levels of leptin (which reports body fat to the brain) fall, and ghrelin (the appetite-stimulating stomach hormone) rises.

II. Social Influence: Social influence is another important factor in gaining weight. A longitudinal study conducted over 32 years found that people are most likely to be obese when a friend becomes obese. If the obese friend happens to be a close one, the chances of your also becoming obese increase by three times.

III. The Food and Activity Factor: People from developed as well as developing countries are getting heavier and obesity has reached an alarming proportion. One of the most important reason

for this phenomenon is our changing food consumption habits and activity levels. We are eating more and moving less. Increasingly, jobs requiring physical activity are declining and technology is enabling us to do everything at the click of the button (remote control). We have put fast food on every corner, junk food in our schools, we have got rid of physical education classes, we put chocolates and soft drinks at the payment counters in malls and every other shop. Junk food is available on every road and street, in every nook and corner.

C) Weight Control:

With set point, metabolism and genetic and environmental factors always working in favor of obesity, it is not easy to lose weight permanently. Many people lose weight successfully but it all comes back with vengeance the moment they are not vigilant.

Psychologists believe that obesity is neither the result of any personality maladjustment, nor it is due to lack of will power. In fact, continuously trying to be thin puts people at the risk of binge eating, food obsession, weight fluctuations, malnutrition, smoking, depression, and harmful side effects of weight loss drugs. It is better to accept oneself as a bit heavy than to diet and binge and feel continually out of control and guilty.

12.3.4 Close Up: Waist Management:

Researchers have offered some tips for managing your waist line.

1. Managing waist line requires being self- motivated and self-disciplined. Permanent weight loss requires a lifelong change in eating habits and increased exercise.
2. Minimize exposure to tempting food cues - keep tempting food out of the house. Go for buying food items only when you have eaten and your stomach is full. Avoid the counters where sweets and chips or other fried items are kept.
3. Eat simple meals. If there is more variety, people consume more.
4. Exercise empties fat cells, builds muscles, speeds up metabolism and helps lower your settling point, especially when supported by 7 to 8 hours of sleep a night.
5. Eat healthy food – Whole grain, fruits, vegetables and healthy fats such as those found in olive oil and fish help regulate appetite and artery clogging cholesterol.
6. Don't starve all day and eat one big meal at night - It slows down metabolism. Those who eat a balanced breakfast are by late morning more alert and less fatigued.
7. Eat slowly that will lead to eating less. Don't consciously restrain your eating, drinking alcohol, and don't feel anxious or depressed about being overweight. This can trigger the urge to eat.

8. Keep monitoring your eating, especially when you are eating with your friends. One tends to eat more with friends. Once a diet is broken, a person has a tendency to binge eat. So, make sure a lapse should not become full collapse.
9. Connect to a support group- Join with others, either face to face or online, with whom you can share your goals and progress.
10. Don't sit with any kind of food or drink while watching television or a movie. Consciously unlearn that behavior.

Check Your Progress:

1. Define Obesity. What is the impact of obesity and how waist management can be done?
2. What are the causes of obesity.
3. Write a short note on waist management.

12.4 SUMMARY

You would recall that we have touched upon the three learning items in this unit- Motivational, Hunger and Obesity.

In motivation, we have dwelled into definition and characteristics of motivation, four theories of motivation- instinct and evolutionary theory, drive-incentive theory, optimum arousal theory and Maslow's hierarchy of needs.

In hunger motivation, we have looked at physiological causes such as hunger pangs, body chemistry and role of hypothalamus, weight set point and metabolic rate. In psychology of hunger we have discussed that eating is a learned behavior. Apart from that memory, taste preference, situational and cultural factors also influence eating behavior. In obesity, we looked at what is obesity, why it is important to study obesity and what causes it and in waist management we pondered over how we can reduce and manage our weight. It is important to study obesity due to biological, cognitive, social, and psychological issues. It is caused due to biological and environmental reasons and tips to control it.

12.5 QUESTIONS

1. Write short notes on
 - a.) Instinct theory of motivation
 - b.) Drive and Incentive theory
 - c.) Motivation and optimal arousal theory of motivation
 - d.) Physiological causes of hunger
 - e.) Psychological causes of hunger
 - f.) Waist management

2. Discuss in detail Maslow's hierarchy of needs.
3. Discuss in detail physiological and psychological causes of hunger.
4. Elaborate on what are the causes of obesity and how can you manage weight?

12.6 REFERENCES

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



MOTIVATION AND EMOTION-II

Unit Structure :

- 13.0 Objectives
- 13.1 The Need to Belong: Introduction
- 13.2 Cognition & Emotions
- 13.3 Embodied Emotions: The Physiology of Emotions
- 13.4 Summary
- 13.5 Questions
- 13.6 References

13.0 OBJECTIVES

After reading this unit, you will be able to understand –

- The concept of Need to Belong and its usefulness for human beings
- The concept of ostracism and why it is a painful experience
- The concept of social networking, its social effects and how to maintain balance between real world and virtual world.
- Historical theories of emotion and what is the connection between cognition and emotions
- The physiology of emotions
- How to detect emotions expressed by others
- The causes and consequences of anger
- The causes and consequences of happiness
- The techniques of being happier

13.1 THE NEED TO BELONG: INTRODUCTION

Aristotle wrote that all human beings are social animals. Even if people have all resources and amenities to live life comfortably, but no social contact with other human beings, they will choose not to live. They will prefer to live with others, even if it means to live with limited resources. We all have a need to affiliate with others, even to become strongly attached to certain others in long lasting close relationships. Alfred Adler called it an “urge to community”. The question arises why do we have such strong desire to affiliate with others. Psychologists believe that need to belong is beneficial for human beings.

13.1.1 Aiding in Survival:

Evolutionary psychologists explained that social bonds increased the survival rate of our ancestors who were living in forests and caves. Survival was enhanced by cooperation. In solo combat, our ancestors could not fight back other animals who were much stronger than them. Similarly, to get food by hunting, fishing or by just collecting from plants, our ancestors realized that it is better to hunt in team and share the spoils rather than try to hunt individually. Travelling in group gave every one of them protection from predators and enemies.

Psychologists believe that all human beings have a strong instinct to propagate their genes in next generation. As adults, those who formed attachments were more likely to reproduce (have children) and to co-nurture their offspring to maturity. By keeping children close to their caregivers, attachments served as a powerful survival impulse. Those who felt a need to belong survived and reproduced more successfully. So being social is there in our genes.

Good Health: Studies have shown that people who feel supported by close relationships are the ones who live longer with better health and at a lower risk of psychological disorder than those who do not have social support, e.g. It was observed that married people are less at risk for depression, suicide and early death. Social isolation puts us at the risk of declining mental and physical health.

13.1.2 Wanting to Belong:

Most people report close, satisfying relationships with family, friends, or romantic partners is the first and foremost requirement for their happiness and meaning in life. (Berscheid, 1985) Studies show that money does not make a person happy, rich and satisfying close relationship do. A person may be very rich and yet unhappy and lonely. When our need to belong is satisfied in balance with psychological needs of autonomy (having a sense of personal control) and competence, we experience a deep sense of well-being. (Deci & Ryan (2002). When we feel included, accepted and loved by those who are important to us, our self-esteem goes up. Therefore, most of our actions are aimed at increasing our social acceptance. To avoid rejection, we generally **conform to** group norms and try to make favorable impressions.

The need to belong influences our need to define who we are. We express our identity in terms of faithful relationships and loving families. We proudly say that I belong to so and so family. However, our need to define who we are can be expressed in negative way also. For example, we may become part of teen gangs, we may become part of ethnic rivalries (our identity as Hindu, Muslim, or Sikh, etc.) and fanatic nationalism.

13.1.3 Sustaining Relationships:

It is well known that generally familiarity produces liking. Think of it. In a new class or conducted vacation trips, initially, we are indifferent to other students/participants, who are total strangers for us, but by the end of the course/ vacation trip, parting ways and breaking social bonds becomes a distressing experience and we promise to keep in touch with each other. These friendships with at least some of them becomes lifelong.

Our strong desire to maintain relationships with others, no matter how bad or abusive, are due to our fear of being alone. Studies on abusive relationships have shown that people prefer to stay in abusive relationships and suffer emotional and physical abuse rather than face the pain of being alone. People suffer emotional trauma even when bad relationship breaks down. After separations, people have feelings of loneliness and anger. Sometime they have strange desire to be near the former partner even if the relationship with former partner was not good.

Children who move through a series of foster homes or through repeated family relocations, with repeated disruptions of budding attachments, may have difficulty in forming deep attachments in later life. (Oishi & Shimmack, 2011). It has been observed that children reared in institutions have no sense of belonging to anyone, or children locked away at home under extreme neglect become pathetic beings – withdrawn, frightened and speechless.

Life's best moments occur when close relationships begin, e.g., when new friendship develops, we fall in love or when a new baby is born in the family. The worst moments of life take place when close relationship comes to an end. When some situation threatens, or dissolves our social ties, we experience extreme anxiety, loneliness, jealousy or guilt. When a person loses a life partner, he or she feels that life has become empty and meaningless. For immigrants and refugees moving alone to new places, the stress and loneliness can lead to depression for them. But if the feeling of acceptance and connection increases, then our self-esteem, positive feelings and desire to help others instead of hurting others also increases.

13.1.4 The Pain of Ostracism:

This social exclusion is called ostracism. For centuries together, humans have controlled social behavior by using the punishing effect of severe ostracism. In extreme form, it can be in the form of exile, imprisonment or solitary confinement. In milder form, it can be being excluded, ignored or shunned by your friends, being given a silent treatment by not talking to you, by avoiding you or averting his/her eyes in your presence or even making fun of you

behind your back. Williams & Zadro (2001) stated that being shunned – given the cold shoulder or the silent treatment, with others' eyes avoiding yours- threatens one's need to belong. This is the meanest thing you can do to someone, especially when you know that the other person can't fight back. Even just being linguistic outsider among people speaking a different language that you can't speak or understand must have made you feel excluded.

People often respond to social ostracism with depressed moods. In the beginning, they try to restore their acceptance and if they don't succeed, they go into withdrawal. People lose their self-esteem and their weight drops. Experiencing cyber-ostracism is equal to experiencing real pain. Ostracism (in the form of being ignored in a chat room or email going unanswered) even by strangers or by a despised out group takes its toll on the victim. It activates the same area of brain that is activated in response to physical pain. (Williams et.al.,2006).

When people experience rejection, and cannot rectify the situation they seek new friends or gain stress relief by strengthening their religious faith. They may turn nasty, may indulge in self- defeating behaviors, may underperform on given tasks, may not empathize with others and are more likely to behave aggressively, especially towards those who had excluded them.

13.1.5 Social networking:

Since social relationships are essential for leading a healthy life, it is but natural for us to see how the progress of communication technology has significantly impacted satisfaction of our need to have social contacts. Technology has changed the way we connect with others and communicate. Texting, e-chatting and e-mailing has replaced phone talking. With social networking being pervasive in all aspects of our life it is important for us to see how it impacts us.

The Social Effects of Social Networking:

As electronic communication becomes part of new normal, researchers are exploring how these changes affect our relationships. The question asked by psychologists is “**Are Social Networking Sites Making Us More Or Less Socially Isolated?**” Research has reported that when online communication in chat rooms and during social games was mostly between strangers in the internet's early years, adolescents and adults who spent more time online spent less time with friends, and their offline relationships in real world suffered.

Bonetti et.al. (2010) reported that lonely people tend to spend greater than average time online. Social networkers are less likely to know their real-world neighbors, and compared to non-

internet users, are 64% less likely to rely on neighbors for help either for themselves or for their family members.

However, social networking has its own **advantages** also. The internet is diversifying our social networks. It is possible to connect with likeminded people having similar interest from all over the world. Geographical boundaries are broken. To a large extent, social taboos are also broken. Despite the decrease in neighborliness, social networking is mostly strengthening our connections with people we already know. For example, we form groups on Facebook and WhatsApp. If Facebook page helps you to connect with friends, stay in touch with extended family, or find support in facing challenges, then you are not alone.

Another phenomenon noticed on social networking sites is that people disclose personal information to perfect strangers or for the whole world to see that in normal circumstances they will not like to disclose in real life. This observation brought another important question to psychologists – **Does Electronic Communication Stimulate Healthy Self-Disclosure?**

Mental health experts point out that confiding in others can be a healthy way of coping with day to day challenges. Very often we find that people pour out their woes on social networking site. For example, it was reported in TOI, dated 16th May 2017, that a film producer of Marathi films posted his suicide note on Facebook before committing suicide. This is not isolated news. Before that also, media has reported many such incidents. The question arises why people disclose their distress on social networking sites rather than talking to somebody in their vicinity. There can be many reasons for it such as:

1. People may not have any close friends to whom they can communicate face to face about their problems.
2. While disclosing our distress face to face, we are not sure how the other person is going to react. We are vulnerable and self-conscious. It makes us feel weak and hits our self-esteem. On the other hand, while communicating electronically rather than face-to-face, we often are less focused on others' reactions, feel less self-conscious and thus feel less inhibited. We become more willing to share our joys, worries and vulnerabilities. Sometimes, this disinhibition can take an extreme form. For example, people indulge in sexting, teens send nude photos of themselves to their internet friends, youth are "cyber-bullied" or trolling takes place, hate groups post messages promoting bigotry or crimes.

3. Self-disclosure can also help to deepen friendships. Even if our friendship with internet friends gets stronger, we crave to meet them face to face. This is because nature has designed us for face to face communication, which appears to be better predictor of life satisfaction. Texting and e-mailing are rewarding but having face to face conversation with friends and family is more enjoyable.

There are all sorts of people in virtual world just as they are in real world. Some people are honest, loving good human beings and some are cheats, criminals/ predators. Psychologists wondered whether people reveal their true selves on internet. So the next question is –**Do Social Networking Profiles and Posts Reflect People’s Actual Personalities?**

Beck et.al. (2010) found that ratings based on Facebook profiles were much closer to the participants’ actual personalities than to their ideal personalities. This indicated that generally social networks reveal people’s real personalities. In another study, it was found that people who seemed most likable on their Facebook page also seemed most likable in face to face meetings also. This also indicates that Facebook profile reflects real personality of the person.

It has been observed that most of the people using social networking sites are mainly talking about themselves. It is always about me, my life, my family, my thoughts, my experiences etc. So, another question that intrigued psychologists was - **Does Social Networking Promote Narcissism?**

Narcissistic people are self – focused, self- promoting and have an unusual sense of self – importance. They like to be the center of attention. Such people on Facebook compare the number of friends they have, the number of likes they get from others, compared to their other friends. They are very active on social media. Just to feel the pleasure of having maximum number of friends, they collect more superficial friends. They post more staged, glamorous photos of themselves just to get more likes. Anyone who visits their Facebook page can judge that they are narcissists. So, social media is not just a platform for all narcissists to gather there, but it also satisfies their narcissistic tendencies

Maintaining Balance and Focus:

The question arises how to maintain balance between our real world and the virtual world. Some of the suggestions offered by experts are as follows:

1. **Monitor your time:** Keep a diary and see whether the way you use your time reflects your priorities. Check whether the time

spent on internet is interfering with your academic and work performance and whether it is eating your time with friends and family.

2. **Monitor your Feelings:** Check how you feel when you are not online. If you feel anxious and restless, if you keep thinking about social networking sites all the time even when you are in class or at work, then you are getting addicted to social networking sites and you need help.
3. **“Hide” your more distracting online friends:** Before posting anything on your social networking sites, ask yourself, is it something that I would like to read if somebody else had posted it?
4. **Try turning off your handheld devices(mobiles) or leaving them elsewhere:** Cognitive psychologists point out that we cannot pay full attention to two things at a time. When you do two things at once, you don't do either of them as well as when you do them one at a time. So while studying, resist the temptation to check your social networking sites like WhatsApp / Facebook. Disable sound alerts and pop-ups.
5. **Try going on Internet “Fast”:** That means decide to go off internet for five hours/ten hours or one day.
6. **Recharge your focus with a natural walk:** Research has shown that walking in a quiet garden or in a forest recharges people's capacity for focused attention rather than walking in a busy street.

Check your Progress

1. Explain in detail the importance of need to belong in our lives.
2. Discuss in detail social networking.
3. Write a short note on methods to balance virtual world with real world.

13.2 COGNITION AND EMOTIONS

Emotions are responsible for the finest inhuman achievement and for the worst in history. They are the source of pleasure as well as sorrow in our life. Negative and long lasting emotions can make us sick. So, what are emotions? Emotions are our body's adaptive response. They exist to give us support for our survival. When we are faced with a challenge, emotions focus our attention and energize our actions. (Cyders & Smith, 2008). Emotions are a mix of bodily arousal (heart pounding), expressive behaviors (quicken pace) and conscious experience, including thoughts and feelings (panic, fear, joy). (Mayers D.G.,2013)

Historical as well as current research has been trying to find answer to two questions

1. Whether bodily arousal comes before or after we emotional feelings?
2. How do thinking (cognition) and feelings interact?

13.2.1 Historical Emotion Theories:

1) A. James Large Theory: Arousal Comes Before Emotion

Common sense suggests that first we experience a feeling and then consequently comes our action, e.g., we cry because we are sad, tremble because we are scared. But James-Lange theory proposes exactly opposite of that and states that feeling comes as a consequence of our action, e.g., we feel sorry because we cry.

In other words, James and Lange would say, "I feel sorry because I cry, I feel afraid because I tremble". If a person sees a bear while walking along in the woods, James and Lange would suggest that the person would tremble and then realize that, because they are trembling, they are afraid. He further stated that without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colorless, destitute of emotional warmth. We might then see the bear, and judge it best to run, receive the insult and deem it right to strike, but we should not actually feel afraid or angry.

2) The Cannon-Bard Theory:

Cannon disagreed with James-Lange Theory and stated that people who show different emotions may have the same physiological state, e.g., cry when happy and sad. The body's responses such as heart rate, perspiration and body temperature are often too similar and too slow to cause different emotions, which erupt very quickly, e.g., does racing heart signal fear, anger or love? Physiological arousal may occur without the experience of an emotion, e.g., exercise increases heart rate no emotional significance. Cannon - Bard explained that our bodily responses and experienced emotions occur separately but simultaneously, e.g., The emotion triggering stimulus travels to sympathetic nervous system, causing body's arousal. *At the same time*, it travels to brain's cortex, causing awareness of emotion. So, my pounding heart did not cause my feeling of fear, nor did my feeling of fear cause my pounding of heart.

However, Cannon-Bard's theory has been criticized by those doing research on spinal cord injuries. It was reported by them that patients with high spinal cord injury (those who could feel nothing below neck) reported changes in their emotions' intensity. Patients reported that the intensity of experienced emotion such as anger

has come down drastically. One patient reported that “Anger just doesn’t have the heat to it that it used to...” But other emotions that are expressed mostly in body above the neck were felt more intensely, e.g., these patients reported increase in weeping, lumps in the throat and getting choked up when saying good-bye, worshipping or watching an emotional movie. This indicates that our bodily responses feed our experienced emotions.

13.2.2 Cognition Can Define Emotion: Schachter and Singer’s Two Factor Theory:

Schachter and Singer maintain that we don’t automatically know when we are happy, angry, or jealous. Instead, we label our emotions by considering situational cues. Our physical reactions and thoughts together create emotions. So, there are two factors – physical arousal and cognitive appraisal. They also talked about **spillover effect**. some element in the situation (e.g., you have come home after a rigorous exercise) must trigger a general, nonspecific arousal marked by increased heart rate, tightening of the stomach, and rapid breathing. At that time, you get the good news that you have got the job that you wanted for a long time. You will feel more excited because of lingering arousal from the exercise. You would not have felt the same intensity of excitement if you had just woken up from sleep.

To show this spillover effect, they conducted an experiment in which volunteered were told that experiment was about the effects of a vitamin called Suproxin. After volunteers consented they were injected with epinephrine or a placebo. Epinephrine triggers a feeling of arousal and generally increases blood pressure, heart rate, and respiration. Thus, the men who received the epinephrine were more physiologically aroused than those who received the placebo. Schachter and Singer reasoned that once the epinephrine’s effects take place, participants would begin to search for the cause of their arousal and their reaction would depend on the available situational cues. After administering injection, all participants were asked to wait in a waiting room, where another person (actually an accomplice of the experimenters) was already present. This accomplice acted either euphoric or irritated.

Before going into the waiting room some of the epinephrine injected participants were told that there are some common side effects of the drug - they might feel flushed, their hands might shake, and their hearts might pound. The other subjects, in contrast, were given no information at all about the effects of the drug. Once the effect of epinephrine kicked in, people who were told beforehand that the drug would arouse them felt no emotion and assumed that the drug was causing their hands to shake and their heart to pound and those who weren’t told about the drug’s effects, interpreted their arousal as an emotion. As Schachter and

Singer had predicted, the physiologically aroused subjects who hadn't been told about the drug's side-effects responded with motions that matched the confederate's actions. If they were aroused and hadn't been expecting the arousal, then they felt happy when the other person, i.e., confederate, was happy, but angry when the other person was angry. Forewarned subjects and unaroused subjects who received a placebo did not display any pronounced emotion. This finding that arousal state can be experienced as one emotion or the other depending on how we label it has been replicated in many other studies, indicating that arousal fuels emotions, cognition channels it.

13.2.3 Cognition May Not Precede Emotion: Zajonc, LeDoux and Lazarus' Theory:

Zajonc believed that some of our emotional reactions involve no deliberate thinking. He thought that our emotional responses follow two different brain pathways. Some emotions such as hatred and love travel a "high-road" while other emotions such as simple likes, dislikes and fears take "low road". This low road is like shortcut that enables our emotional response before our intellect interferes.

Lazarus said that our brains process vast amount of information without our conscious awareness and that some emotional responses do not require conscious thinking. Much of our emotional life operates via the automatic, speedy low road. However, we still need to appraise a situation to determine what we are reacting to. This appraisal may be effortless and we may not be conscious of it. In other words, he said that emotions arise when we appraise an event as harmless or dangerous, whether we truly know it is or not, e.g., we appraise the sound of the rustling bushes as the presence of danger. Later on we might realize that it was just the wind. So, some emotional responses-especially simple likes, dislikes and fears involve no conscious thinking, e.g., we may fear a snake and our emotion may not change in spite of knowing that snake is harmless. However, studies have shown that highly emotional people are intense partly because of their interpretations and although the emotional low road functions automatically, the thinking high road allows us to retake some control over our emotional life.

13.3 EMBODIED EMOTION: THE PHYSIOLOGY OF EMOTIONS

Different emotions do not have sharply distinct biological signatures and they do not engage very distinctly different brain regions. For example, insula, a neural center deep inside the brain gets activated when we experience different social emotions such as lust, pride and disgust. It gets activated with taste, smell or even

thought of some disgusting food or even if we feel moral disgust over a cheating case. However, researchers have identified some subtle physiological distinctions and brain patterns for different emotions, we can say that we cannot differentiate in emotions on the basis of heart rate, breathing and perspiration, but different emotions have different facial expressions and brain activity.

Emotions and the Autonomic Nervous System:

By now, we know that autonomic nervous system helps in moving our various bodily organs into action when the need arises and parasympathetic nervous system helps in calming down our bodily reactions. For example, when we are faced with a challenging or exhilarating situation, our adrenal glands secrete stress hormones, our liver releases more sugar in the blood stream to provide more energy and respiration rate goes up to provide more oxygen. The digestion slows down to divert more blood from internal organs to muscles and if you are wounded, the blood clots more quickly to stop the bleeding. The pupil in the eyes dilates so that more light comes in and you can see better. The perspiration increases to cool your stirred-up body, etc. This kind of bodily response is beneficial for better performance to meet the challenges. Moderate arousal is needed to give better performance. For example, can you imagine P.T. Usha winning a race if she was not moderately aroused/tense (or was sleeping) just before the race started. However, having too much arousal/ tension or having too little arousal/ tension before an important activity will not enhance the performance. One should not be too relaxed or too tense before the important activity.

On the other hand, when the situation comes back to normal and is no more challenging, the parasympathetic gradually calms down the body and stress hormones slowly dissipate from the blood stream.

The Physiology of Emotions:

Different emotions neither have very distinct biological reactions nor do they originate from specific distinct brain regions. For example, the insula in the brain is activated when we experience various social emotions such as lust, pride and disgust. It does not matter that these feelings may originate from different sources. For example, the feeling of disgust may originate from taste of disgusting food, smell of disgusting food or just a thought of some disgusting food or it may originate from watching a disgusting news of corruption practiced by politicians.

However, studies have shown that even though biological reactions and brain regions for different emotions appear to be similar, there are emotions such as sexual arousal, fear, anger, and disgust that are felt differently by the people and they appear to be

different to other people. Researchers have identified some subtle brain pattern differences and physiological differences for different emotions. For example, the finger temperature and hormone secretion related with fear and rage differ. Heart rate increases in fear and joy but both feelings stimulate different facial muscles. While experiencing fear, your eye brow muscles get tensed up and while experiencing joy, your cheeks and under your eyes pull into smile.

Some emotions also differ in their brain circuits. People show more activity in amygdala when they are watching fearful faces rather than angry faces. Experience of negative emotions such as disgust activates right side prefrontal cortex rather than left side one. People with depression and negative personality in general also show more right frontal activity. People with positive personalities, that is people who are alert, enthusiastic, energized and persistently goal oriented, show more activity in the left frontal lobe than in the right frontal lobe.

Thus, we can say that we can't easily differentiate emotions on the basis of bodily reactions such as heart rate, breathing and perspiration. But facial expressions and brain activity can differ with emotions.

13.3.1 Expressed Emotion:

A.) Detecting Emotions in Others:

To determine other people's emotions we read their bodies, listen to their voice tones and study their faces. Psychologists wondered whether non-verbal language differs according to our culture and can our expressions influence our experienced emotions. For example, in western culture, a firm handshake conveys an outgoing, expressive personality. A gaze, an averted glance or a stare indicates intimacy, submission or dominance. In a study, male-female pairs who were total strangers to each other, were asked to gaze intently at each other for two minutes. They reported feeling a tingle of attraction towards each other.

Most of us read nonverbal cues well. We are especially good at detecting nonverbal threats. In a crowd of faces, a single angry face is identified much faster than a single happy face. Experience can also sensitize us to particular emotions, e.g., viewing a series of faces depicting anger to fear, physically abused children were much quicker to spot the signals of anger than non-abused children. Hard to control facial muscles reveal signs of emotions that a person may be trying to hide, e.g., eyebrows raised and pulled together signal fear. Our brains are very good detectors of subtle expressions. Seeing a face for just 0.1 seconds also enabled people to judge attractiveness or trustworthiness of a person (Willis

& Todorov, 2006). It is rightly said that first impression occurs at lightning speed. Despite our brain's emotion detecting skills, it is difficult to detect deceiving expressions. The behavioral differences between liars and truth-tellers are too minute for most people to detect. However, some people are much better emotion detectors (especially introverts) than others. It is difficult to detect emotions from written communication because it does not have gestures, facial features and voice tones to help detection of emotions. Electronic communication also provides very poor quality nonverbal cues. That is why, people often use emoticons.

Lie Detection:

It is a common practice for researchers and crime detectors to use lie detector- polygraph to detect the lies. The question arises how effective and reliable is polygraph in detecting lies. The polygraph works on the principle that certain emotion-linked bodily changes, such as changes in breathing, cardiovascular activity and perspiration changes take place when a person tells a lie, even if that person can control his facial expressions. The tester/examiner asks questions to the testee and observes these bodily changes taking place in the testee while answering the questions. The tester starts questioning with certain question that may make any person nervous and polygraph will show signs of arousal. These are called control questions. For example, a tester may ask in last 10 years have you taken anything that does not belong to you? The arousal level shown on a polygraph, in response to these control questions serves as the base line. Then the tester will ask the critical questions, e.g., have you stolen anything from your previous employer? The arousal level shown on polygraph in response to this question will indicate whether the person is telling the truth or lying. For example, if the arousal level while answering the critical question is weaker than the base line arousal determined before, then we can say that person is telling the truth. On the other hand, if the arousal shown in response to critical question is more than base line arousal that means the person is telling the lie.

Criticism: It appears to be that simple, but it has certain criticism –
 1. Our physiological arousal is almost same for various emotions such as anxiety, irritation and guilt. So how do we know which emotion a person was experiencing while answering that question?

2. Many innocent people get extremely tensed up while answering a critical question that implies accusation. Lykken (1991) found that many rape victims fail this test because they react emotionally even when they are telling the truth. On the other hand, Robert Park (1999) noted that a Russian spy within CIA went undetected, even though he took many polygraph tests and passed them all. Many hardened criminals also pass this test without getting detected.

Remedies: Psychologists are trying to find new ways to catch the liars. For example, it has been suggested that instead of polygraph, one should use '**guilty knowledge test**'. This test also assesses a suspect's physiological responses to crime-scene details that are known only to police and to the guilty person. For example, if a camera is stolen, then only a guilty person will react strongly to the brand name of the stolen item. Thus, an innocent person will rarely get wrongly accused.

Psychologists are also training police to detect **fleeting signals of deceit in facial expressions**. For example, when a person is lying, he has to use more of his cognitive abilities (that means, he has to think more), during such time his eye blinking will decrease and once he has finished telling a lie, his eye blinking will increase.

Some researchers are developing a **software to analyze the facial micro expressions** or to **compare the language of truth-tellers and liars**. It is believed that liars use less of first person pronouns and more of negative emotion words.

Forensic Neuroscience researchers are analyzing the **EEG recordings**. It has been observed that liars' brain activity can be seen in fMRI scans while honest people's brains do not show any such activity. A liar's left frontal lobe and anterior cingulate cortex becomes active when the brain inhibits truth telling.

B.) Gender, Emotion and Nonverbal Behavior:

Studies have proved that women are better at reading emotional cues than men, even if they are exposed to very little behavior of the other person, e.g., they can detect whether a male-female couple is a genuine romantic couple or just pretending one (Barnes & Sternberg, 1989). Women's nonverbal sensitivity is due to their greater emotional literacy and they are more emotionally responsive. For example, in an experiment on emotional literacy, when men were asked how they will feel saying good bye to a friend, they simply said, "I will feel bad", while women said "It will be bittersweet; I'll feel both happy and sad". (Barrett et.al., 2000). A study of people from 26 cultures found that women reported themselves as more open to feelings than men. (Costa et.al. 2001). This clearly indicates that women are more emotional than men. However, generally, people tend to attribute women's reactions to their emotions while men's reactions to their circumstances, except for the feeling of anger. Anger is considered as more masculine emotion. Surveys showed that women are more likely to describe themselves as empathic. Their heart rate goes up and they are more likely to cry when they see someone in distress.

C.) Culture and Emotional Expression:

Studies have shown that there are universal facial expressions for basic emotions across different cultures. Facial muscles speak a universal language. In entire world, children cry when in distress and smile when they are happy. Even people blind from birth, naturally show the common facial expressions linked with emotions such as joy, sadness, fear and anger. Musical expressions also cut across cultures. In all cultures, fast paced music seems to be happy one and slow music is considered as sad one.

Charles Darwin said that in prehistoric times, before our ancestors communicated through words, they communicated threats, greetings and submission through facial expressions. Their shared expressions help in their survival. Emotional expressions help in our survival in other ways also, e.g., surprise raises the eyebrows and widens the eyes so that we can take in more information. However, it is observed that people are more accurate in judging emotions from their own culture, and there are cultural differences in how much emotion will be expressed. For example, in western culture, people openly show their emotions while in Asian cultures, people tend to have less visible display of their emotions.

D.) The Effects of facial Expression:

Studies indicate that expressions not only communicate emotions, they also amplify and regulate them. People report feeling more fear than any other emotion, when made to construct a fearful expression. It is said smile warmly on the outside and you will feel better on the inside. So, your face feeds your feelings. In an experiment, depressed patients felt better after getting Botox injections that paralyze the frowning muscles. Similarly, it is reported that people see ambiguous behaviors differently depending on which finger they move up and down while reading a story. If they read the story, while moving an extended middle finger, the story behaviors seemed more hostile. If read with a thumb up, they seemed more positive.

13.3.2 Experienced Emotions: Anger and Happiness

The experience of emotions in human beings can be placed on two dimensions – Positive vs. Negative and Low Arousal vs High Arousal. Any emotion is a combination of these two dimensions. For example, if we take emotion of anger, then enraged is angrier than angry (at arousal level) and it is a negative feeling. Let us discuss two of the most noticeable and pervasive emotions that impacts our lives. These are anger and happiness.

Anger:

Ancient wisdom describes anger as 'a short madness'. It says that anger 'carries the mind away' and can be 'many times more hurtful than the injury that caused it'. In other words, it is trying to say that when we are angry, we can't think rationally and may do or say things that ultimately causes more misery to us. However, Shakespeare held a different view and said that noble anger makes a coward person brave and energizes us. Who is correct? The answer is both are right. Anger can harm us. Studies have shown that chronic hostility can cause heart disease, blood pressure, lead to impaired social relationships and may even shorten our lives.

The question arises can we get rid of our anger? If yes, then how?

❖ **Gender Differences:** A Gallup teen survey showed that there are gender differences in dealing with anger. It reported that to get rid of their anger, boys usually move away from the situation that is causing them anger, they do lot of physical activities such as exercising to get over their anger. On the other hand, girls cope with their anger by talking to a friend, listening to music or writing down in diary or journal.

❖ **Cultural Differences:** Western culture, a predominantly an individualistic culture, believes that people should vent their anger, because internalizing the feeling of anger is more harmful. In fact, 'recovery' therapists encourage people to vent their rage against our dead parents, confront our childhood abuser and curse our boss in our imagination. Keeping anger within us is considered bad for our mental and physical health. Western culture believes that venting out of anger can be done through emotional release (either through aggressive act or through imaginary act) or **catharsis**. There is some empirical support for this line of thinking. Studies do show that sometimes, not always, the anger subsides when people retaliate against a provoker. But anger subsides only if a person counterattacks directly his provoker, retaliation is justifiable, their target is not intimidating (Geen et.al., 1977) and if they do not feel anxious or guilty later on. If anger led physical or verbal acts generate regret later on, it becomes maladaptive.

However, catharsis often fails to erase our feeling of rage. There can be some reasons for it

1. **Expressing anger may strengthen the anger instead of reducing it:** e.g., in case of road-rage. Ebbesen et. al. (1975) conducted an experiment on laid off employees. They were allowed to vent their hostility and later on given chance to express their attitude towards the company. Compared to those laid off employees who were not given a chance to vent their hostility in

initial questionnaire, it was found that employees who were given such a chance in first questionnaire, expressed more hostility. Their hostility increased instead of reducing. Similar results were reported by another study. Brad Bushman (2002) rightly said that venting to reduce anger is like using petrol to put out a fire.

2. It may provoke retaliation and a minor conflict may turn into major confrontation: In Asian culture, which is a community culture, giving vent to your aggression in this manner is considered bad. People don't give vent to their rage because they derive their identity from the group and have a sense of interdependence. Such people consider venting their anger as a threat to group harmony.

3. Angry outbursts are dangerous in another way: They may temporarily calm us but this may act as reinforcement and so may be habit forming.

4. Anger can lead to prejudice: Americans developed prejudice against immigrants and Muslims after 9/11.

Techniques to Control Anger:

1. Wait before reacting. You can bring down the level of physiological arousal of anger by waiting.
2. Don't ruminate. Ruminating inwardly serves to increase it
3. Calm yourself by exercising, playing an instrument or talking it through with a friend.
4. Anger when used wisely can be a strength and can benefit the relationship. Express the grievances in ways that promotes reconciliation rather than retaliation.
5. Talk things over with the offender, thereby reducing the aggravation. Be civil but assertive.
6. If conflict can't be resolved, use forgiveness. Forgiveness releases anger and calms the body.

Happiness:

Happiness is a state of mind or a feeling of contentment, satisfaction, pleasure, or joy. 'Positive psychology, describes happiness as a high ratio of positive to negative feelings or sense of satisfaction with life.

A) Importance of Happiness in Our Lives:

Happiness/ unhappiness has tremendous impact on each and every aspect of our lives. This impact can be temporary or long lasting, mild or severe. Psychologists have been investigating the difference between happy and unhappy people and how it affects them. Some of the conclusions are that **happy people** perceive the world as safer and they feel more confident, make decisions and cooperate more easily, are more tolerant, rate job applicants more

favorably, savor their positive past experiences without thinking too much on the negative aspects, are more socially connected, live healthier and more energized and satisfied lives (Mauss et.al., 2011), earn significantly more money (Diener et.al.,2002).

Baas et.al. (2008) stated that when your mood is gloomy, life as a whole seems depressing and meaningless, you are critical of your surroundings and thinking is skeptical, in such a situation, if you put in efforts to brighten your mood, your thinking will get broadened and you will become more playful and creative. In other words, you will get transferred from unhappy state to happy state. When we are happy, our relationships, self-image, and hopes for the future also seem more positive.

Feel - Good, Do- Good Phenomenon: Many research studies have reported that happiness doesn't just feel good, it does good, e.g., in many studies, mood boosting experiences (such as finding money, recalling a happy event, etc.) had made people more likely to give money, pick up someone's dropped papers, volunteer time and do other good deeds. Reverse of feel good and do good was also found to be true. When you do good for someone, you feel good.

B) The Short Life of Emotional Ups and Downs:

Studies have shown that over the long run, our emotional ups and downs tend to balance out, not only over the days but also during the day. Positive emotion rises over the early to middle part of most days and then drops off. A stressful event can trigger a bad mood, but by the next day, the gloom almost always lifts. Even when negative event persists for longer period, our bad mood usually ends. For example, romantic breakup feels devastating, but eventually the emotional wound heals and we move on in life.

Grief over the loss of a loved one or anxiety after a severe trauma such as child abuse, rape, or the terrors of war, may last for longer period, but eventually we get over it. No tragedy is permanently depressing. People who become blind or get paralyzed too recover near normal levels of day to day happiness.

People cope well with a permanent disability, though they do not rebound back to former emotions of happiness and well-being. A major disability leaves people less happy than average, yet much happier than able bodied people suffering from depression. Bruno et.al. (2008) commented that most patients "locked-in" motionless body(being in coma) do not say they want to die. The fact is that we overestimate the duration of our emotions and underestimate our resiliency and capacity to adapt.

C) Wealth and Well-Being:

To some extent, wealth does correlate with well-being, e.g., rich people are typically happier, healthier than poor people who lack control over their lives. Money can help to get out of hunger and hopelessness and also buy happiness. But once you have sufficient money for comfort and security, adding more money does not add to more happiness. This is because of diminishing returns of phenomenon. The power of more money to increase happiness is significant at low incomes and diminishes as income rises. In every culture, those who strive hardest for wealth tend to live with lower well-being, especially if they are seeking money to prove themselves, gain power or show -off rather than support their families.

D) Two Psychological Phenomena - Adaption and Comparison:

There are two psychological phenomena that explain why happiness is relative. These are Adaptation and Comparison. Let us understand these two principles –

1) The Adaptation-Level phenomenon: This principle suggests that we have a natural tendency to judge various stimuli in comparison to our past experiences. Harry Helson (1977) explain this phenomenon by explaining that on the basis of our past experience, we all reach certain neutral levels for everything, e.g., there are certain levels at which we will not find sounds either too loud or soft, temperatures as too high or low, events as pleasant or unpleasant. We will feel just neutral about them. Once these neutral points are developed, then we judge any new events or variations in existing events in comparison to these levels, e.g., if temperature goes higher than our neutral point temperature, then we find temperature too hot for our comfort.

Similarly, if compared to our present income we get higher income, we feel a temporary surge in our happiness, but later this new high becomes the new normal level and then to again feel happy we will require income more than this new normal level also. Same is true for other areas such as academic rewards, social prestige, etc. For example, do you remember, the thrill you had when cordless phones came in the market and you owned one (Those phones worked only within a limited range of landline phones, giving you very little flexibility). Later, mobile phones came into market and they gave you the freedom to talk to anyone even while traveling far away from your home. At that stage you were no more thrilled with cordless phones. Afterwards, mobiles got upgraded to smart phones and now you could not only talk with mobile phone but could also do lot more like using internet on phone. Now does ordinary mobile phone gives you any happiness or excitement? The answer will be no. This is exactly what the psychologists meant when they said happiness is relative to our own experiences.

There is no permanent happiness. Tomorrow, suppose you get a chance to live in an ideal world where you don't have any economic worries or health worries and your near dear ones give you unconditional love. You will be elated, but after some time you will adjust your adaptation level and this new world will become your new normal. Now you will feel satisfied if events exceed your expectations or you will feel dissatisfied if these events fall below your expectations. The point is that satisfaction or dissatisfaction are just our judgments based on our past experiences.

2) Comparison -Relative Deprivation: We always compare ourselves to others and our feeling of good or bad depends upon with whom we are comparing. Seeing many others getting rich may create a sense of relative deprivation. Such comparisons are the reason why rich people are more satisfied with life than the poor people. However, Russell (1930,p90) noted very aptly that "Beggars do not envy millionaires, though of course they will envy other beggars who are more successful". Comparing ourselves with those who are better off creates envy and comparing ourselves with those who are worse off creates contentment.

E) Predictors of Happiness:

Happy people share many characteristics such as they have high esteem, are optimistic, outgoing and agreeable, have close relationships or a satisfying marriage, have work and leisure that engages their skills, have an active religious faith, sleep well and exercise. Research shows that age, gender, parenthood and physical attractiveness has no link with happiness, but **genes matter**.

Heritability: In one study of identical and fraternal twins, it was found that about 50% of the difference among people's happiness ratings was heritable. Other studies have also indicated that identical twins raised apart are often similarly happy.

Personal History and Culture: On the personal level, we already know that our emotions tend to balance around a level defined by our experiences. On the cultural level, groups differ in the traits that they value. For example, self-esteem and achievement are more important to Westerners due to emphasis on individualism. Social acceptance and harmony are more important for people living in communal cultures such as Japan, where family and community is more important than personal achievements. However, apart from our genes, studies indicate that relationship quality is also an important determinant of our happiness.

So, depending on our genes, our values, our recent experiences, our happiness seems to fluctuate around our "happiness set point". Due to this some people are always happy

while others are always negative. However, psychologists believe that our satisfaction with our lives is not fixed. Happiness can increase or decrease. It can be influenced by factors under our control.

13.3.3 Close up: Want to be Happier?

Our happiness, like our cholesterol levels, is genetically influenced. As cholesterol can be kept under check through diet and exercise, similarly, level of happiness can also be partly kept under our control. Researchers have given some research based suggestions to improve our mood and satisfaction of life. These suggestions are –

1. Realize that long lasting happiness may not come from financial success: We adapt to changes by adjusting our expectations. Neither wealth nor any other circumstances that we desire can guarantee happiness.

2. Take control of your time: Happy people feel in control of their lives. To manage time, set goals and break them into sub-goals for daily aims. It will be difficult and frustrating because you will find that first of all it is not possible to set goals, then break them into daily sub-goals. We need to have very clear and systematic thinking for that. Another problem is that human beings have a natural tendency to overestimate how much work they can accomplish in any given time, e.g., you may set a goal that you will finish studying the present chapter in a day. At the end of the day, you may realize that you have not been able to finish it for various reasons. So, to avoid disappointments and frustration, one needs to practice setting up realistic goals and organize the daily activities accordingly.

3. Act Happy: Empirical research showed that when people were manipulated to put on a smiling expression, they felt better. So, put on a happy face, laugh more, talk as if you feel positive self-esteem, being optimistic and outgoing. We can often act our way into a happier state of mind.

4. Seek Work and leisure that engages your skill: Happy people are often in a zone called “flow” – that is, they are absorbed in tasks that challenges but does not overwhelm them. The most expensive forms of leisure often provide less flow experience than simple activities such as gardening, socializing or creating something new. Money also buys more happiness when spent on experiences that enjoy, remember, and look forward to rather than when money is spent on buying some material stuff such as expensive mobile or clothes.

5. Joint the “Movement” movement: It has been found that aerobic exercise can relieve mild depression and anxiety as it promotes health and energy. Sound mind resides in sound body.

6. Sleep Sufficiently: Give your body the sleep it wants. Happy people live active lives, yet reserve time for renewing sleep and solitude. Now days, many people suffer sleep debt that results in fatigue, diminished alertness and gloomy mood. They remain irritable throughout the day that can have further negative experiences.

7. Give Priority to Close Relationships: Intimate friendships can help you to sail through difficult times. Confiding is good for soul as well as for body. It has been noticed that compared to unhappy people, happy people engage less in superficial talks and more meaningful conversation. Nurture your close relationships by not taking your loved ones for granted. Show them the sort of kindness you show to others, affirming them, playing together and sharing together.

8. Focus beyond Self: Reach out and help those who are in need. Happiness increases helpfulness but doing good also makes one feel good.

9. Count Your Blessings and Record Your Gratitude: Keep a gratitude journal, that is keep a register where at the end of the day, remember and enjoy good moments once again and write in that journal all positive events that occurred that day and why they occurred. You also write express your gratefulness to others in that journal. It is scientifically proven that keeping gratitude journal heightens one's well-being.

10. Being Happy is a Matter of Choice: It is our attitude that makes us feel happy or unhappy. It is true, we meet all kinds of situations during the day, and some of them may not be conducive to happiness. We can choose to keep thinking about the unhappy events, and we can choose to refuse to think about them, and instead, relish the happy moments. If we let outer events influence our moods, we become their slaves. We lose our freedom. We let our happiness be determined by outer forces. On the other hand, we can free ourselves from outer influences. We can choose to be happy, and we can do a lot to add happiness to our lives.

11. Surround yourself with happy people: It is easy to begin to think negatively when you are surrounded by people who think that way. Conversely, if you are around people who are happy their emotional state will be infectious.

Check your progress:**Write short notes on the following-**

1. The physiology of emotions
2. Gender and nonverbal expression of emotions
3. Consequences of anger
4. Predictors of happiness
5. Techniques to be happier

13.4 SUMMARY

In this unit, we have touched upon three learning items - need to belong, emotions and happiness.

In need to belong, we looked at the definition and usefulness of need to belong. We also discussed how ostracism is painful for anybody and in social networking topic we discussed how technology has impacted our social communications. We also looked at the ways and means of maintaining a balance between real world and internet world.

In emotions we first talked about its definition, and we discussed four historical theories of emotion to see the link between cognition and emotions. The James Lange theory proposed that first comes bodily response and then we label emotions based on those bodily responses. Cannon-Bard's theory argued that emotions and autonomic responses occur simultaneously but separately. One is not the cause of the other. The individual's appraisal of the emotion producing situation largely determines the emotions.

Schachter and Singer believed that to experience emotions, we must consciously interpret and label them. Zajonc, LeDoux and Lazarus noted that we have many emotional reactions without interference of intellect. Many emotions occur without our being aware of them. Then we discussed the physiology of emotions and how emotions can be detected by others. We also dwelled upon how gender and culture can influence the expression of emotions, and how facial expression can influence the actual experience of emotions.

Lastly, we discussed about experiencing two major emotions, that is, anger and happiness. We saw in detail what are the consequences of anger and how it can be controlled. In case of happiness, we discussed the definition, nature of happiness and how there is a positive yet limited connection between wealth and feeling of well-being. How two psychological phenomena- adaptation and comparison can influence the experience of happiness. Finally, we looked at the predictors of happiness and how happiness can be increased.

13.5 QUESTIONS

1. Explain the usefulness of need to belong and pain of ostracism.
2. What is social networking and how can we maintain balance between real world and virtual world.
3. Define emotion and discuss various theories of emotion.
4. How can we detect emotions in others and what role is played by gender and culture in detecting emotions?
5. What are the consequences of anger and how it can be reduced?
6. "Catharsis may or may not reduce anger". Explain
7. Write a detailed note on happiness.
8. Define happiness. What are the consequences of happiness?
9. "Happiness is relative to our own experience and to others' success. Explain

Write a short note on

- a. Effects of social networking
- b. Maintaining balance between real world and virtual world
- c. Cannon-Bard theory of emotion
- d. Schachter & Singer's theory of Emotion
- e. Predictors of Happiness
- f. Tips to reduce anger

13.6 REFERENCES

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



PERSONALITY - I

Unit Structure :

- 14.0 Objectives
- 14.1 Introduction
- 14.2 Psychodynamic Theories
 - 14.2.1 Freud's psychoanalytic perspective - exploring the unconscious
 - 14.2.2 The Neo-Freudian and psychodynamic theorists
 - 14.2.3 Assessing unconscious processes
 - 14.2.4 Evaluating Freud's psychoanalytic perspective
 - 14.2.5 Modern views of the unconscious
- 14.3 Humanistic theories
 - 14.3.1 Abraham Maslow's self-actualizing person
 - 14.3.2 Carl Rogers' person-centered perspective
 - 14.3.3 Assessing the self
 - 14.3.4 Evaluating humanistic theories
- 14.4 Summary
- 14.5 Questions
- 14.6 References

14.0 OBJECTIVES

After studying this unit, you should be able to understand:

- The psychoanalytic view of human mind, its views on division of personality and the stages of personality development.
- The work of various Neo-Freudians and modern views of unconscious.
- The contribution of humanistic psychologists such as Abraham Maslow and Carl Roger to personality development.
- The pros and cons of humanistic theories.

14.1 INTRODUCTION

Though all human beings are similar in many ways they perceive, learn, remember, think and feel, yet there are individual differences and each one of us is unique. These differences and uniqueness is due to personality differences. Personality is an

important dimension of individual differences. Personality has been the area of interest for psychology for more than 100 years. This and the next unit would provide an exposure to different personality theories, ranging from classical to contemporary. This unit discusses psychodynamic and humanistic theories of personality. The next unit discusses trait and socio-cognitive theories of personality.

Personality can be considered as sum-total of who you are – emotions, attitudes, motives, and behaviour. No two people are same because they have different personality.

Personality is unique and relatively stable way in which people feel, think, and behave throughout the life.

Personality can be defined as a person's characteristic pattern of thinking, feeling, and acting (Mayers ,2013).

14.2 PSYCHODYNAMIC THEORIES

Psychodynamic theories of personality consider human behavior as a dynamic interaction between the conscious and unconscious mind and its associated motives and conflicts. These theories originated from Sigmund Freud's psychoanalysis theory and later on Neo-Freudian theories were included. So, let us begin with psychoanalytic perspective.

14.2.1 Freud's Psychoanalytic Perspective: Exploring the Unconscious:

Sigmund Freud was born 1856. That was a Victorian era in Europe – a time of tremendous discovery and scientific advancement, but also a time of sexual repression and male dominance. In general, only male sexuality was acknowledged and that too very discreetly. Freud was very independent, brilliant and voracious book reader right from his teens. He became a doctor specializing in nervous disorders and started a private clinic. Very soon he became famous because of his work in psychiatry. Till today his influence lingers in psychiatry and clinical psychology as well as in many other courses.

Many of his patients were rich females, and while treating them he realized that they had disorders without any neurological base, e.g., a patient may complain that she has lost all sensations in her hand and yet he observed that no sensory nerve was damaged that would numb only the entire hand but nothing else. Freud's search for a cause for such disorders made him realize that some neurological disorders can have psychological causes. He called his theory of personality and the associated treatment techniques as Psychoanalysis. In his personality theory, he

emphasized first of all on division of mind, then on structure of personality, psycho-sexual stages of personality development and defense mechanism.

Division of the Mind:

Freud believed that mind is divided into three parts. The conscious, the preconscious, and the unconscious.

1) The Conscious Mind:

The conscious mind is the uppermost part of the mind. It contains information one is aware of at any given time. This is an Individual's current perceptions, memories, thoughts, fantasies, feelings that he is aware of. It is quite close to *short-term memory* concept which you have studied in earlier chapters. Freud believed that mind is mostly hidden and the conscious awareness is like the part of an iceberg. In other words, what we are aware of is a very small part of our consciousness and beneath this awareness is the large unconscious mind with its thoughts, wishes, feelings and memories.

2) The Preconscious Mind:

The preconscious mind contains ideas, feelings, events, concerns beliefs, thoughts that person is not aware at present but can easily be made accessible to the conscious. This contains memories that are not at the moment in the conscious thought process, but can readily be brought to mind whenever needed. It works closely with the conscious mind. Today, it can be called as explicit long-term-memory. But Freud suggested that these two are the smallest parts of mind.

3) The Unconscious Mind:

The unconscious mind (often called as "the unconscious") is the most central and significant part of Freudian theory. The unconscious is most important determinant of human personality and behaviour. According to Freud, the unconscious is a mass of unacceptable passions and thoughts that he believed we repress or forcibly block from our consciousness because it would be too stressful to acknowledge them. These are the major source of our motivations ranging from simple desires for food, and sex to the complex motives like creativity of an artist. This largest part of mind remains hidden to conscious. Without our awareness, these troubleshooting feelings and ideas powerfully influence us, sometimes getting expressed in disguised form such as dreams, slip of tongue or pen, the work we choose, the beliefs we hold, our daily habits, or other behavior that people carry out without understanding the reasons for it. He believed that nothing is ever accidental and considered jokes as expression of repressed sexual and aggressive tendencies and dreams as the "royal road to the unconscious". In dream analyses, he searched for patients' inner conflicts.

To gain access to patients' unconscious mind, initially he used hypnosis. But that did not work. So, he devised a new method called "**Free Association**". In using this method, he asked his patients to relax and say whatever came to their mind, no matter how embarrassing or trivial it is. He assumed that certain mental blocks from patient's distant past are responsible for his troubled present and free association will allow him to retrace those mental blocks, allowing him to peep into patient's unconscious mind and retrieve and remove painful memories stored from his childhood.

Personality Structure:

According to Freud, personality can be divided into three parts. They dynamically interact with each other. They are: Id, Ego, and Superego.

1) ID:

The first and primitive part of personality is Id. It is present since infancy. It is completely unconscious and amoral. It contains all the basic biological drives to survive, reproduce and aggress. The id is the impulsive, child-like portion of the psyche that operates on the "pleasure principle". The **pleasure principle** states that there should be immediate gratification of the needs without caring about outside world's restrictions or societal conventions of civilized, standard, and moral behaviour. People dominated by ID will concentrate on present pleasure rather than think about future pleasure, e.g., they will enjoy parties, movies now rather than sacrifice today's pleasure for future success and happiness.

Freud believed that human personality is the result of our efforts to resolve these conflicts between impulses and restraints between our aggressive, pleasure seeking biological urges and our internalized social control over these urges.

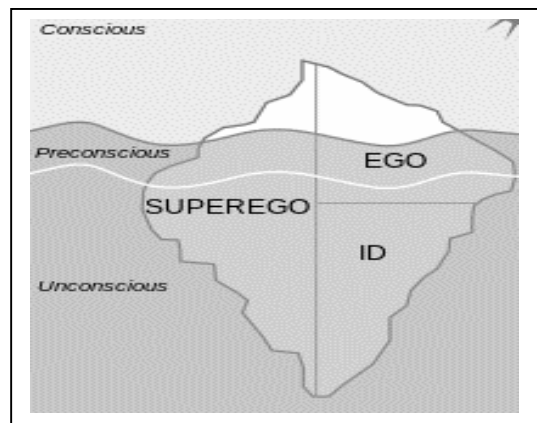
2) EGO:

This second part of personality is developed to handle the reality. It is partially conscious part of mind that includes our higher cognitive abilities, rationality, perceptions, thoughtfulness, memories, learning, and logical processes. It provides buffer between illogical, amoral impulses of id and societal restrictions. The Ego works on reality principle, which means that the id's drives are satisfied in a realistic way that will avoid negative outcomes and will bring long term pleasure. So, there are times when ego denies the gratification of id's drive because of possible negative consequences. For example, if a very young kid is hungry, then he picks up food from anybody's plate, but slightly older kids will not do that. Instead they would wait for their plate to come or make a request in more formal ways. If they are at stranger's place, then they will prefer to stay hungry than asking for food. This is because ego develops with the age.

3) SUPEREGO:

Freud believed that around the age of 4 or 5 our superego starts developing and ego starts recognizing the demands of superego. **Superego** represents our moral values imbibed from the society. These are the rules and regulations about what is right and wrong taught by parents, teachers, and important others. The superego tells us how we ought to behave. It forces ego to consider not only the real world but also the ideal world. In other words, it tells ego to not only avoid punishment but also to strive for ideal behavior. It strives for perfection. It prevents us from doing morally incorrect things, by producing guilt (also called as *moral anxiety*). It produces feeling of pride when we do morally correct things. A person with very strong superego may be virtuous and yet guilt-ridden, while another person with weak superego may be low in using self-restraint and yet may not feel any guilt.

Fig. 14.1



Since the Id is unrealistically impulsive and the superego is unrealistically moralistic, the id and superego's demands are always in conflict, the ego tries to strike a balance between the two. The ego is the "executive" part of the personality. It mediates between the impulsive demands of the id and the restraining demands of the superego and the real life demands of the external world. Anxiety is created when ego cannot meet their needs. Extreme anxiety leads to disorders. The Psychological Defense Mechanisms are used to deal with anxiety and stress created by conflicts between the three components of personality. They are unconscious strategies people use to deal with the anxiety and by distorting the reality. They have been classified as psychotic, immature, neurotic and healthy defense mechanisms. But before talking about defense mechanisms in detail let us look at the developmental stages of personality.

Developmental Stages of Personality:

Freud proposed that development of personality takes place when a child passes through a series of psychosexual stages. Freud has identified particular body parts as a focus of specific

developmental stage. In each psychosexual stage, id's pleasure seeking energies focus on specific body parts that provide sensation of pleasure during that stage. It is called as erogenous zone. In every psychosexual stage, there is a conflict between id, ego and superego. Conflicts unresolved during earlier psychosexual stages could lead to maladaptive behavior in the adult years. These stages are *Oral, Anal, Phallic, Latency, and Genital*.

Table 14.1

Freud's Psychosexual Stages of Development

Stage	Age	Erogenous	Characteristics
Oral	Birth to 18 months	Mouth	Indulges in oral activities like sucking, biting, mouthing, eating, to obtain pleasure.
Anal	18 to 36 months	Anus	Gratification obtained from withholding and expelling fesses, try to handle the pressures of society regarding toilet training. Fixation leads to anal expulsive or anal-retentive personality.
Phallic	3 – 6years	Genitals	Derives pleasure by fondling genitals. Oedipal Conflict is important characteristics, and it is resolved by identifying with same sex parents.
Latency	6 years to Puberty	Adolescence Social skills intellectual abilities.	The sexual feelings are kept latent by repressing them in unconscious.
Genital	Puberty onwards		Maturation of sexual interests - The mature, adult sexuality develops during this stage.

1) Oral Stage:

The duration of first stage of psychosexual development, namely Oral Stage, is from birth to 18 months. The erogenous zone of oral stage is mouth. Children enjoy activities like sucking, biting, mouthing, etc. The conflict that is experienced in this stage is weaning the child from bottle or mother's breast feed. The child will get fixated in the oral stage if the child overindulges (continue to breast/bottle feed for longer duration) or become frustrated (due to early or abrupt weaning) with the oral gratification. This leads to development of oral personality in adulthood. Aggressive-pessimistic traits develop if oral needs are under gratified and dependency-optimism develops if they are over gratified. If they are over gratified, they may continue to seek oral gratification by overeating, talking too much, smoking, etc. If they are weaned away too early leading to under gratification they may act tough or speak in "bitingly" sarcastic way, etc.

2) Anal Stage:

The duration of Anal Stage of psychosexual development is from 18 months to 3 years. The erogenous zone of anal stage is anus. Children at this stage derive pleasure by both withholding and expulsion of fesses at will. In addition to physical pleasure, child also derives pleasure from self-control and the praise from parents. The conflict that is experienced in this stage is toilet training. The child will get fixated in the anal stage if toilet training is too harsh. The conflict leads to development of anal personality in adulthood. They are of two types: *anal expulsive personalities* and *anal retentive personalities*. Anal Expulsive Personality results from child's rebel against toilet training by parents. The adult would show destructiveness, hostility, emotional outbursts, disorganization, rebelliousness and carelessness. They could also become extremely generous and indisciplined. Anal-Retentive Personality develops due to fear of punishment. The child retains fesses and refuses to go to toilet. They develop traits like excessive orderliness, neatness, stubbornness, a compulsion for control and have interest in collecting, holding, and retaining objects.

3) Phallic Stage:

The Phallic Stage is between 3 years to 6 years. The genitals are erogenous zone during this stage. Child derives pleasure by fondling genitals. They develop unconscious sexual desires for their mother and jealousy and hatred for their fathers, whom they consider as their rivals. Similarly, girls develop unconscious sexual desire for their fathers. Boys experience Oedipal Conflict and girls experience Electra Complex in this phase. Father is perceived as powerful, and they develop castration anxiety, a fear that their penis will be cut-off by their fathers, if fathers come to know of their sexual attraction towards their mothers. To resolve this anxiety boys identify with their fathers and

girls identify with their mothers. This is called as Oedipus complex. According to Freud, girls get attracted to father and experience penis envy, feeling of inferiority for not having that anatomical part. They held mother responsible for this. To resolve this conflictual feeling towards mother, girls identify with mother. Normal sexual development occurs if the conflict is resolved. Immature sexual attitudes, promiscuous or sexually inhibited behaviour, and sexual confusion in adulthood may result from fixation in phallic stage.

4) Latency Stage:

The duration of this stage is from 7 to 12 years. The sexual feeling of child is repressed in unconscious, or kept *latent*, and the child grows physically, intellectually, and socially. This is relatively a calm stage where sexual energy is converted into interest in excelling in school work and sports, etc.

5) Genital Stage:

The duration of this phase is from 13 years onwards till death. The mature, adult sexuality develops during this stage. At this stage, once again the attention is shifted to genitals but sexual attraction is shifted from one's parents to members of the opposite sex. Sexual urges are expressed through socially approved channels. Sex takes a matured form by moving from desire for pleasure only to a desire for reproduction. The sexual and aggressive motives are transferred into energy for marriage, occupation and child rearing.

Defense Mechanisms:

Table 14.2

Defense Mechanism	Unconscious process employed to avoid anxiety-arousing thoughts/feelings	Examples
Regression	Reverting back to more immature behavior from infantile psychosexual stage, where some psychic energy remains fixated.	Throwing temper tantrums as an adult when you don't get your way or reverting back to the oral comfort of thumb sucking.
Reaction Formation	Acting in exactly the opposite way to one's unacceptable impulses.	Being overprotective of and generous towards an unwanted child, or repressing angry feelings, a person may display exaggerated friendliness.

Projection	Attributing one's own unacceptable feelings and thoughts to others and not to yourself.	Accusing your friend on cheating on you because you have felt like cheating on her. There is a saying "The thief thinks everyone else is a thief".
Rationalization	Creating false excuses for one's unacceptable feelings and thoughts to others and not to yourself. In other words, offering self-justifying explanations in place of the real, more threatening unconscious reasons for one's actions.	Justifying cheating in an exam by saying that everyone else does that, or a habitual drinker says he drinks just to be sociable.
Displacement	Redirecting unacceptable feelings from the original source to a safer, more acceptable substitute target.	Taking your anger towards your boss out on your wife or children by shouting at them and not at your boss or a child bangs the door hard instead of shouting back at his mother.
Denial	Blocking external events from awareness. If some situation is just too much to handle, the person refuses to believe or even perceive painful realities.	Smokers may refuse to admit to themselves that smoking is bad for health, or a person may refuse to believe that his son is involved in anti-national activities.

Freud held that anxiety is the price we pay for civilization. There is a constant tug of war between id and superego and ego has to balance both of them. Sometimes, ego fears losing control over this inner war and we experience anxiety. At such times, ego protects itself with defense mechanisms, i.e., the tactics used to reduce or redirect anxiety by distorting reality. All these defense mechanisms work at unconscious level and ego unconsciously defends itself against anxiety. Some of these defense mechanisms are discussed here.

14.2.2 The Neo-Freudian and Psychodynamic Theorists:

Freud's theory has been criticized as well as praised by his contemporaries and by other psychologists later. Those who followed broad framework of Freud and developed their own theories of psychoanalysis are called as Neo-Freudians. Neo-Freudians accepted his basic ideas such as personality structure of id, ego, superego; the importance of the unconscious; the shaping of personality in childhood; and the role of anxiety and defense mechanisms in personality development. However, they did not agree with the idea that only sex and aggression are dominant motives in our lives. They believed that social interaction also plays an important role. Similarly, while accepting the role of unconscious mind they emphasized the role of conscious mind also in interpreting our experiences and in coping with our environment. Some of the important Neo-Freudian theorists are Jung, Adler, Horney, etc.

Carl Jung:

Carl Gustav Jung differed from Freud on the nature of unconscious and parted away from Freud. In addition to Personal Unconscious, he developed the concept of Collective Unconscious. It is the store house of our experiences as a species since ancient ages. We are born with it and are not conscious of it. He called these collective universal human memories as Archetypes, an unlearned inclination to experience world in a particular way. Among the many archetypes, *Mother* (our inner tendency to identify a particular relationship of "mothering"), *Anima/Animus* (feminine component within males/ masculine component within females), *Shadow* (dark side of ego containing sex and life instincts), *persona* (individuals public image) are important.

Jung was initially Freud's disciple but later turned his dissenter. While he agreed with the idea that unconscious exerts a powerful influence on our behavior, he believed that unconscious holds more than our repressed thoughts and feelings. He criticized Freud's theory of the Oedipus complex and his emphasis on infantile sexuality. He said we all have a collective unconscious, a storehouse of repressed memories specific to the individual and our ancestral past. This is a level of unconscious shared with other members of the human species comprising latent memories from our ancestral and evolutionary past. 'The form of the world into which [a person] is born is already inborn in him, as a virtual image' (Jung, 1953, p. 188). Jung called these ancestral memories and images that have universal meaning across cultures as archetypes. These archetypes show up in dreams, literature, art or religion. These past experiences explain why people in different cultures share certain myths and images, e.g., mother as a symbol of nurturance, or fear of the dark, or of snakes and spiders.

Alfred Adler:

Alfred Adler had struggled to overcome his own childhood illnesses and accidents due to which he had suffered from inferiority complex. So, while proposing the concept of inferiority complex he stated that everybody experiences sense of inferiority, weakness and helplessness as a child and struggle to overcome the inadequacies by become superior and powerful adults. He identified 'striving for superiority' as a thrust propelling thought, feelings, and actions of humans. Two important concepts in his theory are: Parenting and Birth Order. According to Adler, the order in which person is born in the family innately influences persons personality. The *first born*, experience crisis as the attention shifts to younger sibling after their births and to overcome this they become overachievers. *Middle born children* are not pampered but get the attention and become more superior. After dethroning older sibling, they have power over their younger siblings and engage in healthy competition. *The youngest children* have the least amount of power in family and are more pampered and protected. This creates a sense that they cannot take responsibilities and feel inferior to others.

Adler identified two Parenting Styles that leads to problems in adulthood: *Pampering and Neglect*. Pampering parents overprotect a child, provide excessive attention, and protect from the dark part of life. As adults, child has poor skills to deal with realities, self-doubts about abilities. A Neglecting Parent do not protect child at all, and they are left to deal with life problems alone. As adults, they fear the world, cannot trust others, and have trouble in developing close relations.

Karen Horney:

Karen Horney differed from Freud on his masculine focus and idea of 'penis envy' and women having weak superego. She substituted the concept of 'penis envy' with her idea of 'womb envy'. She said that "The view that women are infantile and emotional creatures, and as such, incapable of responsibility and independence is the work of the masculine tendency to lower women's self-respect". She considered the basic anxiety, a feeling of fearfulness and anxiety experience in childhood triggers the desire for love and security.

Post Freud's life, most contemporary psychodynamic theorists and therapists do not accept the idea of sex as the basis of personality. They do not accept the idea of id, ego and superego and do not classify their patients in terms of oral, anal or phallic characters. But they do accept that much of our mental life is unconscious, that very often we struggle with inner conflicts among our wishes, fears and values and that our childhood experiences shape our personality and the way we become attached to others in later life.

Neo-Freudians' major disagreements with Freud can be summarized as -

1. Socio cultural factors determine conflicts, not instincts.
2. Infantile sexuality is of little importance compared to socio-cultural factors. Conflicts can be or are predominately non-sexual.
3. Societal factors cause anxiety, not a defense.
4. Dreams have no latent content: could be metaphorical expressions of the patient's real concern or reflect struggles to achieve self-awareness and responsibility.
5. Oedipal complex has no sexual component, is due to interpersonal/ social factors.
6. Technique of treatment: normally emphasize 'here and now', de-emphasis on past, gaining insight etc.

14.2.3 Assessing Unconscious Processes:

To peep into unconscious mind, early childhood experiences and to unearth hidden impulses and conflicts, psychologists have developed certain tools that do not ask direct questions and expect answers in yes-no or true-false format as objective assessment tools do. These tools that measure personality indirectly are known as projective tools. Projective tests are like "psychological X-ray" in which a test taker is asked to tell a story or describe an ambiguous stimulus. It is assumed that any hopes, desires and fears that test taker sees in the ambiguous image are the projections of their own inner feelings or conflicts. One of these projective tests is

Rorschach Inkblot Test:

People are presented a series of 10 inkblots printed on cards and people are asked to describe what they see in these inkblots. The test has been criticized on various counts. For instance, some clinicians believe in the power of Rorschach test so much that they have used it to assess criminal's violence potential and present it to court as evidence. Others consider it as a helpful diagnostic tool, an icebreaker and a revealing interview technique. However, the scoring and interpretation of the test had been criticized often and to overcome this criticism a research based, computerized tool has been designed to bring uniformity in scoring and interpretation. Yet many critics comment that only some of Rorschach based scores, such as scores for hostility and anxiety, have shown validity. So these tests are not reliable as a whole. Other critics believed that this test diagnoses many normal people as pathological as clinician's interpretations of the answers given are based on intuitions of the clinicians.

14.2.4 Evaluating Freud's Psychoanalytic Perspective and Modern Views of the Unconscious:

Recent research disagrees with Freud's ideas on many counts. For instance-

1. Modern developmental psychologists believe that development is a lifelong process and not fixed in childhood only as Freud believed.
2. They do not believe that an infant's neural networks are mature enough to hold as much emotional trauma as Freud assumed that they do.
3. Some critics think that Freud overestimated the parental influence and underestimated the peer influence.
4. Freud's idea that conscience and gender identity develops when children resolve Oedipus complex at the age of 5 or 6 was also criticized. It is observed that children develop their gender identity much earlier than age of 5 or 6 and become strongly masculine or feminine even without a same sex parent present.
5. Critics also believe that Freud's ideas about childhood sexuality arose from his skepticism of stories of childhood sexual abuse told by his female patients. He attributed these stories of childhood abuse to their own childhood sexual wishes and conflicts.
6. Freud is also criticized on his methodology of collecting information. The way he framed his questions might have created false memories of childhood sexual abuse.
7. New ideas about why we dream are also contrary to Freud's belief that dreams display hidden feelings and are tools for wish fulfillment. Similarly, slips of the tongue can be explained as competition between similar choices in our memory. When someone says that "I don't want to do it- it's a lot of bother" may simply be blending bother and trouble.
8. Freud's idea that defense mechanisms disguise sexual and aggressive impulses, and suppressed sexuality causes psychological disorders, is also not supported by modern research. From Freud's time, our sexual inhibitions have gone down but psychological disorders have not gone down.
9. Psychoanalytic theory assumes that the human mind often represses troublesome wishes and feelings, banishing them into the unconscious mind until they resurface. He believed that if we can recover and resolve childhood's conflicts and wishes, emotional healing would follow. However, modern researchers believe that repression is a rare mental response to trauma. Even those who have witnessed a parent's murder or survived Nazi death camps retain their unrepressed memories of the horror. (Helmreich 1992; Pennebaker, 1990)
10. It is also argued that Freud's theory does not meet the criteria of being scientific theory. A scientific theory must offer new testable hypotheses and objective way of testing the existing theory.

11. The most serious problem with Freud's theory is that it offers after-the-fact explanations of any characteristic but fails to predict such behaviors and traits, e.g., according to his theory, if you feel angry at your mother's death, it is because your unresolved childhood dependency needs are threatened. On the other hand, if you do not feel angry, it is because you are repressing your anger. Lindzey (1978) rightly commented that it is like betting on a horse after the race is over.
12. Critics said that a good theory should give testable predictions but Freud's supporters said that Freud never claimed that psychoanalysis was a predictive science. He merely claimed that looking back, psychoanalyst could find meaning in our state of mind.
13. His supporters further point out that some of Freud's ideas are everlasting, e.g., he drew attention to the idea of unconscious, irrationality, self-protective defense mechanisms, importance of sexuality, tension between our biological impulses and our social well-being. He challenged our self-righteousness, punctured our pretensions and reminded us of our potential for evil.

14.2.5 The Modern Unconscious Mind

Modern researchers agree with Freud that we have very limited access to all that goes on in our minds, but they think unconscious does not comprise of just seething passions and repressive censorings, rather there is information processing going on there without our awareness. This information processing can involve:

- a.) Formation of the schemas that automatically control our behavior
- b.) The implicit memories that operate without conscious recall, even among those with amnesia.
- c.) The emotions that activate instantly, before conscious analysis.
- d.) The formation of self-concept and stereotypes that unconsciously influence the way we process information about ourselves and others.

So, our lives are guided by off-screen, out-of-sight, unconscious information processing. The unconscious mind is huge.

Recent research also supported Freud's idea of defense mechanisms. People tend to see their own faults and attitudes in others. Freud called this tendency as 'Projection', a defense mechanism. Modern researchers call it "False Consensus Effect", the tendency to overestimate the extent to which others share our

beliefs and behaviors. For example, people who break traffic rules assume that everyone does it, people who are happy, kind and trustworthy assume all others are also have same attributes. Similarly, another defense mechanism used by people to defend their self-esteem is Reaction formation. Baumeister stated that defense mechanisms are less likely to be used by seething impulses and more by our need to protect our self-images.

Modern research has supported Freud's idea that we unconsciously defend ourselves against anxiety. Greenberg et.al. (1997) rightly said that one source of anxiety is "the terror resulting from our awareness of vulnerability and death". Terror management theory shows that death anxiety increases contempt for others and esteem for oneself (Koole et.al.,2006). Living in a threatening world, people tend to act not only to enhance their self-esteem but also to stick strongly to worldviews that answer questions about life's meaning. For example, the likelihood of death increases religious sentiments and deep religious beliefs enable people to be less defensive (Jonas & Fishcher,2006). When faced with death, people yearn for and stick to close relationships, e.g., when a person is nearing his end, he/she yearns to meet family and friends, and put in extra efforts to reach out to them even if they have not communicated before for years together.

Check your progress:

1. Write short notes on the following-
 - a.) Division of Mind
 - b.) Personality Structure
 - c.) Defense Mechanisms
 - d.) Neo-Freudian Psychologists
 - e.) Rorschach Inkblot Test
2. Describe in detail the developmental stages of personality according to Psychoanalytic theory
3. Critically evaluate Freud's Psychoanalytic theory.
4. Describe the modern view of unconscious mind.

14.3 HUMANISTIC THEORIES

By 1950s and 1960s, some personality psychologists were dissatisfied with Freud's deterministic and B. F. Skinner's mechanistic explanation of personality. They objected to Freud's ideas that human behavior is determined by forces beyond our control, that human beings are basically evil and would destroy themselves if not restrained by social norms which are internalized

in the form of superego. Moreover, Freud's theory was developed on the basis of motives reported by sick people. On the other hand, Skinner viewed human personality through respond-reward prism and emphasized only on learning. He considered human beings like machines, where they respond to environmental inputs on the basis of reward or punishment received in the past. They felt that these theories ignored the qualities that make humans unique among animals. Two psychologists, Abraham Maslow and Carl Rogers, became well known for their humanistic theories. Humanistic theorists focused on the ways 'healthy' people strive for self-determination and self-realization and offered a 'third force' option that emphasized human potential

14.3.1 Abraham Maslow's Self-Actualizing Person:

Maslow developed his theory based on healthy, creative people rather than troubled clinical cases. He proposed that we are motivated by a hierarchy of needs. First, we are motivated to satisfy our physiological needs followed by safety needs, then need to be loved or belong and then self-esteem and finally self-actualization and self-transcendence. Self-actualization refers to a process of fulfilling our potential and self-transcendence refers to searching meaning, purpose and communion beyond the self.

He based his study of self-actualization on the basis of studying people like Abraham Lincoln, who were known for their rich and productive lives. Maslow stated that such people share certain similar characteristics. They are more self-aware, self-accepting, open and spontaneous, loving and caring and not stuck by their own opinions. While working with college students, Maslow said that those who will become self-actualizing adults later on are the ones who are likeable, caring, privately affectionate to their elders and secretly uneasy about the cruelty, meanness and mob spirit.

Maslow's self-actualizing characteristics:

- **Efficient perceptions of reality:** Self-actualizers are able to judge situations correctly and honestly. They are very sensitive to the fake and dishonest, and are free to see reality 'as it is'.
- **Comfortable acceptance of self, others and nature:** Self-actualizers accept their own human nature with all its flaws. The shortcomings of others and the contradictions of the human condition are accepted with humor and tolerance.
- **Reliant on own experiences and judgment:** Independent, not reliant on culture and environment to form opinions and views.

- **Spontaneous and natural:** True to oneself, rather than being how others want. They have outgrown their mixed feelings towards their parents, have found their ultimate goals, have enough courage to be unpopular, to be unashamed about being openly virtuous.
- **Task centering:** Since they are secure in their sense of who they are, their interests are problem-centered and not self-centered. They focus their energies on a particular task and make that task as the mission of their lives. Most of Maslow's subjects had a mission to fulfill in life or some task or problem 'beyond' themselves to pursue
- **Autonomy:** Self-actualizers are free from reliance on external authorities or other people. They tend to be resourceful and independent.
- **Continued freshness of appreciation:** The self-actualizer seems to constantly renew appreciation of life's basic goods. A sunset or a flower will be experienced as intensely time after time as it was at first. There is an "innocence of vision", like that of an artist or child.
- **Profound interpersonal relationships:** The interpersonal relationships of self-actualizers are marked by deep loving bonds.
- **Comfort with solitude:** Despite their satisfying relationships with others, self-actualizing people value solitude and are comfortable being alone.
- **Non-hostile sense of humor:** This refers to the ability to laugh at oneself.
- **Peak experiences:** All of Maslow's subjects reported the frequent occurrence of peak experiences(temporary moments of self-actualization). These occasions were marked by feelings of ecstasy, harmony, and deep meaning. Self-actualizers reported feeling at one with the universe, stronger and calmer than ever before, filled with light, beauty, goodness, and so forth. According to Maslow, peak experiences are "Feelings of limitless horizons opening up to the vision, the feeling of being simultaneously more powerful and also more helpless than one ever was before, the feeling of ecstasy and wonder and awe, the loss of placement in time and space with, finally, the conviction that something extremely important and valuable had happened, so that the subject was to some extent transformed and strengthened even in his daily life by such experiences." In

other words, these are moments of transcendence in which a person emerges feeling changed and transformed.

- **Socially compassionate:** Possessing humanity. They are emotionally mature and have learned enough about life so that they are compassionate towards others.
- **Few friends:** They have few close intimate friends rather than many superficial relationships.

14.3.2 Carl Rogers' Person-Centered Perspective:

Carl Roger also believed that people are basically good and are endowed with self-actualizing tendencies. Unless faced with an environment that hinders growth, each of us is like a fruit, ready for growth and fulfillment. Roger believed that growth promoting climate needs to fulfill three conditions:

1. **Genuineness:** Genuine people are open with their feelings, drop their pretensions or deceptive outward appearance, are transparent and self-disclosing.
2. **Acceptance:** When people are accepting, they offer unconditional positive regard, an attitude of grace that values us even knowing our failings. It is a great relief to drop our pretensions, confess our worst feelings, and discover that we are still accepted, that we are free to be spontaneous without feeling the loss of others' esteem.
3. **Empathy:** Empathic people share and mirror other's feelings and reflect their meanings.

Rogers believed that genuineness, acceptance and empathy are like water, sun and nutrients that help us to grow like a fruit. As people are accepted and prized, they tend to develop a more caring attitude toward themselves. When people are heard emphatically, it becomes possible for them to listen more accurately to the flow of inner experiencing. Unconditional love makes a person optimistic, enthusiastic and helpful. For Carl Rogers and Maslow, the central figure of personality is self-concept. Self-concept refers to all the thoughts and feelings that one has in response to a question-Who am I? If self-concept is positive we view the world positively and if we have negative self-concept, we view the world negatively and we will feel dissatisfied and unhappy.

14.3.3 Assessing the Self:

To measure personality, humanistic psychologists ask people to fill out a questionnaire that would evaluate their self-concept. The questionnaire has questions asking people to describe themselves both as they would ideally like to be and as

they actually are. Rogers said that the self-concept will be positive when ideal self and real self are nearly alike.

Some humanistic psychologists believe that using a standardized assessment tool such as questionnaire, to measure personality is depersonalizing. Instead of forcing a person to respond to narrow categories, it is better to use tools like interviews and intimate conversations for a better understanding of each person's unique experiences.

14.3.4 Evaluating Humanistic Theories:

Just like Freud, Maslow and Carl Rogers also have had a tremendous impact on other psychologists. Their ideas have influenced counseling, education, child-rearing, and management. Unintendedly, they have also influenced today's popular psychology. But there has been some criticism for humanistic theories.

1. Humanistic psychology believes in tenets such as positive self-concept is key to happiness and success, acceptance and empathy nurture positive feelings about oneself, people are basically good and capable of self-improvement, humans are basically rational, socialized and forward moving (striving to be better), humans are constructive, trustworthy, and congruent when they are free of defensiveness. These ideas are well accepted in western cultures but not in all cultures.
2. Critics are of the opinion that humanistic theories are vague and subjective. For example, Maslow's description of self-actualizing people as open, spontaneous, loving, self-accepting and productive is not a scientific description. This description is merely a description of Maslow's own values and ideals, an impression of his personal heroes. However, if another theorist has another set of heroes such as Napoleon or Margaret Thatcher, he would probably describe self-actualizing people as "undeterred by others' needs and opinions", "motivated to achieve", and "comfortable with power". (M. Brewster Smith, 1978) . In other words, subjective ideas such as authentic and real experiences are difficult to objectify; an experience that is real for one individual may not be real for another person.
3. Humanistic psychology is not a true science because it involves too much common sense and not enough objectivity. Humanistic concepts are difficult to define operationally and test scientifically. These theories have been criticized for merely describing personality, rather than explaining it

4. Critics also objected to the idea that put by Rogers that the only thing that matters is the answer to a question, “Am I living in a way which is deeply satisfying to me, and which truly expresses me?” Critics said that this encouragement on individualism in humanistic psychology can be detrimental. Emphasizing on trusting and acting on one’s feelings, being true to oneself, fulfilling oneself can lead to self-indulgence, selfishness, and an erosion of moral restraints. Those who focus beyond themselves are most likely to experience social support, enjoy life and cope effectively with stress. However, humanistic psychologists defended themselves by saying that a secure, non defensive self-acceptance is the first step towards loving others. If people don’t love themselves, how can they love others.
5. There are those who believe humanistic theory falls short in its ability to help those with more severe personality or mental health pathology. While it may show positive benefits for a minor issue, using the approach of Rogers to treat schizophrenia would seem ludicrous.
6. Critics also say that humanistic psychology is naïve, i.e., lacking wisdom. It fails to appreciate the reality of our human capacity for evil. We are living in a world where we are facing the challenges of climate change, overpopulation, terrorism and the spread of nuclear weapons. In such a situation, it is most likely that we may lose optimism that denies the threat and we may drown in dark despair where we think it is hopeless to try to change the situation. Critics say that humanistic psychology does encourage the hope that is needed for taking action but it does not provide equally necessary realism about the evil and how to cope with it.

Check Your Progress:

1. Explain the concept of self-actualization given by Maslow.
2. Discuss Carl Rogers’ person-centered perspective to explain personality.
3. Critically evaluate Humanistic theories of personality.

14.4 SUMMARY

In this unit, we have discussed various theories of personality. We began with Freud’s theory of psychoanalyses in which he had explained the division of mind, personality structure divided into three parts – id, ego and superego, five psychosexual developmental stages of personality – oral, anal, phallic latency and genital stage, and based on the conflicts and anxieties faced during these developmental stages, people use various defense

mechanisms such as projection, reaction formation, denial, regression, rationalization and displacement. These defense mechanisms can be useful to alleviate anxiety, only if they are used in moderation. If they are used in excess they can lead to maladjustment.

However, Freud's theory has been criticized on various counts by Neo-Freudians as well as Humanistic psychologists. Though Neo-Freudians could not shake themselves away from Freud's ideas completely but they significantly held different views. They said that they don't completely agree with Freud's idea that sexuality explains everything. They either modified, extended or revised Freud's original psychoanalytic theory and emphasized the role of social, cultural and interpersonal factors also in shaping the personality. Some of the most well known Neo-Freudians are Alfred Adler, Karen Horney and Carl Jung. While Freud assumed that people have no choice in shaping their personality, Adler believed that people are largely responsible for who they are and they are driven by need reduce inferiority complex. Freud assumed that present behavior is caused by past experiences while Adler believed that present behavior is shaped by people's view of the future. Unlike Freud's emphasis on unconscious mind, Adler believed that psychologically healthy people are usually aware of what they are doing and why they are doing it.

Horney objected strongly to the concept of "penis envy", Oedipus complex, lack of confidence and an overemphasis on love relationships, and said that personality development has got very little to do with the anatomy of sex organs. She also believed that aggression is not inborn, but humans try to protect themselves by it. Similarly, she did not believe that conflict is inbuilt in human nature, rather she felt that it arises from social conditions.

Carl Jung also objected to the idea of Oedipus complex and infantile sexuality and emphasized on collective consciousness.

Maslow and Carl Rogers emphasized on looking at healthy and successful individuals while framing the tenets of personality theory and emphasized that human beings are inherently directed towards self-actualization. However, their ideas were also not without criticism.

14.5 QUESTIONS

1. Describe Freud's views on Personality.
2. Discuss in detail Neo-Freudian views of personality.
3. Discuss in detail various developmental stages of personality development and defense mechanisms used by people according to Psychoanalytic theory.
4. Critically evaluate Psychoanalytic theory and discuss the modern view of unconscious mind.
5. Discuss in detail humanistic psychologists view personality. What criticism they have faced?

14.6 REFERENCES

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



PERSONALITY - II

Unit Structure :

- 15.0 Objectives
- 15.1 Introduction
- 15.2 Trait theories
 - 15.2.1 Exploring and assessing traits
 - 15.2.2 Thinking critically about: how to be a “successful” astrologer or palm reader
 - 15.2.3 The Big Five Factors
 - 15.2.4 Evaluating Trait Theories
- 15.3 Social cognitive theories
 - 15.3.1 Reciprocal influences
 - 15.3.2 Personal control;
 - 15.3.3 Close-up: Toward A More Positive Psychology
 - 15.3.4 Assessing behaviour in situations
 - 15.3.5 Evaluating social-cognitive theories
- 15.4 Exploring the self -
 - 15.4.1 The benefits of self-esteem
 - 15.4.2 Self-Serving Bias
- 15.5 Summery
- 15.6 Questions
- 15.7 References

15.0 OBJECTIVES

After studying this unit, you should be able to understand -

1. Personality traits, how trait theories originated and how personality is measured
2. Why astrologers and others in the profession of future gazing should not be believed
3. The concept of Reciprocal determinism and personal control
4. The concept of Positive psychology
5. The concept of Self, Self-esteem and Self-serving Bias

15.1 INTRODUCTION

In the last unit, we have discussed some approaches to understand personality. In this unit, we are going to explore Trait Perspective, social cognitive approach to personality and we will be looking at self in detail. We will see how self-esteem is beneficial for us and how self-serving biases influence our behavior. We will also see how biology is linked to personality.

15.2 TRAIT THEORIES

15.2.1 Exploring and assessing traits

Instead of focusing on unconscious forces and hampered growth opportunities Trait theorists define personality in terms of traits - *traits*, which can be defined as habitual patterns of behavior, thought, and emotion. Traits are relatively stable over time, differ across individuals (e.g. some people are outgoing whereas others are shy), and influence behavior.

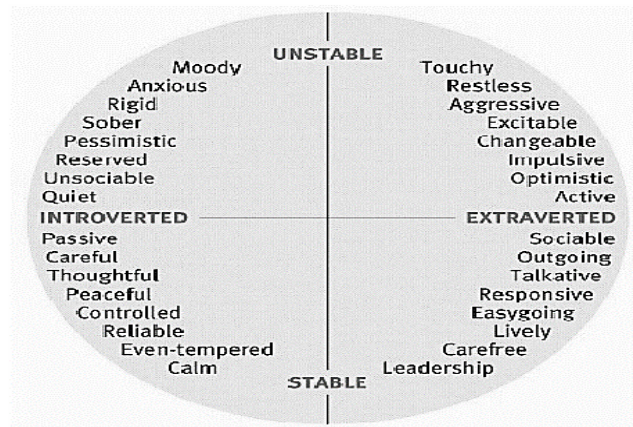
The seed of this approach was sown when in 1919, Gordon Allport, a young psychologist met Sigmund Freud, a renowned psychologist of that era, out of curiosity. During that meeting, Freud kept trying to find out what were Allport's hidden motives behind that meeting. That experience led Allport to describe personality in terms of traits. He was not interested in explaining the individual traits, rather he was more interested in describing these traits.

Exploring traits:

Each of us are a unique combination of multiple traits. The question arises which trait dimensions describe personality. Allport and Odbert (1936) counted all the words in a dictionary with which one could describe people. There were almost 18000 such words. It was necessary for psychologists to condense this list to a manageable number of basic traits. To achieve that they used a statistical technique called factor analysis.

Factor Analysis: It is a statistical procedure used to identify clusters of test items that represent basic components of a given trait. For example, people who describe themselves as outgoing also tend to like excitement and practical jokes and dislike quiet reading. Such a statistically correlated cluster of behaviors indicates a basic trait, in this example it is extraversion.

Fig.15.1



Hans Eysenck and Sybil Eysenck believed that by using factor analysis, we can reduce many of our normal individual variations to two or three dimensions such as extraversion-introversion and stability-instability. (Fig. 15.1)

Biology and Personality: There are many traits and mental states such as extraversion, intelligence, impulsivity, addictive cravings, lying, sexual attraction, aggressiveness, empathy, spiritual experiences, racial and political attitudes, etc. that can be studied with brain-imaging procedures. For example, studies using brain imaging indicate that extraverts seek stimulation because their normal brain arousal is relatively low and frontal lobe area involved in behavior inhibition is less active in them.

Similarly, studies have shown that our genes also significantly influence our temperament and behavioral style. For example, Kagan attributed differences in children's shyness and inhibition to their autonomic nervous system reactivity. If we have highly reactive autonomic nervous system, we respond to stress with greater anxiety and inhibition. On the other hand, the fearless, curious child may become the rock climbing or fast-driving adult. It has been found that not only humans but even animals have stable traits that shapes their personalities and by selective breeding, researchers can produce bold or shy birds.

Assessing Traits:

Once it was established that stable traits influence our behavior, the next question was how to measure these traits in most reliable and valid way. Many trait assessment techniques have been devised, such as personality inventories. Personality inventories are longer questionnaires covering a wide range of feelings and behaviors, i.e., they assess many traits at once. Some of these personality inventories are -

MBTI: Myers and Briggs devised a questionnaire with 126 questions based on Carl Jung's personality types. This questionnaire is known as Myers-Briggs Type Indicator (MBTI). It is available in 21 languages and is used mostly for counseling, leadership training, and work-team development. It counts the test-taker's preferences, labels them as indicating "feeling type" or "thinking type" and gives feedback to the test-taker in complimentary terms. For example, feeling type are told that they are sensitive to values, sympathetic and tactful, while thinking type are told that they prefer an objective standard of truth and are good at analyzing. Each type has its strengths, so everyone is affirmed. Though this test is popular in business and career counseling but it is not a good predictor of job performance.

Minnesota Multiphasic Personality Inventory (MMPI): This test was developed by Starke Hathaway et.al. (1960) originally to assess "abnormal" personality tendencies such as emotional disorders, but now it is used for many other screening purposes, such as work attitudes, family problems, and anger.

To construct this test, the MMPI items (questions) were empirically derived. Hathaway et.al. initially gave hundreds of true-false statements to groups of psychologically disordered patients and normal people. From a large collection of items, they retained only those questions on which both groups differed significantly. Then these questions were grouped into 10 clinical scales such as scales measuring depressive tendencies, masculinity-femininity, and introversion-extraversion.

Personality inventories are better measure of personality than projective tests discussed in previous unit, because projective tests have subjective interpretation while personality inventories can be scored objectively. In fact, so objectively that a computer can administer and score them. Yet these personality inventories do not guarantee high validity. For instance, people taking MMPI for employment purpose may not give truthful answers and may give socially desirable answers to create a good impression on the tester. To overcome this problem the MMPI has a lie scale and those who are not being very truthful may get high lie score revealing to the tester that test-taker has faked his answers. The objectivity of the MMPI has made it more popular than many other tests and it has been translated in more than 100 languages.

15.2.2 Thinking Critically about how to be a "successful" Astrologer or Palm reader:

For centuries now, psychologists have been wondering, can we predict personality traits, career of a person from his horoscope or can we be assured that marriage based on matching horoscope

will be successful and long-lasting. The answer to all these questions is “NO”. Research has shown that matching the horoscope is no guarantee that couple will be happy or well-adjusted with each other or that their marriage will last.

Similarly, graphologists (who make predictions from handwriting samples) have been found to be very often inaccurate in judging people’s personality and occupation from their handwritings. Yet, millions of people seek out these astrologers, palm readers and graphologists. The question arises how these people are able to fool so many people?

Ray Hyman (1981), a palm reader turned research psychologist revealed the tricks used by these people. Some of these tricks or suckering methods are –

1. Stock Spiel: This method is based on the observation that everyone in this world is different from everyone else and yet they are very similar. Since we are similar to others in many ways, when the astrologer/palm reader makes a generalized statement, it appears to be very accurate to the listeners. For example, he may say, “I sense that you worry about things more than you disclose, even to your best friends” or he may say, “I sense that you're nursing a grudge against someone; you really ought to let that go” or he may say, “you have a strong need for other people to like and to admire you, you have a tendency to be critical of yourself...”, etc. These are general statements that can be connected with personality traits. People accept the generalizations that are true of nearly everybody to be specifically true of themselves.

2. Barnum Effect: People have the tendency to accept potentially vague and over-generalized, unsupported information as true, especially if that information is flattering or favorable to them. This is called the Barnum effect. For several decades, psychologists have investigated the ‘Barnum effect’ (sometimes known as the Forer effect). This phenomenon occurs when people accept personality feedback about themselves because it is supposedly derived from personality assessment procedures. In other words, people fall victim to the fallacy of personal validation. People accept the generalizations that are true of nearly everybody to be specifically true of themselves. For example, Davies(1997) conducted an experiment, in which college students were given a personality test and then given false, generalized feedback for the test that they had taken. When that feedback was favorable and were told that it was prepared just for them, the students always rated that feedback as good or excellent. Studies showed that when favorable personality description was given as a feedback, students who were initially doubtful about astrology were more likely to accept the personality description as well as increased their

belief in astrology as a whole. In other words, those for whom astrological theory provided a more attractive self-portrait were more likely to express belief in the validity of astrologers.

3. Read: Astrologers keep their eyes open. They also use their other senses to judge a client on the basis of clothing, jewelry, mannerisms and speech. For example, if they see a lady dressed in expensive clothes longingly looking at the calendar on the wall with a happy child's photo, the astrologer can judge that lady is rich but does not have or has lost a child of her own.

4. Tell them what they want to hear: Astrologers start with some safe sympathy statements such as "I sense you are having some problems lately. You seem unsure what to do..." Then tell them what they want to hear. They memorize some Barnum statements from astrology manuals and use them liberally.

5. Gain a client's cooperation in advance: They tell clients it is their responsibility to cooperate by relating astrologer's message with their specific experiences. They emphasize that the success of reading their palm or horoscope depends as much upon client's sincere cooperation as upon astrologer's efforts. The clients will connect those statements with their experiences and later on they will think that astrologer predicted those specific details.

6. Fishing: They use the technique of fishing - a method for getting the client to tell the astrologer about himself/herself. One way of fishing is to phrase each statement in the form of a question. Then wait for the client to reply (or react). If the reaction is positive then the astrologer turns the statement into a positive assertion. Very often the client responds by answering the implied question and later forgets that he was the source of astrologer's information.

7. Good Listener: During the session, astrologer listen carefully to his client and later on, in different words, reveal to client what the client himself earlier revealed to the astrologer. He does not realize that what astrologer is saying is exactly what he had told the astrologer a few minutes ago. So, the saying goes, if you dupe the clients, they will come back. Another value of listening is that most clients who seek the services of a reader actually want someone to listen to their problems. In addition, many clients have already made up their minds about what choices they are going to make. They merely want support to carry out their decisions.

15.2.3 The Big Five Factors:

Personality Trait	Representative Traits	
	High	Low
Neuroticism	Emotional, insecure, moody, anxious, angry, depressed, embarrassed, worried	Self-confident, secure, assured, hopeful, encouraging
Extraversion	Talkative, assertive, energetic, social, gregarious, active, lively	Introverted, reserved, withdrawn, silent, inactive, unsocial
Openness to Experience	Curious, imaginative, creative, original, artistic, broad-minded	Stubborn, unimaginative, uncreative, narrow-minded, unoriginal
Agreeableness	Cooperative, forgiving, modest, tolerant, trustworthy, courteous, flexible, soft hearted, altruistic, sensitive	Aggressive, argumentative, suspicious, confrontational, impolite, inflexible, egoistic, insensitive
Conscientiousness	Organized, persistent, thorough, responsible, goal directed, careful	Disorganized, negligent, undisciplined, irresponsible, unsystematic, careless

Modern trait researchers believe that while simple trait factors such as Eysenck's' introverted-extroverted and unstable-stable dimensions are important but they do not cover the entire personality. Costa & McCrae (2009) felt that a slightly expanded set of factors, called the Big Five, does a better job of judging entire personality. The Big Five is the most popular trait theory in personality psychology in modern times, and since 1990s lot of research is being carried out on this theory. These Big Five factors are as shown in the above table.

Research has explored various questions related to Big Five. For example, psychologists wondered:

a.) How stable are these traits? Research shows that in adulthood, these traits are quite stable, with some tendencies (such as emotional instability, extraversion, and openness) decreasing or even disappearing a bit during early and middle adulthood, and some tendencies (such as agreeableness and conscientiousness) rising. Conscientiousness increases most during people's 20s while agreeableness increases during people's 30s and continues to increase through their 60s (Srivastava et.al.2003)

b.) Psychologists were curious to know whether these traits are heritable. It is found that individual differences in each of Big Five factors are attributable to genes up to 50% or little more. Many genes combine to influence our traits. It is also found that certain brain areas are also associated with the various Big Five traits. For example, frontal lobe area is sensitive to reward and is larger in extraverts.

c.) Another question that psychologists asked was, do the Big Five traits predict other behavioral attributes? The answer is yes. For example:

i) Shy introverts are more likely than extraverts to prefer communicating by e-mail rather than face-to-face (Hertel et.al.,2008)

ii) Highly conscientious people earn better marks. They are also more likely to be morning type persons, that is, they get up early in the morning and are fully alert and full of energy in the morning. Evening types are more likely to be extraverted.

iii) People low on agreeableness, stability and openness are more likely to suffer marital and sexual satisfaction.

iv) Big Five traits influence our written language use also. For instance, in text messaging, extraverted people use more of personal pronouns, people high on agreeableness use more of positive emotion words, and those high on neuroticism (emotional instability) use more of negative emotion words.

15.2.4 Evaluating Trait Theories:

The question arises whether research supports the consistency of personality traits over time and across situations. Is our behavior influenced by the interaction of our inner traits with environment? If yes, which is more important – the traits or the environment? Research shows that as people grow older their personality traits stabilize. Their interests, careers, relationships

may change, but their personality traits do not change. It is also empirically recognized that our traits are socially significant. They influence our health, our thinking and our job performance. Longitudinal studies have shown that our mortality, divorce and occupational attainment can be predicted on the basis of our personality traits. Even though our personality traits are stable over time and do influence our behavior, the specific behavior of the people differs from situation to situation. People do not act with predictable consistency. For example, a person will display much more confidence, an outgoing social behavior in a familiar situation when he is with his friends than when he is in unknown, hostile circumstances. However, people's average outgoingness, happiness or carelessness over many situations can be predicted (Epstein, 1983a,b).

Research also shows that we do have genetically influenced traits. And those traits remain in hidden form in our music preference, our preferences in our personal space such as homes or offices, familiar or unfamiliar, formal or informal situations, personal websites, and even e-mails. For instance, it is found that in case of Music preference classical and folk music lovers tend to be open to new experiences and have high verbal intelligence. Religious music lovers tend to be cheerful, outgoing and conscientious (Rentfrow & Gosling, 2003,2006)

Personal Space – Our personal space shows our identity and leaves a behavioral residue. A quick inspection of anyone's room can tell about that person's conscientiousness, openness to new experiences, and even emotional stability (Gosling et.al.2002, 2008).

Personal Website – Personal website or a Facebook profile of a person can reveal that person's extraversion, conscientiousness and openness to new experiences. Even just pictures of people, their clothes, expressions and postures can give us clues about their personality (Naumann et.al. 2009).

E-mail – We can detect personality traits such as extraversion and neuroticism, of people from the writing voice in their e-mails or even blog writing. For example, extraverts use more of adjectives.

Unfamiliar, Formal Situations - When we visit as a guest, the home of a person from another culture, our traits remain hidden as we carefully attend to social cues. In familiar informal situations such as just being with friends, we feel less restricted and allow our traits to emerge (Buss,1989). In informal situation, our expressive styles, our way of speaking and gestures are very much consistent. For instance, Bella DePaulo et.al.(1992) conducted an experiment to evaluate people's voluntary control over their expressiveness.

She ask participants to be either expressive or inexpressive while stating opinions. She found that inexpressive people, even when pretending to be expressive, were less expressive than expressive people who were acting naturally. Similarly, expressive people while trying to pretend to be inexpressive, were less inexpressive than inexpressive people who were acting naturally. It shows that it is difficult to be someone you are not or not to be who you are.

So, to summarize we can say that at any moment the immediate situation (especially strong situation) powerfully influences a person's behavior. For instance, while driving all drivers will stop at red light irrespective of their personality traits. But if we average our behavior across many situations, it does reveal our distinct personality traits.

15.3 SOCIAL COGNITIVE THEORIES

Social cognitive perspective on personality was proposed by Albert Bandura. He said that just like nature and nurture always work together similarly, individuals and their situations also work together. Our behavior is influenced by our learning (social part learnt through conditioning/observing/imitating) and what we think (mental process or the cognitive part) about the situation. It is the way we interpret and respond to external events. Our schemas, memories and our expectations influence our behavior patterns. So let us see some of these influences.

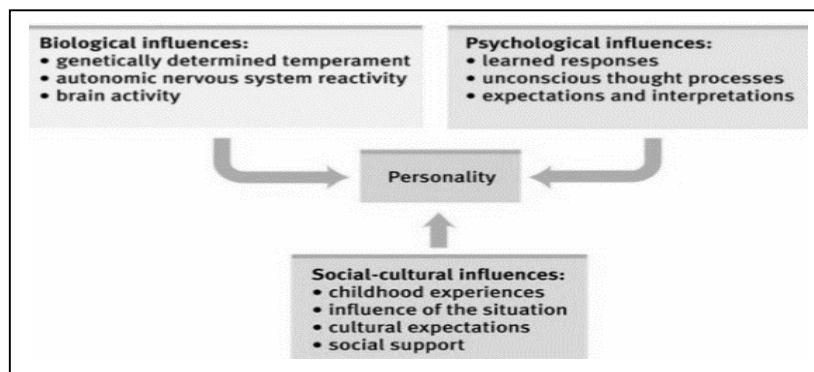
15.3.1 Reciprocal Influence:

Bandura viewed the person-environmental interaction as reciprocal determinism. A person's behavior both influences and is influenced by personal factors and the social environment, e.g., a child's T.V. viewing habits(past behavior) influences his viewing preference(an internal factor) which will influence how TV(an environmental factor) affects his current behavior. These influences are mutual. There are 3 specific ways in which individuals and environments interact-

- a.) **Different people choose different environments:** The kind of programs you watch on TV, the kind of friends you choose, music you listen to, etc. are all part of an environment you have chosen based partly on your nature or personality. First you choose your environment and then it shapes you.
- b.) **Our personalities shape how we interpret and react to events:** For example, anxious people are more receptive to potentially threatening events. They perceive the world as threatening and react accordingly.

- c.) **Our personalities help create situations to which we react:** How we view and treat other people influences how they in turn treat us. If we expect someone to ignore us, we may give that person a cold shoulder, and in return that person may snub us as we expected. On the other hand, if we have an easygoing positive temperament, we are more likely to enjoy close, supportive friendships. Thus, we are both the product and the architects of our environment. Behavior is an interplay of external and internal influences. See figure 15.2

Fig.15.2



15.3.2 Personal Control:

Personal control refers to whether we see ourselves as controlling or being controlled by our environment. When we believe that we control our environment it is known as internal locus of control and when we believe that we are controlled by our environment, it is called external locus of control. Let us see how these beliefs affect us.

a) Internal vs. External Locus of Control:

Those who have internal locus of control believe that whatever happens to them is chosen by them or is due to their efforts. They believe that they are successful due to their hard work and not because of their fate. On the other hand, people with external locus of control believe that whatever happens to them due to their destiny or other external factors, they have no control over them.

Research studies have shown that people having internal locus of control get better marks, are more independent, have better health, are less depressed, and are better in delaying gratification and coping with stressors including marital problems (Miller & Monge, 1986). Such people learn better, perform better at work and are more helpful. Another study found that children who expressed internal locus of control at the age of 10 had less obesity, hypertension and distress at the age of 30.

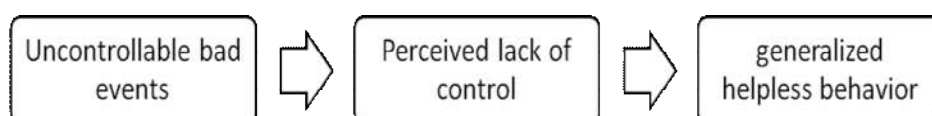
b) Depleting & Strengthening Self-Control:

Self-control refers to the ability to control impulses and delay gratification. People with high self-control have good adjustment, better marks and social success. Students who plan their day's activities and then stick that plan are less likely to be depressed later on. Baumeister & Exline (2000) held that self-control is like a muscle. It temporarily becomes weak after exertion, gets strong again after rest and becomes stronger with exercise. If we use willpower, it temporarily uses up our mental energy needed for self-control on other tasks. It even uses up blood sugar and neural activity associated with mental focus. For example, experiments showed that hungry people who had resisted the temptation to eat chocolate biscuit gave up sooner on a tedious task later than those who had not resisted and eaten chocolate biscuit. Similarly, people who had used up their mental energy in trying to control their prejudices were less restrained later in being aggressive in response to provocations. They were less restrained in their sexuality after spending willpower on laboratory tasks. However, it was also found that their effortful thinking improved if they were given energy-boosting sugar.

Self-control requires attention and energy. People who practice self-regulation through physical exercise and time-management develop self-regulation capacity. People with strengthened self-control have better self-management in eating, drinking, smoking and household chores (Oaten & Cheng, 2006a,b). In other words, if we develop self-discipline in one area of our lives, this strengthened self-control spills into other areas of life as well. We can grow our willpower muscle by using some willpower.

c) Learned Helplessness vs. Personal Control:

People with external locus of control often feel helpless and oppressed. This perception deepens their feeling of resignation. For example, an elephant who had been shackled right from childhood develops a feeling of helplessness and later on when it becomes strong enough to break the chain and free itself, still does not do it due to learned sense of helplessness. Similarly, among human beings also, when people are repeatedly faced with traumatic events over which they have no control, they start feeling helpless, hopeless and depressed. This is called learned helplessness.



We feel shocked in an unfamiliar culture due to reduced sense of control, we are not sure how others will respond to us. People in prisons, factories, colleges and nursing homes

experience lower morale and increased stress due to lack of control over their environment. Studies showed that when prisoners were allowed to move chairs and control room lights and TV, their health and morale went up. Similarly, when factory workers were allowed to participate in decision making and were allowed to personalize their workspace, their work engagement went up, and when patients in nursing homes were offered choices about their environment and allowed to exert more control over their environment, it significantly improved their health and morale. They became more happy, alert and active.

These studies showed that people thrive when they are given personal freedom and empowerment. This is the reason why people in stable democracies report higher levels of happiness. It shows in their body language also, e.g., even poor people in democracy feel empowered and often laugh more, sit upright rather than slumped. However, Barry Schwartz (2000,2004) concluded from his study that excess of freedom in today's Western cultures leads to decreasing life satisfaction and increases depression and sometimes decisional paralysis. For instance, research showed that people express dissatisfaction when they choose jam or chocolate out of 30 brands than those who choose jam/chocolate out of only 12 brands. The tyranny of choice brings information overload and the chances are more that we will regret over some of the unchosen options and feel dissatisfied.

d) Optimism vs. Pessimism:

Optimism and Pessimism refers to attributional style of the people, their characteristic way of explaining positive and negative events. For instance, if a student fails, he may attribute his failure to his lack of ability or to situations that were beyond his control (Pessimism). Such a student is more likely to continue getting low marks than those who adopt more helpful attitude that hard work and good study habits and self-discipline can make a difference. Similarly, in dating couples, optimists and their partners feel more supported and satisfied with their relationships. Expect good things from others and you will get what you expect is the assumption.

e) Excessive Optimism:

Though positive thinking is beneficial when we are faced with difficulties in life, but realism is equally important. One should not be overly optimistic. Realistic anxiety over possible failure can lead us to put in more energetic efforts to avoid such a failure. A student who is realistically anxious about upcoming exam will study more and make sure that he passes the exam compared to a student who is over confident and does not study much. Studies have indicated that Asian American students show higher pessimism than European-American students. That is why Asian American students have higher academic achievements. To be

successful you need to have enough optimism to give you hope that you can succeed and there should be enough pessimism to prevent complacency. Remember the story of hare and tortoise. Hare was too optimistic and very low on pessimism.

Excessive optimism can blind us to real risks. This an unrealistic optimism about future life events gets fueled by our natural positive thinking bias. For example, most teenagers who are rash drivers see themselves as less vulnerable to meet with the accidents than other average teenager rash drivers. If we are overconfident of our ability to control an impulse such as the urge to smoke, we are more likely to expose ourselves to temptations, and to fail. That is why, you must have often heard smokers to say confidently, "there is nothing much to giving up smoking I have done it many times". Those who optimistically deny the power and effects of smoking, get into failed relationships, outwit themselves in many other ways and ring the truth of "blind optimism can be self-defeating".

People also show illusory optimism about their groups. For example, in all IPL matches, we keep guessing that our cricket team has better chance of winning than the other teams even though other teams may be known to be strong. Even when we ourselves are getting prepared to get feedback such as our results from the exams given, we tend to assume that we will pass irrespective of how did we fare in our exams. This is due to natural positive-thinking bias. Similarly, when the match is coming to an end, we are more doubtful of our team winning especially if our team has been ahead than when our team was fairing worse than the other team. Positive illusion also vanishes after a traumatic personal experience. For example, Americans were living with positive illusion that terrorism will not touch their lives till 9/11 happened.

f) Blindness to One's Own Incompetence:

It is rather ironic that most people are most overconfident when they are most incompetent. Justin Kruger and David Dunning(1999) said it takes competence to recognize competence. Our ignorance of what we don't know helps in sustaining our confidence in our own abilities. This ignorance about our own abilities becomes part of our self-concept and then our self-assessment also influences how we perceive ourselves doing. So it is important to ask someone else also to assess our competence and predict our future performance. For example, if you want to assess your leadership abilities, don't assess yourself, ask your batch mates to judge your leadership abilities.

15.3.3 Close-Up: Toward a More Positive Psychology:

Martin E. P. Seligman (2004) has been proponent of positive psychology. Positive psychology can be defined as The scientific study of optimal human functioning. It aims to discover and promote strengths and virtues that enable individuals and communities to thrive.

Positive psychology is an umbrella term for the study of positive emotions, positive character traits and enabling institutions.

- a.) Positive emotion is a combination of satisfaction with the past, happiness with the present, and optimism about the future. Seligman stated that happiness is a by-product of a pleasant, engaged and meaningful life.
- b.) The Positive character focuses on exploring and enhancing creativity, courage, compassion, integrity, self-control, leadership, wisdom and spirituality. Seligman stated that positive psychology is about building not just a pleasant life, but also a good life that engages one's skills, and a meaningful life that points beyond oneself.
- c.) Positive groups, communities and cultures, seek to foster a positive social ecology. This includes healthy families, communal neighborhoods, effective schools, socially responsible media and civil dialogue.

Positive psychologists hope that positive psychology will be able to build healthy minds and cure mental diseases. Just like Humanistic psychology positive psychology also believes in advancing human fulfillment but its methodology is scientific.

15.3.4 Assessing Behavior in Situations:

Social cognitive theories do not believe that future behavior can be predicted by administering a personality test or through an interviewer's intuition. They believe that future behavior of a person, in any given situation, can be predicted by looking at the person's past behavior patterns in similar situation, e.g., the best predictor of future aggressiveness is past aggressiveness and the best predictor of future job performance is past job performance. If it is not possible to check the past performance of a person to predict his future performance, then we need to create an assessment situation that simulates the task that a person will have to perform on actual job. For instance, to assess a candidate for spy mission, The U.S. Army psychologists made candidates go through simulated undercover conditions. They tested their ability to handle stress, solve problems, maintain leadership, and withstand intense interrogation without blowing up their cover.

This method is time consuming and expensive, but it predicts future behavior more accurately. Seeing the success of simulated method, similar method called assessment center had been developed and is extensively used by military, educational institutes and Fortune 500 companies.

15.3.5 Evaluating Social-Cognitive Theories:

Social cognitive theories are based upon psychological research conducted in the field of learning and cognition. These theories sensitize researchers to how situations affect and how situations are affected by individuals.

Critics of social cognitive theories however argue that these theories give too much importance to situations and do not give much attention to person's inner traits. For instance, a person's unconscious motives, emotions, and general personality traits, biologically influenced traits.

15.4 EXPLORING THE SELF

For more than a century now, psychologists have been vigorously researching the concept of self. There are many studies that have studied topics like self-esteem, self-disclosure, self-awareness, self-schema, self-monitoring, etc. Even neuroscientists have identified a central frontal lobe region in brain that gets activated when people answer self-reflective questions related to their personality traits. The self generates so much interest among researchers because it is assumed that the self as an organizer of our thoughts, feelings, and actions is the center of personality.

Possible selves: Hazel Markus et.al. proposed that when people think about self, they think about their possible selves. Possible selves include a person's vision of the self that he dreams of becoming, e.g., rich self, successful self, loved and admired self, etc. as well as vision of self that he fears of becoming, e.g., the unemployed self, lonely self, failed self, etc. Such possible selves motivate people to set specific goals to be achieved and also to muster up energy to work towards those goals.

Spotlight Effect: When we are self-focused, we easily tend to assume that others are noticing and evaluating us, e.g., a conservative lady, wearing a swim suit for the first time feels self-conscious and assumes that everybody in the swimming pool is watching her. While in reality very few people may have noticed her. There are very few people who notice any variations in our appearance and performance (Gilovich et.al.,2002), our nervousness, irritation or attraction. In fact, even when we make a mistake such as wearing creaky shoes and reaching late for a class, dropping books with a loud noise in library, the number of

people who notice those blunders are far less than what we assume. If you know about this tendency of spotlight effect, it can empower you. For example, if a public speaker understands that his nervousness is not obvious to his audience, his speaking performance will improve.

15.4.1 The Benefits of High Self-Esteem:

Having high self-esteem can be advantageous. For instance, people with high self-esteem:

- Have less sleepless nights
- Do not easily give in to pressures to conform
- Are more persistent at difficult tasks
- Less shy, anxious and lonely.
- Are much happier than others. If they feel bad, they believe that they deserve better and make more efforts to repair their mood.

Effects of Low Self-esteem:

People with low self-esteem tend to be oversensitive and judgmental (Baumgardner et.al.1989).Even if people's self-image is temporarily deflated, they are more likely to belittle others or to express heightened racial prejudice (Ybarra,1999).People with low self esteem are insecure and often become highly critical of others, as if they want to impress others with their own brilliance (Amabile,1983).

Maslow and Rogers proposed that a healthy self-image is beneficial for our growth and happiness. If we accept ourselves as we are, it is easier for us to accept others. If we belittle ourselves, we tend to criticize and reject others also.

15.4.2 Self-Serving Bias:

Carl Rogers (1958) stated that most of the people "despise themselves, regard themselves as worthless and unlovable". Mark Twain seconded his opinion and said, "No man, deep down in the privacy of his heart, has any considerable respect for himself". However, later research indicated exactly the opposite of Rogers' and Mark Twain's views. Research studies done on self-esteem indicated that actually people have a good reputation of themselves. Even low scoring people responded in midrange of possible scores, e.g., a low self-esteem person will respond to statements such as "I have good ideas" by saying "I have somewhat good ideas" while a person scoring high on self-esteem will simply say that "I have good ideas". Modern psychologists believe that people with low self-esteem also respond positively about themselves due to self-serving bias. Self-serving bias can be defined as our readiness to perceive ourselves favorably, accepting more responsibility for success than failure, for good deeds than bad.

A self-serving bias is any thought or perception that is distorted by the need to maintain and enhance self-esteem, or the tendency to perceive oneself in an overly favorable manner. Individuals tend to attribute their success to their own abilities and efforts, but attribute their failure to external factors. When individuals reject the validity of negative feedback, focus on their strengths and achievements but overlook their faults and failures, or take more responsibility for their group's work than they give to other members, they are protecting their ego from threat and injury.

These cognitive and perceptual tendencies perpetuate illusions and error, but they also serve the self's need for esteem. For example, a student gives credit to his own intelligence and preparation when gets good marks in an exam, but if he gets low marks, he blames external factors such as that the teacher did not teach properly or teacher does not know how to teach or question paper was not set properly, etc. Thus, he shows his self-serving bias. Research studies have shown that self-serving bias plays a dominant role in various situations, such as the workplace, interpersonal relationships, sports, and consumer decisions, driving behavior, etc. For instance, a driver will always say that I was driving properly, it is the other driver who was rash and smashed his car into mine, or that pedestrian was not looking carefully while crossing the road.

Most people see themselves as better than average, especially when the behavior is socially desirable. For example, studies have shown that 90% managers and more than 90% professors rate their performance as superior to that of their average peers. Similarly, most business managers say that they are more ethical than their average counterparts. This phenomenon of overestimating self and underestimating others is more common in western countries. It is less prevalent in Asian countries because in Asian culture modesty is valued. It does not mean that it is totally absent in Asian countries. Self-serving bias is a worldwide phenomenon. Pronin (2007) commented that the irony is that most of the people think that others suffer from self-serving bias and they themselves are immune to it, but the reality is that all of us suffer from self-serving bias. Daniel Gilbert (2006) rightly said that "if you are like most people, then like most people, you don't know, you are like most people.....one of the most reliable of these facts is the average person doesn't see herself as average".

Some additional findings from research on self-serving bias are:

- a.) People remember and justify their past actions in self-enhancing ways.
- b.) People show an inflated confidence in their beliefs and judgments.

- c.) In situations, where most of people behave in less desirable manner, we overestimate how desirable we would act.
- d.) People are quicker to believe flattering descriptions of themselves rather than unflattering ones, and they are impressed with psychological tests that make them look good.
- e.) People tend to enhance their self-image by overestimating the commonality of their weaknesses and by underestimating the commonality of their strengths.
- f.) We tend to believe that our contribution to our group task is better than average. Since every member of the group believes that his/her contribution to group task is better than average, group members' self-contribution estimates are usually higher than 100%.
- g.) We display group pride, that means, that we have a tendency to see our group as superior than others' group.

The Dark Side of Self-serving Bias/ High Self-Esteem:

Self-serving bias can be a major root cause for conflicts in interpersonal relationships or even at world forum, e.g., people tend to blame their spouse for marital discord, or they arrogantly believe and promote their own ethnic superiority (e.g., Nazis believed in "Aryan Pride" and committed atrocities on Jews.) when their self-esteem is threatened, people with large egos, not only run down other people but also react violently. Self-serving biases have the potential to initiate wars and can make ending war more difficult.

Self-serving bias is not restricted to adults only, one can see these tendencies even in children. Most of the fights among children take place, when children with high self-esteem face social rejection. Children with high self-esteem tend to be more aggressive, when other children dislike them and that hurts their ego. Similarly, teenagers or adults who have very high opinion about themselves become potentially very dangerous if their ego is deflated by an insult, e.g., if a boy with very high opinion about himself proposes to a girl and girl out rightly rejects him and may even insult him, he will be become potentially very dangerous for that girl. Brad Bushman & Roy Baumeister (1998) called it "the dark side of high self-esteem". Their experiment showed that threatened egotism, more than low self-esteem, inclines a person towards aggression. When people are encouraged to feel good about themselves when they have not earned it seems to create problems. Baumeister (2001) said, "Conceited, self-important individuals turn nasty toward those who puncture their bubbles of self-love".

In western culture as well as in Asian culture, from 1980s onwards, popular songs have been emphasizing that one should be self-focused and should have high self-esteem to succeed in life. Research shows that college going students are getting influenced

by these songs and their self-esteem has gone up several notches but the adverse effect of increasing self-esteem is that people have correspondingly gone down on empathy. People with high self-esteem do not see things from others' perspective or do not have tender, concerned feelings for people less fortunate than them (Konrath et.al. 2011).

Jean Twenge (2006;2010) reported that modern generation – generation Me shows more narcissism than previous generation. Narcissists are people who believe they are superior than others or that they are special people. Narcissism is closely related with materialism, the desire to be famous, inflated expectations, more hookups with less committed relationships, more gambling and more cheating. All these characteristics are on the rise in modern generation as narcissism is rising.

Use of Self- Disparage:

The question arises that if self-serving bias is so common then why do so many people undervalue themselves. Research shows that people undervalue themselves for four reasons:

- a.) Sometimes self-directed put-downs are subtly strategic. They extract reassuring comments from others, e.g., if somebody says “No one likes me”, the other person may respond by saying, “But not everyone has met you”.
- b.) Before a game or an exam, self-belittling statements prepare us for possible failure. If somebody tells you that in an upcoming game your opponent is a very strong one, then if you lose the game, it does not hurt your ego. You blame your losing a game to the unfairness of the competition that is superior strength of your opponent. On the other hand, if you win the game, it enhances your ego that in spite of having a strong opponent you have won the game.
- c.) Self- disparaging comments such as “How could I be so stupid” also helps you to learn from your mistakes.
- d.) Very often, Self -disparagement is related to one's old self. When people asked to remember their really bad behaviors, they recall things from long ago while good behavior is recalled from recent past. For example, a person may say I used to short- tempered when I was a teenager but now I have cooled down as I have matured. Wilson & Ross(2001) rightly pointed out that people are much more critical of their distant past selves than of their current selves- even when they have not changed.

While researchers acknowledge the dark side of self-serving bias and self-esteem, they also point out that we have two types of self-esteem having two distinct effects.

- a.) **Defensive self-esteem:** It is fragile and focuses on sustaining itself, which makes failures and criticism feel threatening. This perceived threat leads to anger and disorders.
- b.) **Secure Self-esteem:** It is less fragile and less dependent on external evaluations. People with secure self-esteem feel accepted for who they are and not for their looks, wealth or acclaim. They are not under pressure to succeed and focus beyond themselves. One can gain secure self-esteem by losing oneself in relationships and purposes larger than self.

Check your Progress:

Write a detailed note on –

- a.) Assessing traits
- b.) The Big Five
- c.) Reciprocal Influences
- d.) Exploring Self
- e.) Self-serving Bias

15.5 SUMMARY

In this unit, we talked about how trait theories originated with Allport's meeting with Freud. Trait theorists had a herculean task of reducing the list of thousands of traits describing human personality into manageable basic traits. For this they used the method of factor analysis. We also looked at how our autonomic nervous system and genes can influence our traits and shape our personalities. The most popular trait theory now days is Big Five that speaks of five traits that describes entire hue of personality. While evaluating trait theories, we looked at the person-situation controversy and found that both are important. Our personality traits also influence our behavior in different situations and if situation is very strong, then situation influences our behavior rather than traits. Out of this controversy originated social cognitive theories.

Social cognitive theories talked about reciprocal determinism and personal control. In personal control, we talked about locus of control, techniques to strengthen self-control, learned helplessness vs. personal control, pessimism and optimism and blindness to one's own incompetence.

We shortly touched upon on benefits of positive psychology and the evaluation of social cognitive theories.

While exploring the self we touched upon the benefits of self-esteem and how self-serving bias protects our self-esteem. However, there can be both advantages and disadvantages of self-serving bias. It can make us narcissist if overused and it can protect our ego if we use self-disparage.

15.6 QUESTIONS

1. Describe in detail and evaluate trait theories.
2. Discuss in detail The Big Five Factors and evaluate trait theories.
3. Write a detailed note on –
 - a) Techniques used by successful Astrologers or Palm readers
 - b) Reciprocal Influences
 - c) Internal vs. External locus of control
 - d) Depleting and strengthening Self-Control
 - e) Learned Helplessness
 - f) Optimism vs. Pessimism
 - g) Positive Psychology
4. Discuss in detail personal control from social-cognitive psychology point of view.
5. Why psychologists have been doing extensive research on self and how self-esteem is beneficial to us.
6. Discuss in detail self-serving bias and how it protects our self-esteem.

15.7 REFERENCES

- 1) Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
- 2) Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian sub-continent adaptation). New Delhi: Dorling Kindersley (India) pvt ltd.



STATISTICS IN PSYCHOLOGY: UNDERSTANDING DATA

Unit Structure :

- 16.0 Objectives
- 16.1 Introduction
- 16.2 Why do Psychologists use Statistics?
- 16.3 Descriptive Statistics
 - 16.3.1 Frequency Distributions
 - 16.3.2 Histogram
 - 16.3.3 Frequency Polygon
- 16.4 Measures of Central Tendency: Mean, Median, Mode
- 16.5 Measures of Variability: Range, SD
- 16.6 Z – Scores and the Normal Curve
- 16.7 The Correlation Coefficient
- 16.8 Inferential Statistics
- 16.9 Summary
- 16.10 Questions
- 16.11 References

16.0 OBJECTIVES

After studying this unit, you should be able to:

- Understand as to why psychologists use statistics
- Know the various descriptive measures of Statistic
- Know the various measures of central tendency
- Understand the measures of variability, the concept of Z-score and the normal curve
- Understand the concept of inferential statistics as well as the concept of correlation coefficient.

16.1 INTRODUCTION

Statistics and Psychology are intimately connected. Psychology is research oriented. Research requires application of statistical knowledge to summarize the data and to draw certain valid inferences or conclusions. Statistics deals with the method of

collecting, organizing, classifying, analyzing and interpreting numerical data. Statistics is divided into two broad fields: Descriptive Statistics and Inferential Statistics. In this unit, we would discuss the uses of Statistics for Psychologists. Following this we would discuss the Descriptive and Inferential Statistics and topics associated with it.

16.2 WHY DO PSYCHOLOGISTS USE STATISTICS?

Psychologists use statistics for multiple purposes. Some of which are briefly outlined below:

1. Knowledge of statistics helps us in our understanding of issues related to applied and theoretical research.
2. Statistics helps us to summarize the data so as to study the patterns in the given data. The branch of statistics that deals with organizing numbers and summarizing them so that patterns can be determined is called as Descriptive Statistics.
3. Statistics helps us to make scientific interpretations and draw valid inferences. The field of statistics which deals with drawing valid and scientific inferences is called as Inferential Statistics.
4. Knowledge of Statistics helps in measuring /quantifying human characteristics or abilities.
5. Statistics is of great use in identifying the general pattern of the set of scores. Besides identifying we can also tabulate and make graphic representations of the sets of scores (e.g., Results of Students in a given class for Example XII).
6. It gives an idea as to how each individual's own performance in each area compares with his performance in other areas. For e.g., how has Meena done in Paper IV as compared to Paper V. This going togetherness is known as a measure of correlation.
7. Distribution of scores, also, tells us something about the test or the question paper. For e.g.: Are the scores evenly distributed, too easy or too difficult or do they vary uniformly or differently.
8. It can help us to get the standing of each individual, to see how he/she has performed on each test. This requires a common yardstick to express performance in two different areas.
9. Statistics gives an idea about the average level of a group, makes comparison possible, and gives the typical level of performance in the group. For e.g., how have the 8th standards done on the Math's test?

16.3 DESCRIPTIVE STATISTICS: FREQUENCY DISTRIBUTIONS

Descriptive Statistics refers to various methods of organizing, summarizing, and presenting data in an informative way. Descriptive Statistics is that statistics that is used to describe the given data in a summarized manner. We can summarize the data by using either the numerical method or the graphic method.

Descriptive Statistics includes the following:

- a. Frequency Distribution, histogram and Frequency Polygon, the normal curve and other distribution types.
- b. Measures of Central Tendency (i.e., Mean, Median, Mode).
- c. Measure of Variability (Range, Quartile Deviation, Average Deviation, and standard Deviation).
- d. Measure of Relationships.

However, in this part of the unit we are focusing only on Frequency Distribution and related concepts.

16.3.1 Frequency Distribution:

A frequency Distribution is a method of presenting the data in a summarized form. Frequency distribution can be constructed by determining how often (with what frequency) various scores occur. The other way is to set up the categories or classes and check the occurrences of scores in each category or class. Some frequency distribution tables include an extra column that shows the percentage of cases in each category. Frequency distributions are presented as frequency tables, histograms or polygons.

The advantages of using frequency distribution are:

1. Frequency tables help in organizing raw data in such a way that information makes sense at a glance.
2. Frequency tables can help to identify obvious trends within a data set and can be used to compare data between data sets of the same type.
3. Frequency tables are easy to interpret and they can display a large data sets in a fairly concise manner.
4. Frequency tables are used to present a frequency distribution visually, with graphs.

Let us see an example of how frequency distribution table looks for students scoring marks on psychology test

Table 16.1: Raw Data

91	84	80	77	75
72	75	93	73	81
81	91	64	92	82
62	94	84	71	87
62	77	94	89	83
93	83	86	88	84
82	90	86	88	84
83	91	84	92	94

Table No. 2: A Frequency Distribution Table

Scores on Test	Frequency (f)
94	3
93	2
92	2
91	3
90	1
89	1
88	2
87	1
86	2
84	5
83	3
82	2
81	2
80	1
77	2
75	2
73	1
72	1
71	1
64	1
62	2

16.3.2 Histogram:

Histogram is a graph that represents the class frequencies in a frequency distribution by vertical adjacent rectangles. It is the most widely used methods of a frequency distribution. The purpose of a histogram is to show the frequencies within class graphically. In a histogram, it is assumed that scores be spread uniformly over their intervals. The frequencies within each class interval of a histogram are represented by a rectangle. The base of which equals the size of the class interval and the height of which equals the number of scores (f) within that interval.

The histogram has following special features:

1. The area of the histogram corresponds to the total (N) of the distribution
2. The area of each bar in a histogram corresponds to the frequency within a given interval.
3. The class intervals shown at the x axis in histogram do not have any gaps. They are continuous and always touch. For example, if we want to draw a histogram of above table, then on x axis, for class interval 50-59 we will begin with 49.5 -59.5, then 59.5 - 69.5 and so on.
4. The bars are always vertical.

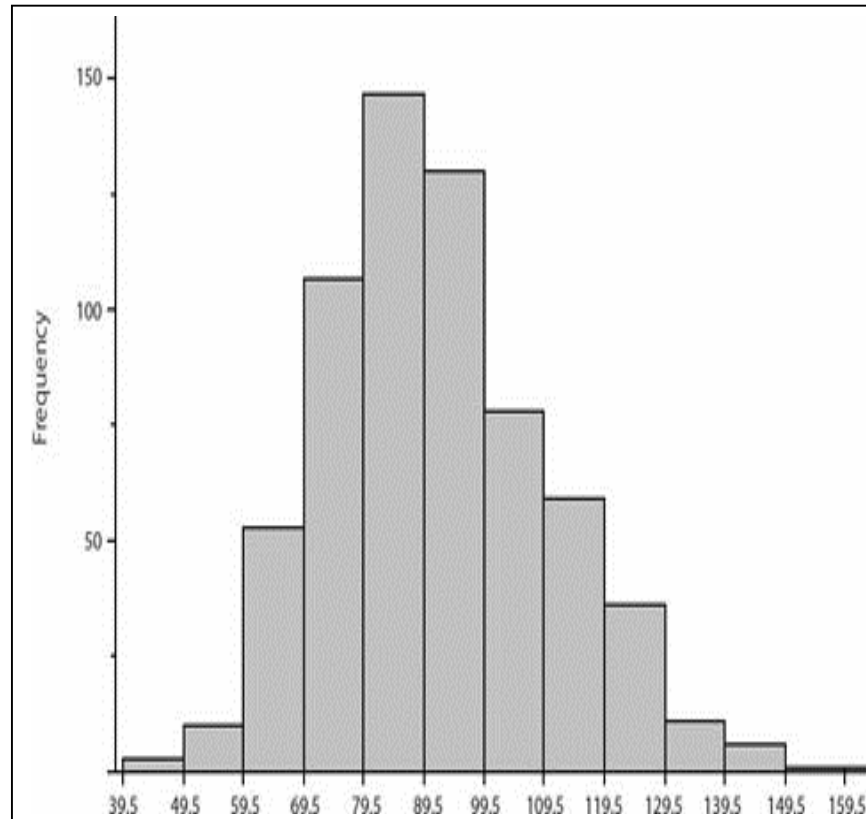
To plot a histogram the first step is to create a frequency table. Let us take an example to plot a histogram from the following frequency table

Table No. 3 Frequency Table

Histogram

Interval's Lower Limit	Interval's Upper Limit	Frequency
159.5	169.5	1
149.5	159.5	1
139.5	149.5	6
129.5	139.5	11
119.5	129.5	36
109.5	119.5	59
99.5	109.5	78
89.5	99.5	130
79.5	89.5	147
69.5	79.5	107
59.5	69.5	53
49.5	59.5	10
39.5	49.5	3

Fig. 1



16.3.3 Frequency Polygon:

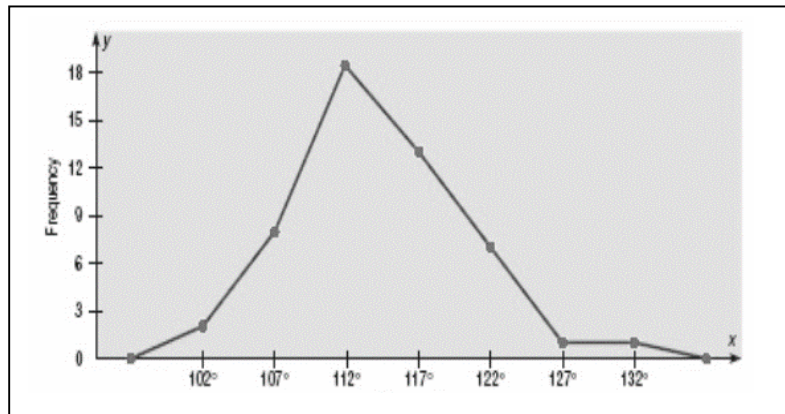
A frequency polygon is also a graphical presentation of frequency distribution. It is a line graph showing a frequency distribution. The basic difference between histogram and frequency polygon is that in histogram, it is assumed that all scores in a given class interval are spread uniformly over that class interval, while in a frequency polygon, we assume that all scores in a given interval are concentrated at the midpoint of that class interval. In other words, while plotting a frequency polygon, the midpoint of an interval is always taken to represent the entire interval.

To plot frequency polygon, we first need to convert raw data into grouped frequency table as shown above in table no. 1. Then we need to calculate the midpoint for each class interval and put them on x axis. Then on y axis, we need to plot the frequency corresponding to each class interval and then to join all these points by straight line, e.g.,

Table No. 4

Class Interval	Midpoints	Frequency
129.5 -134.5	132	1
124.5 – 129.5	127	1
119.5-124.5	122	7
114.5-119.5	117	13
109.5 – 114.5	112	18
104.5 -109.5	107	8
99.5 -104.5	102	2

Midpoints are found by adding the upper and lower boundaries and dividing by 2. For example, $99.5 + 104.5 / 2 = 102$, $104.5 + 109.5 / 2 = 107$, and so on.

Fig.2 Polygon

Some statisticians, however, prefer to close both the ends of the polygon by extending them to the base line as shown in the above figure. To do this, two hypothetical classes (one on each end) are added to the frequency table, each with a frequency of zero.

The polygon is closed at the base by extending it on both its sides (ends) to the midpoints of two hypothetical classes, at the extremes of the distribution, with zero frequencies. See Fig.2

On comparing the Histogram and a frequency polygon, you will notice that, in frequency polygons the points replace the bars (rectangles). Also, when several distributions are to be compared on the same graph paper, frequency polygons are better than Histograms.

Comparison of Histogram and Polygon:

Though no one type of graph is good for all purposes, each one has its own advantages and disadvantages.

1. Histogram is easier and best pictorial presentation if only one distribution is to be shown. If two or more distributions are to be compared, then polygon is better. For example, if we want to show graphically the performance of a particular class on one particular subject such as psychology, we can use histogram and we will be able to say how many marks majority of the students have got on that exam. On the other hand, if we want to graphically present performance of the same students on number of subjects such as English, Psychology, Political Science, etc. then using polygon will be better for easier comprehension of the results.
2. Frequency polygons are good for showing the shape of a distribution. However, a frequency polygon is less precise than a histogram because it assumes all the scores within a class interval are at the midpoint which is not an accurate representation.

16.4 MEASURES OF CENTRAL TENDENCY

Though frequency distribution tells us how scores are distributed in a given data but this does not give us a single score that is “typical” of that data. Measures of Central Tendency are those numbers that best represent the most typical scores of a frequency distribution. These measures of Central Tendency are used to represent the entire distribution of scores which are usually found near the center of the data when arranged in order of size. Different measures of central tendency are more or less average values that represent a group value. Such a value is of great significance because it depicts the characteristic of the whole group.

The most common measures of Central Tendency are Mean, Median and Mode. The various measures of central tendency have two important uses in psychology.

- They are an average which represent all of the scores made by a group and as such gives a concise description of the performance of the group as a whole.
- It enables us to compare two or more groups in terms of typical performance. This comparison can be within one group or between groups of data.

Now let us see how to compute mean, median and mode.

16.4.1 Mean:

Mean is also called as arithmetic mean or average. It is the most commonly used measure of central tendency. It is simply the sum of the numbers divided by the number of numbers. For example,

- a) The mean of 7, 12, 24, 20, 19 is $(7 + 12 + 24 + 20 + 19) / 5 = 16.4$.
 b) The mean of the numbers: $1+2+3+6+8=20/5=4$.

The formula for mean is

$$\bar{X} = \frac{\sum X}{N}$$

In this formula, each letter and symbol has a specific meaning:

\bar{X} = It is the symbol of mean.

\sum = It is sigma, the Greek letter for S, and it stands for “sum”, i.e., total.

X = It represents the scores in the distribution, so the numerator of the formula says “sum up all the scores”.

N = N is the total number of scores in a distribution.

So, according to the formula, the mean is equal to the sum of all the scores divided by the total number of scores, as shown in above example.

This formula is useful when the data is not too big and is not grouped in frequency distribution. But if the data is too large and needs to be grouped then we need another method of computing the mean.

Although the mean is usually the most representative measure of central tendency because each score in a distribution is included in the computation but mean is susceptible to the effects of extreme scores in a distribution. It means, any unusually high or low score will pull the mean in its direction and you will not get correct representation of the distribution.

16.4.2 Median:

Median is that value of a variable which divides a series in two equal parts in such a manner that the number of items below it is equal to the number of items above it. The median is a positional average referring to the place of a value in a series. Median is influenced by the position of items in a series and not by the size of the items like the mean.

Median is used under following conditions:

- (i) Median is used when the exact midpoint of the distribution is wanted.
- (ii) The median is useful for distribution containing open ended intervals, since these intervals do not enter its computation.
- (iii) The Median, is almost useful when the distribution has extreme scores i.e.,

Median is most useful when a given distribution is skewed.

Computation of the Median:

When there is an odd number of scores in an ungrouped data, the median is simply the middle number. For example, the median of 2, 4, 7 is 4. Similarly, the median of 3, 5, 6, 9, 15 is 6.

When there is an even number of numbers, the median is the average of the two middle numbers.

Thus, the median of the numbers 2,4,7,12 is $4+7$ divided by $2 = 5.5$.

Similarly, the median of 2, 7, 15, 20 is $(7+15)/2 = 11$.

16.4.3 Mode:

Mode is defined as the most frequently occurring value in a given data. There are many situations in which arithmetic mean and median fail to reveal the true characteristic of data. For example, when we take the common habitat, attitude, behaviour, etc., we have in mind mode and not the mean or median. The mean does not always provide an accurate reflection of the data due to the presence of extreme items. Median may also prove to be quite unrepresentative of the data owing to an uneven distribution of the series. Both these shortcomings can be overcome by the use of the mode which refers to the value which occurs most frequency in a distribution. Mode is used under following conditions:

- We use mode with a quick and approximate measure of central tendency is wanted.
- We use mode when information regarding the most typical case, such as style of dress or shoes is all that is wanted.
- Mode is employed when the most typical value of a distribution is desired.
- It is the most meaningful measure of central tendency in case of highly skewed or non-normal distribution as it provides the best indication of the point of maximum concentration.

Example:

- a) For individuals having the following ages — 18, 18, 19, 20, 20, 20, 21, and 23, the mode is 20.
- b) Problem: Find the mode from the following data: 7, 13, 18, 24, 9, 3, 18

Solution: Ordering the scores from least to greatest, we get: 3, 7, 9, 13, 18, 18, 24

Answer: The score which occurs most often is 18, Mode = 18

- c) Determine the mode of the following scores: 8, 11, 9, 14, 9, 15, 18, 6, 9, 15. The mode of the above data is 9 as it is the most frequently occurring value.

16.5 MEASURES OF VARIABILITY

Measures of variability are also called as the measures of dispersion or averages of the second order. Average is not always a good measure of a given distribution. Two or more groups may have the same average but different variabilities. Too much of dispersion or spread of the data is not good. Hence, measures of central tendency should always be accompanied by measures of variability.

We can define measures of variability as statistics that describe the amount of difference and how scores are spread out in a data set. It is a measurement of the degree of differences within a distribution.

There are many measures of variability. In this section, we would discuss the two measures of variability which include the Range, Standard Deviation. The Z-scores and normal curve we shall discuss in next section.

These various measures of variability are used for four basic purposes:

- To determine the reliability of an averages;
- To serve as a basis for the control of the variability;
- To compare two or more series with regard to their variability;
- To facilitate the use of other statistical measures that depends on the variability;

16.5.1 Range:

The Range is one of the crudest, simple and straight-forward measures of variability which can be defined as the difference

between the value of the smallest item and the value of the largest item included in the distribution. In other words, range is the difference between the highest and the lowest scores in a distribution. (See the first step in frequency distribution in table no. 1)

- Range is not suitable for precise studies.
- It is only a rough measure of dispersion. It is useful to compare groups roughly, when the measures are small. It can't be used to compare large groups.
- It takes into account the extreme measures only. It is generally used when we need to know the highest and the lowest scores so as to know the total variation.
- It is not a reliable measure of variability.
- It can't be used when there are many gaps in the distribution.
- It can be used when the data are too scant or too scattered to justify the computation of a precise measure of variability or when we just want to know the extreme scores of the total spread.

16.5.2 Standard Deviation:

The standard deviation indicates the "average deviation" from the mean, the consistency in the scores, and how far scores are spread out, around the mean of the distribution. In other words, it can be defined as the square root of the sum of the squared deviations from the mean of scores and divided by the number of scores, in a distribution.

- It is one of the most reliable measures of variability.
- It is always positive.
- It is based on all the observations/scores of the data.
- It is a basic building block for analyzing our data.
- It provides insights into identifying outliers.
- It is important in inference.
- It is less affected by the fluctuations of sampling than most of other measures of dispersion.

Let us take an example to see what are the steps needed to compute standard deviation.

Formula for standard deviation is :

$$SD = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$$

Where

SD = the standard deviation of a sample

\sum = means sum of

X = each score in the data set

\bar{X} = mean of all scores in the data set

N = number of scores in the data set

Steps to compute standard deviation (Refer Table No. 5)

Table No. 5

Score X	Mean \bar{X}	Score – Mean $X - \bar{X}$	(Score-Mean) Squared $(X - \bar{X})^2$
155	124	31	961
149	124	25	625
142	124	18	324
138	124	14	196
134	124	10	100
131	124	7	49
127	124	3	9
125	124	1	1
120	124	-4	16
115	124	-9	81
112	124	-12	144
110	124	-14	196
105	124	-19	361
102	124	-22	484
95	124	-29	841
Sum (\sum) =1860 Mean (\bar{X}) =124		$\sum = 0$	$\sum = 4388$

$$SD = \sqrt{4388/15} = 17.10$$

1. Arrange the data in ascending order.
2. Add up all the scores in first column (you get sum = 1860).
3. To get the mean, divide the sum of all the scores in first column with the number of scores in that column. ($1860/15 = 124$).
4. Put the mean of the data against each score in second column.
5. In third column, for each score (X), we find the difference between the X and \bar{X} . When the mean is subtracted from a score a score, the result is a deviation from the mean. Scores that are above the mean would have positive deviations and the scores that are below the mean would have negative deviations. If the deviations from the mean are added together, the sum will be 0 because the negative and positive deviations will cancel each other out.
6. In mathematics, if a negative number is squared, it becomes positive. So, to get rid of the negative deviations, we will square off each deviation and put it fourth column. Then we calculate the sum of these squared deviations.
7. To get standard deviation, we take the sum of squared deviations and divide by the total number of cases, and take the square root.

Standard Deviations a measure of absolute distribution, the greater the amount of dispersion, the greater the standard deviation. standard deviation is generally used under following conditions:

- When further computations that depend on SD are needed.
- When we have to compare individuals score on two or more tests.
- When interpretations related to the normal probability curve are desired.

One of the greatest limitations of standard deviation is that it is sensitive to extreme values.

16.6Z – SCORES AND NORMAL CURVE

16.6.1 Z – Scores

Z - scores are one type of standard scores which represents the differences between individual scores and the mean score expressed in units of standard deviations. Z-scores are a conversion or transformation of individual scores into a standard form, where the transformation is based on knowledge about the population's mean and standard deviation.

Z – Score can be defined as a statistical measure which indicates how far away from the mean a particular score is in terms of the number of standard deviations which exists between the mean and that score.

A positive Z-score means that the score is above the mean, while a negative Z-score means that the score is below the mean. The larger the z-score, the farther away from the mean the score is.

There are two major uses of Z-score:

- It tells the exact location of a score in a distribution: For example, Vijay is 09 yrs. old and weighs 40 Kilograms. How does his weight compare to other children of his age groups?
- Z-score allows us to compare two scores coming from different distributions. Geeta scored 72 on her Psychology test and 61 on her biology test, on which test did she perform better? It would not automatically mean that she did better on Psychology test. You cannot simply compare two marks from the two classes because each class is composed of a different population. If most of the students from Psychology class get scores in 90s, then Geeta might be just performing in below average range and if in biology most of the students have got marks in 50s then Geeta's performance comes in above average range. So the only way to find out would be to convert her scores in the two subjects into Z-scores.
- Z-scores take data of any form and put them into a standard scale. High score in a distribution always has a positive z-score and a low score in a distribution always has a negative z score.

The formula for computing Z-score is:

$$z = \frac{X - \bar{X}}{SD}$$

\bar{X} = Raw score

X = Mean

SD = Standard Deviation

Let us take an example from table no. 4

$$z = 149 - 124 / 17.10 = 1.46$$

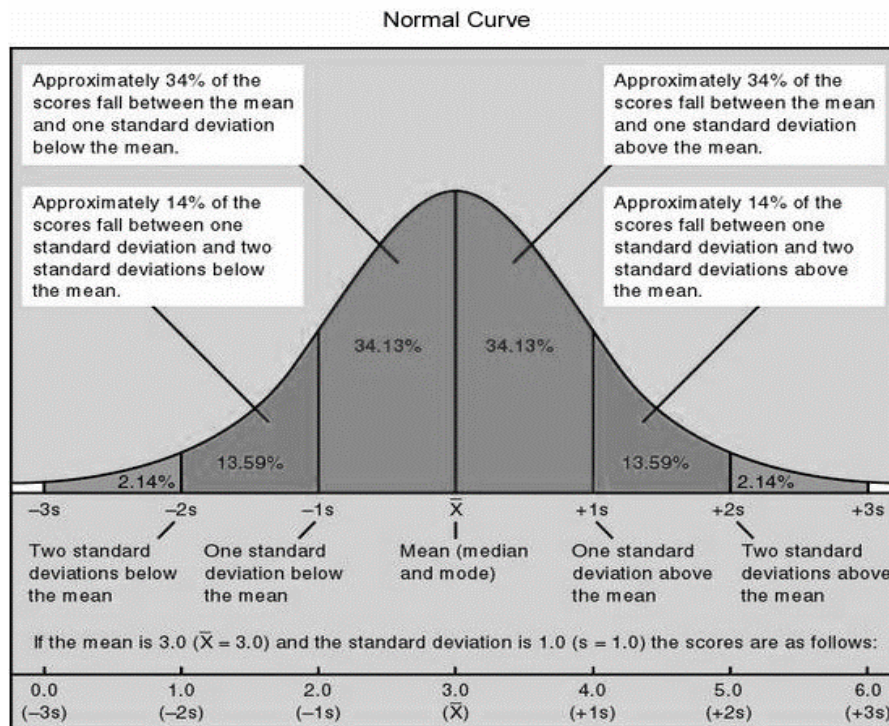
$$z = 115 - 124 / 17.10 = -.53$$

A z score of +1.46 indicates that a person scoring 149 marks falls about one and a half standard deviation above the mean. On the other hand, a person scoring 115 marks falls below the mean and has negative z score. A score of 115 is a little more than one-half a standard deviation below the mean.

16.6.2 Standard Normal Curve:

It is also called standard normal distribution. Normal Curve is also called as the Normal Probability Curve, the Gaussian Curve (after a great German mathematician who investigated its properties and wrote the equation for it).

Fig.3



It is also called as the Bell-Shaped Curve or Mesokurtic Curve (Meso means middle or medium). Normal Curve is a special frequency polygon in which the scores are symmetrically distributed around the mean.

In this curve the mean, median and mode are located exactly in the middle of the curve with scores decreasing as the curve extends from the mean. If a line is drawn down its center, one side of the curve is a mirror image of the other side.

Features of Normal Curve:

1. The normal curve is symmetrical about the mean. The number of cases below the mean in a normal distribution is equal to number of cases above the mean.
2. The height of the curve is maximum at its mean. Thus, mean, median, and mode are equal in normal probability curve.
3. There is one maximum point of the normal curve which occurs at the mean. The height of the curve declines as we go in either direction from the mean. This dropping off is slow at first, then rapid, and then slow again. This pattern is the reason the normal curve is often described as "bell shaped". Theoretically, the curve never touches the base line. Its tail approaches but never reach the base line. Hence, the range is unlimited.

4. The point of inflection i.e., the points where the curvature changes in direction are each plus or/and minus one standard deviation from the mean ordinate.
5. If a variable is normally distributed, that is, if it has the standard bell-shaped pattern, a person's z-score can tell us exactly where that person stands relative to everyone else in the distribution.
6. The total interval from plus one standard deviation to minus one standard deviation contains 68.26% of the cases. Similarly, 99.44% of the total area will be included between the mean ordinate and an ordinate 2 standard deviation from the mean. Similarly, 99.74% of the total area will be included between the mean ordinate and a point 3 standard deviation away from the mean.

16.6.3 Other Distribution Types

Besides the normal distribution, there are many different types of distributions that we may get from a given data. Two such distributions are Skewed Distributions (also called as Skewness) and Bimodal Distributions:

Skewed Distribution:

It can be defined as a frequency distribution in which most of the scores fall to one side of the distribution or the other side. The word skewed means lacking symmetry or distorted.

Skewness shows the direction of symmetry. A distribution is said to be skewed when the mean and the median fall at different points in the distribution and the balance or center of gravity is shifted to one side or the other. In normal distribution, the mean equals the median and the skewness is of course, zero, the more nearly the distribution approaches the normal form, the closer together are the mean and the median and the less the skewness.

Types of Skewed Distributions: There are two types of Skewed Distributions:

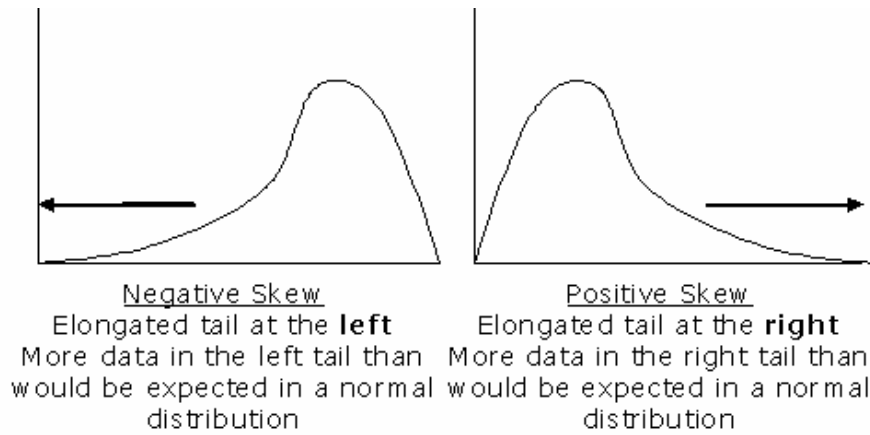
Negatively Skewed

The mass of distributions is concentrated on the right end of the figure and are spread out more gradually towards the left. The left tail is the longest.

Positively Skewed

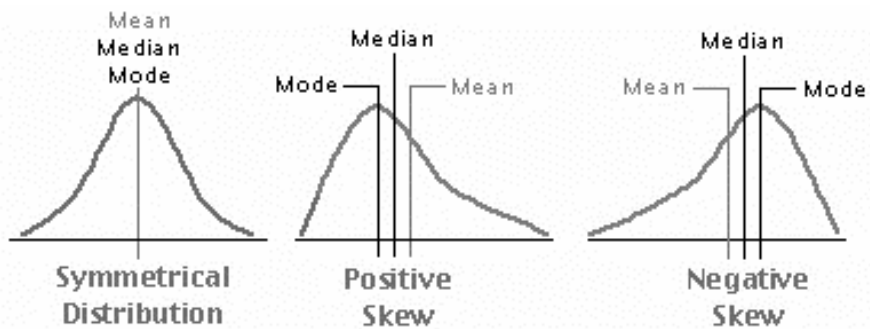
The mass of distribution is concentrated on the left of the figure and are spread out more gradually towards the right. The right tail is the longest. See Fig.4

Fig.4



All three types of distribution will look like Fig. 5

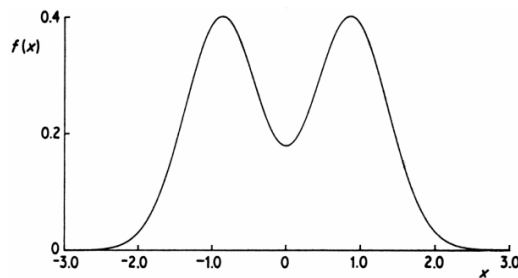
Fig.5



Bimodal Distributions:

Some frequency polygons show two high points rather than just one, such a distribution is called as bimodal distribution. A bimodal distribution is a frequency distribution in which there are two high points rather than one. In a bimodal distribution, there are two peaks in occurrences, so you should see two humps or spikes. For example, a bimodal distribution would look like figure 6

Fig.6



16.7 THE CORRELATION COEFFICIENT

Correlation refers to the relationship between two variables. It is a method of summarizing the relationship between two sets of data. Correlation is expressed in terms of coefficient of correlation or Correlation Coefficient. It is denoted as “ r ”.

Correlation requires two scores from the SAME individuals. These scores are normally identified as X and Y. The pairs of scores can be listed in a table or presented in a scatter plot. Usually the two variables are observed, not manipulated.

A correlation coefficient is a number that represents the strength and direction of a relationship existing between two variables that tells us to what degree one variable varies with the variations in the other.

Coefficient of correlation is a single number that varies from +1.00 to 0.00 to -1.00. The number tells us about the magnitude or degree of relationship whereas signs, plus or minus, tells us about the direction of relationship. A number close to 1 (whether positive or negative) indicates a strong relationship, while a number close to 0 indicates a weak relationship. Thus +1.00 denotes perfect positive correlation, whereas -1.00 denotes perfect negative correlation. In psychology and other social sciences, it is very difficult or rather impossible to get perfect correlation. Such perfect correlations are usually obtained in physical sciences.

- A correlation coefficient close to zero indicates a weak linear relationship between two variables.
- A correlation coefficient of zero would indicate that there is no correlation, or relationship, between two variables. For example, the correlation coefficient between shoe size and number of books read.
- A positive correlation coefficient occurs when the values of both variables increase together. That is, an increase in one variable tends to be associated with an increase in the other variable. For example, relationship between studying hard and high grades in school. Those who study more, get higher grades in school. Take another example of height and weight. Taller a person is, heavier he will be.
- A negative correlation coefficient occurs when the increase of one variable corresponds with the decrease of another variable. That is an increase in one variable tends to be associated with a decrease in the other variable in the same proportion. For example, the more you study, less the chances of failure. Take another example, the relationship between the height above the

sea level and temperature. As the height above the sea level increases, the temperature drops and it gets colder.

So, when increase in one variable lead to simultaneous increase in another variable or vice versa, it is called as positive correlation. On the other hand, when increase in one variable leads to decreases in other variable or vice versa it is called as negative correlation. When increase or decrease in one variable does not affect the other variable in any manner, then it is called as zero correlation.

Correlation coefficient is computed by using following formula:

$$\text{Correlation coefficient} = \frac{\sum Z_x Z_y}{N}$$

Steps in Computation of Correlation Coefficient:

1. As mentioned above, correlation is computed between two variables and for computation purpose we call them X and Y. To compute a correlation coefficient, the data from both variables can be converted to z scores. So, each individual will have two z scores – one for X variable and one for Y variable.
2. Each person's two z scores are multiplied together.
3. All these cross products are added up
4. The sum of all cross products is divided by the number of individuals.

Thus, correlation coefficient is the mean of the sum of the products of the z scores for the two variables. In terms of z scores -

- In positive correlation, high z scores on one variable tend to be multiplied by high z scores on the other variable and the low z scores on one variable tend to be multiplied by low z score on the other variable. However, the sum of cross products is always positive in both cases, because when two negative numbers are multiplied, they result in a positive number.
- In negative correlation, high z scores (which are positive) on one variable tend to be multiplied by low z scores (which are negative) on the other variable, and vice versa. This results in negative cross products. So, when the sum of these negative cross products is divided by N, the result is a negative correlation coefficient.

The following figure depicts the graphic representation of different types of correlation. Plotting two variables together creates a scatter diagram or scatter plot.

As you can see in fig. 7 and Fig. 8, positive relationship generally forms a line running from lower left to upper right. A perfect negative relationship generally forms a line running from upper left-hand corner of the graph to lower right-hand corner of the graph.

The minimum coefficient is .00, which indicates there is no consistent relationship between the two variables. From a z-score point of view, when two variables are not related, the cross-products are mixed, that is, some are positive and some are negative. In other words, sometimes high z scores on one variable go with high z scores on the other and low z scores on one variable go with low z scores on the other. When the cross products for the two variables are summed, the positive and negative numbers cancel each other out, resulting in a 0 correlation.

From this minimum value, the coefficients increase in both directions until -1.00 is reached on one side and +1.00 is reached on the other side. Both -1.00 and +1.00 indicate perfect and close relationship between the two variables. The sign of plus or minus indicates the direction of the relationship while the number indicates the magnitude of the relationship.

Fig.7

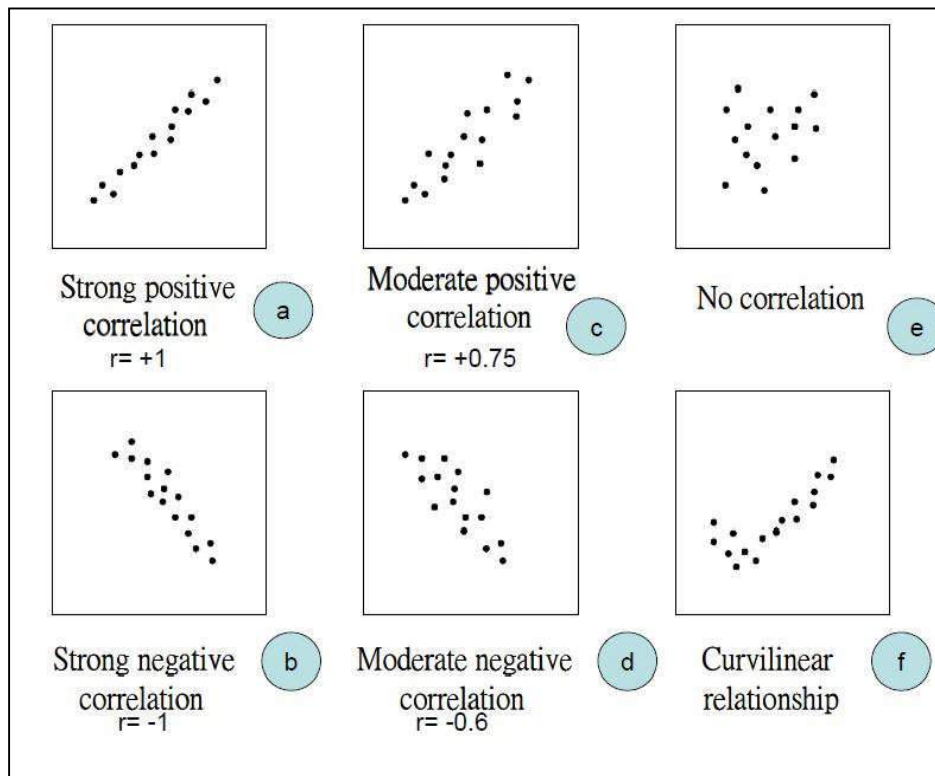
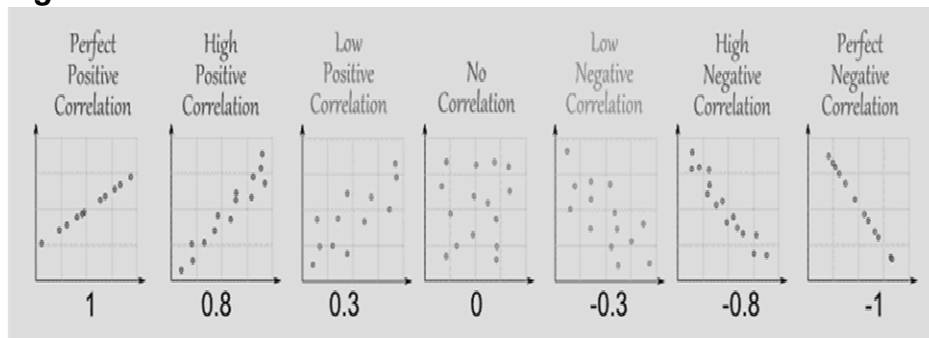


Fig.8**Uses of Correlation Method:**

1. Relationship: Correlation allows the researcher to investigate naturally occurring variables that maybe unethical or impractical to test experimentally. For example, it would be unethical to conduct an experiment on whether smoking causes lung cancer. Correlation allows the researcher to clearly and easily see if there is a relationship between variables. This can then be displayed in a graphical form.

2. Prediction: The coefficient is useful in predicting the performance on the second variable by knowing the score on the first variable.

Causality: However, correlation does not necessarily mean causation. The fact that two variables are highly correlated does not necessarily mean that one variable directly causes the other. For example, there might be a strong correlation between ice-cream sales and the sale of sunglasses. Can we say buying ice-cream causes people to buy sunglasses also? NO, there can be other reasons for positive correlation between the sale of ice-cream and sunglasses and that is hot weather.

Experimental method is the only method that can give strong scientific evidence of cause-and-effect relationship between two or more variables.

16.8 INFERENCE STATISTICS

Inferential statistics is a branch of statistics which helps us to draw inferences about the population on the basis of sample. It enables us to make confident decisions in the face of uncertainty. Inferential statistics consists of statistical techniques that allow researchers to determine how likely it is that a study's outcome is due to chance and whether the outcome can be legitimately generalized to a larger population.

There are many different kinds of inferential statistical methods. The method that is used depends on the design of the experiment, such as number of independent and dependent variables or the number of experimental groups. It allows researchers to determine the difference between results of a study that are meaningful and those that are merely due to chance variations.

Statistical Significance:

Inferential statistics allows researchers to determine how much confidence they should have in the results of a particular experiment. If inferential statistics indicates that the odds of a particular finding occurring are considerably greater than mere chance, we can conclude that our results are statistically significant. Statistically significant results indicate that we can conclude with a high degree of confidence that the manipulation of the independent variable, rather than simply chance, is the reason for the results. In other words, statistical significance is a way to test differences to see how likely those differences are to be real and not just caused by the random variations in behavior that exist in everything animals and people do.

Inferential statistics uses wide variety of statistical tests, some of which include the T test, the F test, Chi Square, etc. For example, t-tests are used to compare the means of two groups. Analysis of variance(ANOVA) is used to compare the means of more than two groups.

Type I & Type II Error:

In psychology, we can't be fully sure that our intervention/manipulation only was responsible for the results that we have got. We always have to deal with probabilities and not certainties. Since researchers are dealing with probabilities, there is always a small but real possibility of erroneously concluding that study results are significant. Here the term error does not mean mistakes or inaccuracies which may be committed in making observations, counting and calculations, etc. It refers to the difference between the true value of a parameter and its estimate provided by an appropriate sample statistic. There are two types of errors that may occur – Type I error and Type II error.

A Type I error occurs when the results show that a difference exists but in reality, there is no difference. So, the results of one study should never be trusted completely. It is asserting something that is absent, a false hit. To have greater confidence in a particular effect or result, the study should be repeated or replicated. If the same results are obtained in different studies, then we can be more certain that our results about a particular effect are correct.

A Type II error occurs when a researcher fails to find a significant effect, yet that significant effect really exists. It is failing to assert what is present, a miss. A Type II error occurs when a study does not have enough power. In other words, the study is not strong enough to find the effect the researcher is looking for. Higher power may be achieved by improving the research design and measuring instruments or by increasing the number of participants being studied.

Population vs. Sample:

A population is a complete set of something- people, nonhuman animals, objects or events. For example, if I want to conduct a study on the study habits of students in the age group of 18 to 25, residing in Mumbai, and irrespective of stream they belong to. They may be students of Arts, Science, Commerce, Medical or Engineering stream or any other stream. Logistically, it won't be possible for me to cover each and every student in that age group and residing in Mumbai. So to conduct such a study, the best way is to take a small portion of this population, to serve as subjects in this study.

A subset of population is known as Sample. The researchers conduct study on the carefully chosen sample. They analyze the results of this sample, using inferential statistics to make guesses about what they would have found had they studied the entire population. Inferential statistics enables researchers to take the findings they get from a sample and apply them to a population. Population here does not mean the population of a country. Population is also defined as a specific segment of the society as stated in above example.

16.9 SUMMARY

This unit began by discussing as to why psychologists use statistics, followed by the definition of descriptive statistics and its types. In descriptive statistics, we discussed the concept of frequency distribution, histogram and frequency polygon. The concept of normal curve as well as its characteristics was also discussed. We have also discussed the skewed distribution and its types as well as bimodal distributions. Measures of central tendency such as mean median and mode were discussed and its computation for ungrouped data was demonstrated. Measures of variability such as range and standard deviation were also discussed. The concept of Z-score was explained. The concept of inferential statistics as well as correlation coefficient was also discussed. Inferential statistics included types of tests used, types of errors and difference between population and sample.

16.10 QUESTIONS

1. Define Frequency distribution, Histogram and Frequency Polygon with graphic representations.
2. Explain the following terms:
 - a. Normal Curve
 - b. Skewed Distribution
3. Discuss the different Measures of Central Tendency
4. Discuss the different Measures of Variability.
5. Write short notes on the following
 - a. Inferential Statistics – Statistical Significance
 - b. The Correlation Coefficient.

15.11 REFERENCES

1. Myers, D. G. (2013). Psychology. 10th edition; International edition. New York: Worth Palgrave Macmillan, Indian reprint 2013
2. Ciccarelli, S. K. & Meyer, G. E. (2008). Psychology. (Indian subcontinent adaptation). New Delhi: Dorling Kindersley (India)pvt Ltd.
3. Baron, R. A., & Kalsher, M. J. (2008). Psychology: From Science to Practice. (2nd ed.). Pearson Education inc., Allynand Bacon

