Master of Arts

(Psychology)

Advanced General Psychology -1

Semester-I

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Advanced General Psychology I(paper-1)

Learning out comes

Students will be able to understand:

Unit-1

- Understand the definition of psychology and its broad scope in studying human behavior and mental processes.
- Understand the biological basis of behavior, exploring the role of the brain, neurotransmitters, and genetics.
- Observe and record behavior in natural settings without interference, providing a realistic understanding of behavior.

Unit-2

- Understand the fundamental components of neurons and their communication.
- Explain the impact of neurotransmitters on behavior.
- Distinguish between the peripheral and central nervous systems.

Unit-3

- Explain classical conditioning principles and identify key elements.
- Differentiate between instrumental and operant conditioning and recognize key terms.
- Define observational learning and understand Bandura's social cognitive theory.

Unit-4

- Understand the structure of the information processing model, including sensory register, short-term memory, and rehearsal.
- Define Tip-of-the-Tongue (TOT) phenomenon and understand its implications in memory retrieval.
- Explain the process of retrieval from long-term memory, including recall and recognition.

Unit-5

- Define intelligence as a complex cognitive ability.
- Understand Spearman's general intelligence, Thurstone's primary mental abilities, and Gardner's multiple intelligences.
- Grasp Sternberg's triarchic theory and its components.

ADVANCED GENERAL PSYCHOLOGY - I SYLLABUS

UNIT I

PSYCHOLOGY

Definition of psychology: Sub-fields of psychology, Experimental, Developmental, Biological, Personality, Social, Clinical and Counseling, Development and quantitative psychology, Methods in psychology, Survey, Case Study, Naturalistic, Observation, Experiment, Psychologists at work.

UNIT II

BEHAVIOUR

Biological basis of Behaviour: Brain and Behaviour - Neurons, Neurotransmitters, PNS and CNS. Structure of brain and its functions, Left and Right Hemisphere and its function.

UNIT III

LEARNING

Definition of Learning, Classical Learning, Instrumental and operant conditioning Learning, Observational Learning, Cognitive Process in Learning.

UNIT IV

MEMORY

Meaning and nature of memory, Theories of memory: Information processing theories- sensory register, short term memory, rehearsal; Levels of processing theories, Long term memory- organizations, TOT, semantic and episodic memory, encoding and storing long term memories, role of organization, role of imagery, role of constructive processes; Retrieval from long term memory; Forgetting- Motivated forgetting, Interference, Decay through disuse, Techniques of improving memory.

UNIT V

INTELLIGENCE

Definition of Intelligence, Theories of Intelligence, Sperman's General Intelligence, Thurstone's, Primary Mental Abilities, Gardners Mental intelligence and Triarchic Theory of Intelligence. Emotional Intelligence, Fluid and Crystallized intelligence.

UNIT I

PSYCHOLOGY

STRUCTURE

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1.1 LEARNING OBJECTIVE

After completion of this unit, student will be able to:

- Understand psychology and its sub-fields.
- Know about the development and quantitative psychology.
- Understand methods of psychology.
- Get some knowledge about psychologist at work.

1.2 INTRODUCTION PSYCHOLOGY

Psychology is the scientific study of mind and behavior. The word "psychology" comes from the Greek words "psyche," meaning life, and "logos," meaning explanation. Psychology is a popular major for students, a popular topic in the public media, and a part of our everyday lives. Television shows such as Dr. Phil feature psychologists who provide personal advice to those with personal or family difficulties. Crime dramas such as CSI, Lie to Me, and others feature the work of forensic psychologists who use psychological principles to help solve crimes. And many people have direct knowledge about psychology because they have visited psychologists, for instance, school counselors, family therapists, and religious, marriage, or bereavement counselors. Because we are frequently exposed to the work of psychologists in our everyday lives, we all have an idea about what psychology is and what psychologists do. In many ways I am sure that your conceptions are correct. Psychologists do work in forensic fields, and they do provide counseling and therapy for people in distress. But there are hundreds of thousands of psychologists in the world, and most of them work in other places, doing work that you are probably not aware of.

Most psychologists work in research laboratories, hospitals, and other field settings where they study the behavior of humans and animals. For instance, my colleagues in the Psychology Department at the University of Maryland study such diverse topics as anxiety in children, the interpretation of dreams, the effects of caffeine on thinking, how birds recognize each other, how praying mantises hear, how people from different cultures react differently in negotiation, and the factors that lead people to engage in terrorism. Other psychologists study such topics as alcohol and drug addiction, memory, emotion, hypnosis, love, what makes people aggressive or helpful, and the psychologies of politics, prejudice, culture, and religion. Psychologists also work in schools and businesses, and they use a variety of methods, including observation, questionnaires, interviews, and laboratory studies, to help them understand behavior.

1.3 SUB-FIELDS OF PSYCHOLOGY

Abnormal Psychology

Abnormal psychology is the area that looks at psychopathology and abnormal behavior. Mental health professionals help assess, diagnose, and treat a wide variety of psychological disorders including anxiety and depression. Counselors, clinical psychologists, and psychotherapists often work directly in this field.

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Behavioral Psychology

Behavioral psychology, also known as behaviorism, is a theory of learning based on the idea that all behaviors are acquired through conditioning. While this branch of psychology dominated the field during the first part of the twentieth century, it became less prominent during the 1950s. However, behavioral techniques remain a mainstay in therapy, education, and many other areas.

People often utilize behavioral strategies such as classical conditioning and operant conditioning to teach or modify behaviors. For example, a teacher might use a system of rewards in order to teach students to behave during class. When students are good, they receive gold stars which can then be turned in for some sort of special privilege.

Biopsychology

Biopsychology is a branch of psychology focused on how the brain, neurons, and nervous system influence thoughts, feelings, and behaviors. This field draws on many different disciplines including basic psychology, experimental psychology, biology, physiology, cognitive psychology, and neuroscience.

Biopsychology is also sometimes referred to as physiological psychology, behavioral neuroscience, or psychobiology.

Clinical Psychology

Clinical psychology is the branch of psychology concerned with the assessment and treatment of mental illness, abnormal behavior, and psychiatric disorders. Clinicians often work in private practices, but many also work in community centers or at universities and colleges.

Others work in hospital settings or mental health clinics as part of a collaborative team that may include physicians, psychiatrists, and other mental health professionals.

Cognitive Psychology

Cognitive psychology is the branch of psychology that focuses on internal mental states. This area of psychology has continued to grow since it emerged in the 1960s. This area of psychology is centered on the science of how people think, learn, and remember.

Psychologists who work in this field often study things such as perception, motivation, emotion, language, learning, memory, attention, decision-making, and problem-solving.

Comparative Psychology

Comparative psychology is the branch of psychology concerned with the study of animal behavior. The study of animal behavior can lead to a deeper and broader understanding of human psychology.

This area has its roots in the work of researchers such as Charles Darwin and George Romanes and has grown into a highly multidisciplinary subject. Psychologists often contribute to this field, as do biologists, anthropologists, ecologists, geneticists, and many others.

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Counseling Psychology

Counseling psychology is one of the largest individual subfields in psychology. It is centered on treating clients experiencing mental distress and a wide variety of psychological symptoms.

Cross-Cultural Psychology

Cross-cultural psychology is a branch of psychology that looks at how cultural factors influence human behavior. The International Association of Cross-Cultural Psychology (IACCP) was established in 1972, and this branch of psychology has continued to grow and develop since that time.

Developmental Psychology

Developmental psychology focuses on how people change and grow throughout life. The scientific study of human development seeks to understand and explain how and why people change throughout life. Developmental psychologists often study things such as physical growth, intellectual development, emotional changes, social growth, and perceptual changes that occur over the course of the lifespan.

These psychologists generally specialize in an area such as infant, child, adolescent, or geriatric development, while others may study the effects of developmental delays. This field covers a huge range of topics including everything from prenatal development to Alzheimer's disease.

Educational Psychology

Educational psychology is the branch of psychology concerned with schools, teaching psychology, educational issues, and student concerns. Educational psychologists often study how students learn or work directly with students, parents, teachers, and administrators to improve student outcomes.

They might study how different variables influence individual student outcomes. They also study topics such as learning disabilities, giftedness, the instructional process, and individual differences.

Experimental Psychology

Experimental psychology is the branch of psychology that utilizes scientific methods to research the brain and behavior. Many of these techniques are also used by other areas in psychology to conduct research on everything from childhood development to social issues.

Experimental psychologists work in a wide variety of settings including colleges, universities, research centers, government, and private businesses. Experimental psychologists utilize the scientific method to study a whole range of human behaviors and psychological phenomena.

This branch of psychology is often viewed as a distinct subfield within psychology, but experimental techniques and methods are actually used extensively throughout every subfield of psychology. Some of the methods used in experimental psychology include experiments, correlational studies, case studies, and naturalistic observation.

Forensic Psychology

Forensic psychology is a specialty area that deals with issues related to psychology and the law. Those who work in this field of psychology apply psychological principles to legal issues. This may involve studying criminal behavior and treatments or working directly in the court system.

Forensic psychologists perform a wide variety of duties, including providing testimony in court cases, assessing children in suspected child abuse cases, preparing children to give testimony and evaluating the mental competence of criminal suspects.

This branch of psychology is defined as the intersection of psychology and the law, but forensic psychologists can perform many roles so this definition can vary. In many cases, people working in forensic psychology are not necessarily "forensic psychologists." These individuals might be clinical psychologists, school psychologists, neurologists, or counselors who lend their psychological expertise to provide testimony, analysis, or recommendations in legal or criminal cases.

Health Psychology

Health psychology is a specialty area that focuses on how biology, psychology, behavior and social factors influence health and illness. Other terms including medical psychology and behavioral medicine are sometimes used interchangeably with the term health psychology. The field of health psychology is focused on promoting health as well as the prevention and treatment of disease and illness.

These professionals not only promote healthy behaviors, but they also work on the prevention and treatment of illness and disease. Health psychologists often deal with health-related issues such as weight management, smoking cessation, stress management, and nutrition.

They might also research how people cope with illnesses and help patients look for new, more effective coping strategies. Some professionals in this field help design prevention and public awareness programs, while others work within the government to improve health care policies.

Industrial-Organizational Psychology

Industrial-organizational psychology is a branch that applies psychological principles to research on workplace issues such as productivity and behavior. This field of psychology often referred to as I/O psychology works to improve productivity and efficiency in the workplace while also maximizing the well-being of employees.

Some psychologists in this field work in areas such as human factors, ergonomics, and human-computer interaction. Human factors psychology is an interdisciplinary field that focuses on topics such as human error, product design, ergonomics, human capability, and human-computer interaction.

People who work in human factors are focused on improving how people interact with products and machines both in and out of the workplace. They might help design products intended to minimize injury or create workplaces that promote greater accuracy and improved safety.

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Personality Psychology

Personality psychology is the branch of psychology that focuses on the study of the thought patterns, feelings, and behaviors that make each individual unique. Classic theories of personality include Freud's psychoanalytic theory of personality and Erikson's theory of psychosocial development.

School Psychology

School psychology is a field that involves working in schools to help kids deal with academic, emotional, and social issues. School psychologists also collaborate with teachers, students, and parents to help create a healthy learning environment.

Most school psychologists work in elementary and secondary schools, but others work in private clinics, hospitals, state agencies, and universities. Some go into private practice and serve as consultants, especially those with a doctoral degree in school psychology.

Social Psychology

Social psychology seeks to explain and understand social behavior and looks at diverse topics including group behavior, social interactions, leadership, nonverbal communication, and social influences on decision-making.

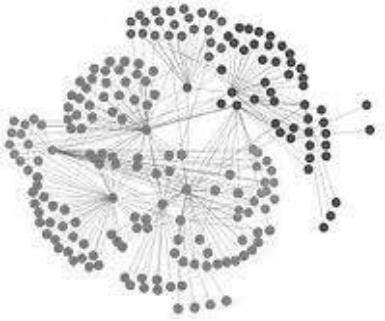
This field of psychology is focused on the study of topics such as group behavior, social perception, nonverbal behavior, conformity, aggression, and prejudice. Social influences on behavior are a major interest in social psychology, but social psychologists are also focused on how people perceive and interact with others.

Sports Psychology

Sports psychology is the study of how psychology influences sports, athletic performance, exercise, and physical activity. Some sports psychologists work with professional athletes and coaches to improve performance and increase motivation. Other professionals utilize exercise and sports to enhance people's lives and well-being throughout the entire lifespan.

1.4 DEVELOPMENT AND QUANTITATIVE PSYCHOLOGY

Understanding Quantitative Psychology



Psychologists use a number of research methods and comb through vast amounts of data to test hypotheses and study complex issues in the real world. Quantitative psychologists are expert in designing methodologies and studies that reveal answers to research questions on topics as diverse as human performance, child development, memory and language retention.

These psychologists conduct their own research studies and work to improve the research tools that psychologists use across the discipline's many subfields. Quantitative psychologists are in high demand, particularly as the government, private sector, educational testing industry and research centers seek experts with the training to handle complex new research methodologies.

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Quantitative Psychology Applied

Quantitative psychologists conduct their own research and collaborate with other scientists in many fields to design research studies and methods and interpret results.

Quantitative psychologists use psychological science to determine the impact of programs at the federal, state and local government levels. They serve as experts in measurement, statistics, research methodology and program evaluation at research centers at major universities and colleges across the nation.

Individuals who have a passion for psychology and an interest in using data and statistics to solve complex issues are well-suited for a career in quantitative psychology.

Developmental psychology

Developmental psychology is the branch of psychology that focuses on how people grow and change over the course of a lifetime. Those who specialize in this field are not just concerned with the physical changes that occur as people grow; they also look at the social, emotional, and cognitive development that occurs throughout life.

Some of the many issues developmental psychologists assist with include:

- Cognitive development during childhood and throughout life
- Developmental challenges and learning disabilities
- Emotional development
- Language acquisition
- Moral reasoning
- Motor skill development
- Personality development
- Self-awareness and self-concept
- Social and cultural influences on child development

These professionals spend a great deal of time investigating and observing how these processes occur under normal circumstances, but they are also interested in learning about things that can disrupt developmental processes.

Developmental Psychology Theories

Developmental psychologists often utilize a number of theories to think about different aspects of human development. For example, a psychologist assessing intellectual development in a child might consider Piaget's theory of cognitive development, which outlined the key stages that children go through as they learn. A psychologist working with a child might also want to consider how the child's relationships with caregivers influences his or her behaviors, and so turn to Bowlby's theory of attachment.

- **Psychosexual Developmental Theory**
  In developing the field of psychoanalysis, famous psychologist Sigmund Freud made significant contributions to the field of developmental psychology, including the psychosexual developmental theory. Freud proposed that a person's

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experiences at different stages in childhood directly affect that person's behavior and personality later in their adult life.

According to this theory, there are five universal stages of development. Each stage is centered around an erogenous zone, which is the source of a person's psychosexual energy. At each stage of development there is some tension between the conscious (where a person is aware of their mental processes) and the unconscious (the mental processes a person is unaware of); this tension arises because the conscious often works to suppress the unconscious.

Freud believed that when a child successfully passes through each of these stages, development culminates in a healthy personality in adulthood. However, being unable to progress from the challenges in one stage will negatively influence a child's behavior as an adult. While the theory was incredibly influential for decades, Freud's theory of psychosexual development holds less sway today.

- **Psychosocial Developmental Theory**
  This theory was developed by renowned psychoanalyst Erik Erikson, and it suggests that human growth through all stages, from infancy to adulthood, can be organized into eight distinct stages. According to Erikson, each stage of life presents an existential dilemma a person must go through successfully in order to gain positive virtues. Failure to resolve any of these hurdles can lead to developing a negative outlook of the world, further affecting a person's growth and development.

  Erikson's psychosocial developmental theory is generally based on social interactions and the conflicts that arise during each stage of development. The theory suggests that exposing a person to social interaction and a wide range of experiences is important in achieving positive outcomes in each stage.

- **Attachment Theory**
  Proposed by another notable psychoanalyst John Bowlby, attachment theory is concerned primarily with the necessity of early meaningful relationships in the development of a child. The theory asserts that these relationships help a child form attachment to a number of people, places or things, and these attachments, in turn, largely affect further developmental patterns throughout the course of the child's life.

  This theory also suggests that the need to form attachments develops naturally in a child as a survival instinct, and explains why a child would likely gravitate more towards relationships that provide them some form of physical or psychological safety.

- **Social Learning Theory**
  Albert Bandura, one of the pioneers in the field of development psychology, believed a child's development doesn't come mainly from learning through direct experience, but through modeling and simple observations. Bandura's theory suggests that learning can be effectively achieved by listening to instructions on how to perform behaviors, or by attentively observing real or fictional persons practicing these behaviors.

- **Cognitive Developmental Theory**
  Swiss theorist Jean Piaget held the now widely accepted view that children think quite differently than adults. And, therefore, one role for adults and caregivers is

to provide children with suitable materials to help them develop interaction skills and improve their ability to reflect on their actions.

According to Piaget, intellectual development occurs in four stages, each stage consisting of skills that a child must master before moving on to the next stage. Successful completion of each of these stages is necessary for the development of a healthy thought and behavioral processes.

Psychologists are also interested in looking at how social relationships influence the development of both children and adults. Erikson's theory of psychosocial development and Vygotsky's theory of sociocultural development are two popular theoretical frameworks that address the social influences on the developmental process. Each approach tends to stress different aspects of development such as mental, social, or parental influences on how children grow and progress.

When to See a Developmental Psychologist

While development tends to follow a fairly predictable pattern, there are times when things might go off course. Parents often focus on what are known as developmental milestones, which represent abilities that most children tend to display by a certain point in development. These typically focus on one of four different areas: physical, cognitive, social/emotional, and communication. For example, walking is one physical milestone that most children achieve sometime between the ages of 9 and 15 months. If a child is not walking or attempting to walk by 16 to 18 months, parents might consider consulting with their family physician to determine if a developmental issue might be present.

While all children develop at different rates, when a child fails to meet certain milestones by a certain age, there may be cause for concern. By being aware of these milestones, parents can seek assistance, and healthcare professionals can offer interventions that can help kids overcome developmental delays. These professionals often evaluate children to determine if a developmental delay might be present, or they might work with elderly patients who are facing health concerns associated with old age such as cognitive declines, physical struggles, emotional difficulties, or degenerative brain disorders.

Developmental Stages

As you might imagine, developmental psychologists often break down development according to various phases of life. Each of these periods of development represents a time when different milestones are typically achieved. People may face particular challenges at each point, and developmental psychologists can often help people who might be struggling with problems to get back on track.

- **Prenatal**
  The prenatal period is of interest to developmental psychologists who seek to understand how the earliest influences on development can impact later growth

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during childhood. Psychologists may look at how primary reflexes emerge before birth, how fetuses respond to stimuli in the womb, and the sensations and perceptions that fetuses are capable of detecting prior to birth. Developmental psychologists may also look at potential problems such as Down syndrome, maternal drug use, and inherited diseases that might have an impact on the course of future development.

- **Early Childhood**
  The period from infancy through early childhood is a time of remarkable growth and change. Developmental psychologists look at things such as the physical, cognitive, and emotional growth that takes place during this critical period of development. In addition to providing interventions for potential developmental problems at this point, psychologists are also focused on helping kids achieve their full potential. Parents and healthcare experts are often on the lookout to ensure that kids are growing properly, receiving adequate nutrition, and achieving cognitive milestones appropriate for their age.

- **Middle Childhood**
  This period of development is marked by both physical maturation and the increased importance of social influences as children make their way through elementary school. Kids begin to make their mark on the world as they form friendships, gain competency through schoolwork, and continue to build their unique sense of self. Parents may seek the assistance of a developmental psychologist to help kids deal with potential problems that might arise at this age including social, emotional, and mental health issues.

- **Adolescence**
  The teenage years are often the subject of considerable interest as children experience the psychological turmoil and transition that often accompanies this period of development. Psychologists such as Erik Erikson were especially interested in looking at how navigating this period leads to identity formation. At this age, kids often test limits and explore new identities as they explore the question of who they are and who they want to be. Developmental psychologists can help support teens as they deal with some of the challenging issues unique to the adolescent period including puberty, emotional turmoil, and social pressure.

- **Early Adulthood**
  This period of life is often marked by forming and maintaining relationships. Critical milestones during early adulthood may include forming bonds, intimacy, close friendships, and starting a family. Those who can build and sustain such relationships tend to experience connectedness and social support while those who struggle with such relationships may be left feeling alienated and lonely. People facing such issues might seek the assistance of a developmental psychologist in order to build healthier relationships and combat emotional difficulties.

- **Middle Adulthood**
  This stage of life tends to center on developing a sense of purpose and contributing to society. Erikson described this as the conflict between generativity and stagnation. Those who engage in the world, contribute things that will outlast them, and leave a mark on the next generation emerge with a sense of purpose. Activities such as careers, families, group memberships, and community involvement are all things that can contribute to this feeling of generativity.

- **Older Adults**
  The senior years are often viewed as a period of poor health, yet many older adults are capable of remaining active and busy well into their 80s and 90s. Increased health concerns mark this period of development, and some individuals may experience mental declines related to dementia. Erikson also viewed the elder years as a time of reflection back on life. Those who are able to look back and see a life well-lived emerge with a sense of wisdom and readiness to face the end of their lives, while those who look back with regret may be left with feelings of bitterness and despair. Developmental psychologists may work with elderly patients to help them cope with issues related to the aging process.

- **Developmental Diagnosis**
  To determine if a developmental problem is present, a psychologist or other highly trained professional may administer either a developmental screening or evaluation. For children, such an evaluation typically involves interviews with parents and other caregivers to learn about behaviors they may have observed, a review of a child's medical history, and standardized testing to measure functioning in terms of communication, social/emotional skills, physical/motor development, and cognitive skills. If a problem is found to be present, the patient may then be referred to a specialist such as a speech-language pathologist, physical therapist, or occupational therapist.

1.5 METHODS IN PSYCHOLOGY

In the last lesson we noted that the interpretation of a psychological phenomenon by a psychologist may differ from that of a novice. A psychologist follows a systematic scientific procedure which has sound theoretical base in order to explain and interpret the phenomenon. Psychology has various methodological ways or approaches to understand and explain psychological phenomena. We will be studying about some of these approaches. In order to obtain responses from individuals a number of psychological tools or instruments are used. The responses taken on those tools constitute the basic data which are analyzed to study human experiences, mental processes and behaviours. In this lesson we will discuss these aspects in detail.

APPROACHES TO THE STUDY OF PSYCHOLOGICAL PROCESSES

As discussed in the previous lesson psychologists use a variety of approaches to describe, predict and control behaviour and mental processes. The main approaches are briefly described below.

Biological Approach: This approach focuses on biological structures and phenomena such as brain, genes, hormones, endocrine system and neurotransmitters in order to understand the dynamics of behaviour. Its main focus is on the role of different parts of brain in regulating feelings, memories, emotions and other aspects of behaviour. Similarly, the impact of over-secretion or under-secretion of different kinds of hormones in governing behaviour is studied. Behaviour genetics as one of the subdisciplines studies the genetic determinants of behaviour. Moreover, this approach looks for physiological basis of human behaviour.

Psychoanalytic Approach: The father of psychoanalytic approach Sigmund Freud focused on unconscious libidinal energy in describing the present state of the individual.

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He studied mind in terms of hierarchical arrangements of experiences in the form of different layers of consciousness (e.g. conscious, preconscious, and unconscious). Freud explored the nature and quality of unconscious through analysis of dreams, slips of the tongue, neuroses, psychoses, work of art, and rituals. He assumed that majority of human behaviours are triggered by unconscious motivation. Thus to understand the present human behaviour the analysis of unconscious mental contents is considered most important.

Humanistic Approach: Contrary to Freud, the father of humanistic approach Carl Rogers put greater emphasis on conscious experiences of the present situation, role of interpersonal experiences across the course of life, and people's capacity to grow toward psychological maturity. This approach basically assumes that a person is an active and self-actualizing agent and has a choice in deciding his behaviour. As a part of the self-actualizing process a person seeks to maintain a congruence between self and experience. However, because of past experiences with conditional positive regard, he may deny or distort the experiences that threaten one's self-system. Such a self-system can be changed in the therapeutic setting through genuineness, unconditional positive regard, and empathic understating of the client's problem by the therapist.

Behaviourist Approach: The unit of analysis for this approach is explicit, objective and overt behaviour and its relationship with environmental stimulation. The father of behaviorism J. B. Watson emphasized on objective analysis of behaviour. He advocated that behaviour is largely governed by the association between stimulus and response and the behaviour can be shaped in a desired direction by manipulating this association.

Cognitive Approach: The cognitive approach emerged as an alternative to the mechanistic paradigm of behaviourism. This approach mainly focuses on the study of information processing capacity of the individual in terms of perception, remembering, thinking, language, reasoning, problem solving and decision making which are called higher mental processes. It proposes that we look out for information in the world and our behaviour depends upon the way we process this information. This approach largely relies on computational models and assumes that behaviour and mental processes can best be understood by treating them in terms of information processing.

Methods in psychology

Some of the methods are: 1. Observation Method 2. Experimental Method or Experimental Observation 3. Psychological Experiment 4. Variables – Independent – Dependent and Intervening 5. Control 6. The Case Method 7. Survey Method.

Method # 1. Observation Method:

The basic method of psychology, as is the case with any science, is observation. Early psychologists tried to study and explain behaviour by just observing the behaviour and activities of organisms. On the basis of their observation, they tried to find explanations.

This type of observation is called natural observation or non-controlled observation. This term means that the observation was made in natural settings, as and when the behaviour occurred. On the basis of repeated observations, the psychologists attempted to formulate general laws and principles.

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An outstanding example of laws based on such natural observations is the laws of association formulated by Locke, Berkeley, Brown and other British philosophers. At a still deeper level philosophers tried to combine observation with logic and tried to develop psychological theories. Natural observation was employed for a long time for psychological study.

This method had its advantages as well as disadvantages. Some of the advantages are as follows:

a. It is easy to collect data and no special arrangements or gadgets are necessary.
b. By observing behaviour in natural situations, we are really observing behaviour in life situations.

If the aim of psychology is to understand and predict behaviour in real life situations then the natural thing to do will be to study behaviour in life situations. Whereas in the case of physics or chemistry, observations made in a laboratory can hold good even outside, the same cannot be said about behaviour. Life situations are different from laboratory situations. Hence natural observation would be more ideal and meaningful.

However, there are also some very serious disadvantages and difficulties in employing the method of natural observations. Some of these are as follows:

a. It is not possible to observe all types of behaviour in a natural setting. Some aspects of behaviour are implicit and are not open to observation. Feelings and other internal processes cannot be observed.
b. It is difficult to convert data from natural observation into quantitative terms.
c. Different observers observing the same behaviour may conclude differently.
d. Many instances of behaviour do not repeat themselves. An important requisite of scientific observation is repeatability. This is often impossible in natural observation. Thus, if the psychologist is interested in studying how people react when a close relative is involved in an accident, it is obvious that he cannot either expect or even wish for many such instances. Thus, one may see that the method of natural observation imposes severe limitations. It involves a lot of time and effort. Imagine a chemist who wants to study the effect of heat on some chemical and cannot wait for the solar heat to increase to 600° C.

The best thing for him to do would be to take the chemical into a laboratory, heat it and watch the changes. So natural observation has its limitations and psychology like other sciences has also turned to what is called experimental observation or the experimental method.

Method # 2. Experimental Method or Experimental Observation:

As indicated just above, an experiment is a procedure by which certain conditions, events etc. which occur in nature are artificially created and reproduced in the laboratory. The chemist who studies the effect of heat on a chemical in the laboratory, is actually creating and reproducing a phenomenon that can be expected to occur in nature under certain circumstances.

In fact, this is called simulation. Once the psychologists accepted the idea of experimentation then it became possible to create in the laboratory different types of conditions that can

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produce or simulate any type of behaviour the psychologist may desire to study. In short, the experimental method involves the creation of certain stimulating conditions or the presentation of certain stimuli that would evoke or produce a certain response.

The experimental psychologist, therefore, essentially produces certain stimuli and studies the reaction or response. Through repeated observations on a number of people, he arrives at certain generalisations about the relationships or the connections between stimuli and responses.

Let us take an example. A psychologist wants to study how people react if they hear a very loud noise. The experimental procedure is very simple. He invites some of his friends and other volunteers to his room or his laboratory and arranges to produce a very loud noise without the people being aware of it. Then he observes the behaviour and finds that most of his friends jump from their chairs, a few of them actually fall down, but one or two are relatively undisturbed.

Then he tries to find out why one or two were undisturbed. He comes to know that these two friends had served in the army and were used to loud explosions. He now comes to two conclusions.

First, in general people get disturbed when they hear a very loud noise suddenly.

Second, people who were earlier used to hearing loud noises are not disturbed much. This actually takes us to a second important feature of the experimental method. The psychologist now conducts the experiment a second time. This time he takes the background of all his volunteers and asks them for their previous experience; whether they have served in the army or whether they were used to loud noises.

He excludes those who reported familiarity with loud noise. His experiments show that all his friends are disturbed but one or two of them very significantly. He enquires of them why they were disturbed so much. The answer comes that they were afraid not only of the loud noise but also because of the fact that the room was closed.

He now conducts a third experiment keeping half of the friends in a closed room and the other half in an open room. His experiments show people in the closed room were disturbed much more than the others. Now, what has the experiment shown? It has shown that the disturbance which occurs is caused by not only a loud noise but also by the closed room.

Now compare this with natural observation. The experimenter psychologist goes on varying the conditions of his observation. He can change the people he observes. He can change the nature of stimulus. He can also change the conditions of the experiments. Obviously, such things cannot be done if we depend only on natural observation.

For example, a teacher finds that four of his good students appear very sad after an examination. He may conclude that these four students are disappointed with their performance in their examination. But on enquiring he may find that the two of them are sad because they had lost some money while travelling by the bus and one of them is sad because somebody in his home had fallen ill.

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In view of this, perhaps, they did not do as well in the examinations as they were capable of. But it is difficult to say how much of their sadness is due to the examination and how much due to the other factors. This possibility of changing the various aspects of the observation gives a distinct advantage to the experimental method.

This is called establishment of control. The term control means taking all necessary steps to see that conditions and factors which affect the relationship between stimuli and responses are isolated, eliminated or neutralized. It is characteristic of human behaviour that at any time the organism is exposed to a variety of stimuli and not a single stimulus. In view of this, controls are very important in experimental psychology.

Over the years experimental psychologists have developed very fine techniques and methods of establishing control in their experiments. They can manipulate the people who are being subjected to the experiments or the conditions of the experiment or the stimuli themselves. Very often control involves the changing or manipulation of all these.

The experimental method has another advantage, in that observations can be made much more accurate. The degree of disturbance can be measured in terms of heartbeat, blood pressure, etc. Suitable gadgets or measuring instruments can be made use of to arrive at a precise and accurate observation of the levels of disturbance. This is not possible in natural observation.

In the early stages, experiments in psychology were very simple and not sophisticated. Many of the gadgets and instruments available today were not available then. In view of this, early experimental psychologists depended on what is called introspection.

After producing a stimulus, they would ask the subject or the person to report or state all the psychological changes, events and experiences occurring in them. This method was known as introspection. The term introspection means looking within. Actually it was the subject who made the observations and reported the same to the experimenter.

But the method of introspection soon came in for criticism on the following grounds:

a. The subject may not be able to observe all the experiences.
b. They may not be able to report or express correctly all their experiences.
c. The same experience may be reported differently by different people.
d. Comparison and quantification of different experiences would be erroneous.

In view of these objections, the method of introspection gradually fell out of favour. The psychologist began to develop different types of apparatus and psychological tests for observation and measurement. Some of these are mechanical and electrical gadgets while many of them are paper and pencil tests or requiring the subject to carry out some specific tasks.

One may go on at length about the experimental method but this is neither possible nor necessary here. It is sufficient to say that in the past hundred years or so psychologists have developed the experimental method to a very high degree of perfection comparable to experiments in other sciences.

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However, the experimental method also has its disadvantages.

Firstly, no matter how much the methods of experimentation may improve, there are still certain aspects of behaviour or categories of behaviour which cannot be studied experimentally.

Secondly, generalization and prediction made from laboratory experiments may not be very true in real life situations. It is not possible to control all the conditions of life in laboratory conditions.

Thirdly, the experimental method involves the use of gadgets, apparatus and unnatural elements which may themselves vitiate the control in an experiment.

Finally, it is impossible to study complex behaviour in an experimental situation.

These limitations notwithstanding, experimental psychology has made tremendous advances and contributed a lot to the development of psychology. Generalisations and predictions based on experiments have been found to be very reasonably accurate and true. In recent years, psychologists have developed the experimental method to include the study of not only individuals but of whole groups; not only of normal people but also of abnormal people.

Experiments in psychology often appear to be simple, but this is not so. Psychological experiments call for a lot of thinking, planning and preparation. The different aspects of the experiment like the stimuli, the subjects and the conditions in the laboratory have to be designed and selected very carefully.

Measurements have to be accurate. In spite of these the psychologist should be aware that his prediction and generalization may not always be found to occur in non-laboratory situations. This gap between the findings of the experiment and actual life behaviour can be bridged only by conducting more and more experiments, identifying the reasons for the gap and the failure of the prediction.

Thus, we can say, no experiment in psychology can be said to be complete at any time. There is always a scope, and more than that, a need to go on extending the experiment. This, perhaps, is peculiar to psychology unlike other sciences. To overcome some of these difficulties, psychologists have resorted to non-laboratory experiments like field experiments.

Participant Observation:

Another form of the observation method employed by psychologists is known as participant observation. The method was adopted by psychologists from anthropology. Anthropologists who were interested in studying the customs and practices of different societies very often went and lived as members of these communities adopting the ways and customs of the people whom they were studying.

This method gave them the advantage of being able to understand very intimately the practices. They were able to appreciate the meaning of different aspects in the total context of life. Encouraged by the success of the anthropologists, psychologists also began to adopt this method. This method is today extensively used in psychology.

Psychologists who are interested in the study of groups like committees, work-groups, etc., very often become actual members of such groups, participate in their activities and at the same time make scientific observations. This method has been found to be very useful and helpful. Very often participant observation is employed to validate the findings and interpretations arrived at through other methods.

Method # 3. Psychological Experiment:

Most laypersons and perhaps even beginners in psychology often wonder what a psychological experiment can be like; they are even baffled that the psychologist claims to be an experimental scientist.

Comparing a Psychological Experiment with an Experiment in Chemistry or Physics:

Let us take, for example, a student in a chemistry laboratory who comes across some solid substance. He wants to know what happens if this substance is heated.

He puts some of the powdered bits in a crucible and heats it. After some time the solid disappears and becomes a liquid. On further heating it becomes gaseous, and begins to give a smell. Here, the student finds that the property (behaviour) of the substance changes when heated.

He then proceeds to repeat the experiment to find out at what temperature the solid becomes a liquid and the liquid becomes a gas. Proceeding further he tries to compare the colour, smell, and even other chemical properties and studies how they change. Let us now compare a psychological experiment with this. In the place of the solid substance of the chemist, the psychologist tries to study a human organism.

This organism is the subject. The chemist applies heat. The psychologist also applies some type of force, or changes the state of existence of the organism. This is called the stimulus variable. The chemist observes the change in colour and other properties.

The psychologist studies the changes in appearance, action, emotion, feeling etc. These are the responses. Now, just as the chemist wants to determine the exact temperature of melting, the psychologist also tries to determine the exact stimulating conditions that produce specific changes in response.

The analogy looks simple and neat. In actuality, however, there are certain differences which complicate a psychological experiment. Some of these are:

1. The human organism responds to a number of stimuli at the same time. In the case of the chemical, all other conditions except temperature can be held constant. This is not possible in the case of the human organism, who without the knowledge of this experimenter and perhaps without his own knowledge may be responding to certain stimuli. The changes in behaviour may be produced by these stimuli and not the one studied by the investigator. Secondly, the human organism responds not only to stimuli from outside but also to forces from inside (like the needs of the organism).
2. Similarly, all the responses of the human organism cannot be seen from outside. Some of the changes may be internal. Hence, special observational techniques are necessary.

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3. In the case of the chemical, if you take different pieces, they are alike and react in the same way. But this is not the case with human beings. Individuals differ from each other in responding to the same stimuli. A delicate college girl may swoon at the sight of blood, but another girl, a nurse of the same age, will not.

These differences make the psychological experiment more complicated and this will become clearer as we proceed. Presently it may be useful to consider some of the terms common to the experimental method in general and psychological experiments in particular.

Method # 4. Variables – Independent – Dependent and Intervening:

The term 'variable' means that which can be varied or changed or that which changes or varies itself. Let us go back again to the chemistry student with his experiment. Here, when heat is applied, the nature, colour and properties of the material change. The stimulus is changed and the responses change. The former represents one type and the latter another type of variable.

The first variable can be changed by the experimenter at will and is deliberately and systematically varied to find out how this is accompanied by changes in the second set of variables. Thus, the variation of the one is known and the other unknown. But the variation in the second variable is known to follow changes in the first variable. However, there is no such definite relationship in the reverse direction.

We now go to define the two types of variables Independent and Dependent. The Independent Variable is the one which is systematically and independently varied by the experimenter while the Dependent Variable is the change he expects to occur as a result of the changes he has produced in the Independent Variable. An example may make this clearer.

Let us imagine that a psychologist wants to study experimentally the effect of sleeplessness on accuracy of hearing. He may proceed to conduct the experiment as follows. He takes a group of subjects. He makes a series of sounds from very low intensity to high intensity. Then he makes a note of the lowest sound which this subject is able to hear. After this he keeps the subject busy not allowing them to sleep.

After an hour he again makes a note of the lowest audible sound. The procedure is repeated at the end of 2 hours, 4 hours etc. After a number of trials, he finds that with increasing sleep-deprivation the intensity of the lowest audible sound increases. In this experiment, the amount of sleep-deprivation is the Independent Variable and the ability to hear is the Dependent Variable.

In any experiment, it is not necessary that there should be only one Independent Variable and one Dependent Variable. For example, if the same psychologist, in addition, wants to know not only the effect of sleep-deprivation but also the effect of age, he can take two subjects, one being a young subject and the other being an old subject. Here, age will be the second Independent Variable.

Again, in addition to accuracy of hearing he may study accuracy of vision also. In certain experiments the number of variables may be very large. Such experiments are called

multivariate experiments. Where there is only one independent variable and dependent variable, it is called a Uni-variate Experiment.

Sometimes one may come across a third term Intervening Variable. Intervening variables are in fact, a type of independent variables. But they differ, in that they are not deliberately introduced or varied by the experimenter. But nonetheless, on observing the results, they are also found to have influenced the responses of the dependent variables.

Their effect may be in the same direction as that of the main independent variables or in another direction. In the experiment on sleep-deprivation, let us suppose the subjects do not show any fall in auditory acuity. On enquiry the experimenter finds that these people have taken a cup of coffee, or they were listening to the music playing in the next room or that they are used to sleep-deprivation being night shift workers.

Now, these factors or variables have intervened between the independent variable and the dependent variable and altered the relationship between the two. In most instances, these intervening variables are purely internal or subjective in nature like feelings, needs, practice etc. In any experiment care must be taken to eliminate the operation of these intervening variables. This aspect is called establishing control and is discussed below.

Method # 5. Control:

A chemist before he arrives at a conclusion about the property of a chemical repeats the observation a number of times. The psychologist also has to do the same. He has to make repeated observations on the same individual and also on different individuals before arriving at a conclusion.

Here the chemist is at an advantage. Fortunately for him all samples of the same substance drawn from the same source are to a very large extent similar. But this is not true of human beings who differ very much from each other. So, as far as possible, the psychologist also has to select people who do not differ from each other much. Otherwise, the results of his experiment may not be as expected.

In the experiment on the effect of sleep-deprivation, for the two subjects – one who was active throughout the day and straightaway comes to the laboratory to serve as a subject at 8.30 p.m. and the other who was sleeping till 8 p.m. and comes to the laboratory at 8.30 p.m. – the results will be different.

Here it becomes necessary for the experimenter to ensure that both the subjects have been spending the day in more or less the same way before he starts the experiment. Thus ensuring of homogeneity becomes necessary for all psychological experiments. This is one type of control, which the experimenter has to establish viz., homogeneity in the subjects. He has to select the subjects carefully.

Yet another type of control also becomes necessary in psychological experiments. The human subject differs from the chemical substance in another way. When a chemical is being heated, it is affected by the heat. The chemist can see to it that no other factor affects it.

He can have a control over the atmospheric pressure and other forces which might affect the substance. But with the human being this is not the case. At the same time he is

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influenced by a number of factors. In the experiment on sleep-deprivation it is possible that some subjects may become hungry also and the fall in accuracy of perception may be due to this.

Again, some people may feel the deprivation less if they are given some interesting games or reading material. All these factors are bound to affect the results of the experiment. Hence, the experimenter has to maintain these experimental conditions uniform. He has to see to it that no independent variable other than the one chosen (e.g.. sleep-deprivation) is at work.

In addition, he has also to ensure that experimental conditions are uniform. Thus, here also controls have to be exercised. This is very important. It is here that most psychological experiments face difficulty. As a result, several methods of establishing controls have been arrived at. These methods are devices to establish maximum possible control to prevent irrelevant variables vitiating the results and to ensure homogeneity of the subjects experimented upon.

Experimental and Control Groups:

The psychologist uses groups of subjects. This is necessary for the reason, viz. the need in any scientific experiment to make repeated observation. These repeated observations can be made in two ways, one method is by carrying out the experiment on the same individual many times.

This may not be possible for many reasons:

First, the same individual may not be available or willing to take part in the experiment on many occasions.

The second and more serious is in the nature of psychological experiments themselves. Most psychological experiments require the subject to do something. If he does it once, he learns it and his performance in the subsequent experiments will be affected by this practice. This is not the case with the chemical or physical objects employed by other scientists.

Thirdly, the human beings differ from each other unlike the different samples of a substance studied by the chemist.

Hence, to make a study of some behaviour, we must include different types of human subjects and therefore psychological experiments almost always involve groups of subjects. It is also possible that the individual develops certain habitual ways of responding and perhaps is also able to expect or anticipate experimental stimuli. These result in errors of habituation and anticipation.

In a typical psychological experiment we have two types of groups. There may be only one group in some experiments and more than two in others; the two groups are called 'Control group' and 'Experimental group'. Now both these groups are matched in all respects excepting the independent variables which are proposed to be studied in the particular experiment.

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Let us now discuss the experiment on the effect of sleep-deprivation on auditory acuity. The experimenter could take the same group and study the auditory acuity after different degrees of sleep-deprivation.

Now if the experimenter finds it difficult to study the same group of subjects on repeated occasions, he can as well start the experiment, with two or three groups; one group with no deprivation, a second group with one hour deprivation, a third group, with two hours deprivation etc. Here you will find that in the first group, the independent variable, namely 'sleep-deprivation' does not operate. It is controlled.

Hence this is a 'control group'. In the other two groups the experimental independent variable has been introduced. So, these are then called experimental groups. An experimental group is that in which some independent variable is introduced or altered for the purpose of the experiment.

It must be pointed out, however, that the alteration or introduction of the experimental variables need not always be of an artificial type. If, for example, a psychologist wants to study the amount of self-confidence in children with fathers and children without fathers, he selects a group of children whose fathers are alive and another group whose fathers are not alive.

Here the independent variable is the presence or absence of the father. But both the control and experimental groups are available in nature. In some experiments there can be more than one experimental group. In the experiment quoted above the psychologist may study father absent and mother present children, father present and mother absent, both absent etc. Here there can be many experimental groups.

It must be borne in mind however, that great care must be exercised in selecting the two groups. The two groups must be matched to make them similar in all relevant variables except the specific independent variables under experimentation. The relevant variables on which matching has to be done vary from experiment to experiment.

In experiments where only one group is used for entire experiment, the same group is put under varying conditions, e.g. no sleep-deprivation, one hour's deprivation etc. The independent variable is varied instead of experimental and control groups. Here we have Experimental Conditions and Control Conditions.

In the latter no variation of the independent variable is introduced while in the former, the projected variations in conditions are introduced. Here also care must be taken to keep other factors, like subjects' moods, physiological conditions etc., similar under both the conditions.

Hypothesis:

We will discuss the term which is very frequently used in experimental psychology. The main aim in any experiment is to study the effect of some stimulus or condition on some response or behaviour. That is, an attempt is made to study the relationship between an Independent Variable and a Dependent Variable.

Now taking the experiment on sleep-deprivation and auditory acuity, an experimenter can proceed in two ways. He can start without any preconceived idea, go on experimenting

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with different individuals and, based on the findings, come to the conclusion that sleep-deprivation lowers auditory acuity.

On the other hand, if he already knows something about the physiological aspects of sleep, and also the physiology and psychology of hearing he can start the experiment in another way. From the knowledge of sleep physiology and psychology, he can conclude that sleep-deprivation produces fatigue. From the knowledge of psychology of hearing he knows that auditory acuity depends on a healthy body and mind.

Putting the two together he can have some idea of the relationship between sleep-deprivation and auditory acuity, i.e. sleep-deprivation brings down auditory acuity. Now he can start his experiment with this preliminary idea, and proceed to confirm or reject his preliminary idea.

Most psychological experiments start with such hypothesis. The practice of starting an experiment with a hypothesis has some advantage. It helps the experimenter to be more definite about the specific Dependent Variables he has to study, so that he can measure them more accurately.

Also, if his results are not in the expected direction, it is easy for him to know whether it is due to some defects in the experiment or due to the real nature of the phenomenon. The latter is not possible in the first method, because we do not know what is the expected result and what is not. Thirdly, if one were to adopt the first approach he may, theoretically speaking, never know when to end his experiment.

However, the method of hypothesis formation and verification poses some problems. First of all hypothesis formation implies the knowledge of previous experiments on the related areas or practical experience and observations. A hypothesis can be formulated only if there are some known facts about some variables common between the Independent Variable and the Dependent Variable.

For example, in the above illustration the formation of hypothesis implies the knowledge of previous experiments on the related areas of practical experience and observations. A hypothesis can be formulated only if there are some known facts about some variables common between the Independent Variable and the Dependent Variable.

For example, in the above illustration the formation of the hypothesis involves knowledge of origin of fatigue and the effect of fatigue on sensory behaviour. When such knowledge is absent it may not be correct to form a hypothesis. A hypothesis when it is formed must be precise, clear and specific.

Otherwise, it is not likely to be very useful. If it is vague it approaches a theory and if it is specific it is useless. For example, in the above experiment, if an experimenter starts with a hypothesis that fatigue affects sensory capacities, this tells us nothing definite about sleep-deprivation and auditory acuity.

It is very vague. On the other hand if he states that sleep-deprivation affects capacity to hear bell sounds this becomes very specific and psychologically not very meaningful. Hence, a hypothesis has to be precise and specific and at the same time wide enough to be psychologically meaningful and scientifically useful.

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Method # 6. The Case Method:

The case method is a gift to psychology from the field of medicine. Clinical psychology uses this as a main method. Subsequently other branches of psychology also found it useful to employ this method. Social psychologists studying certain problems, employ the case method.

Social psychologists employ the case method at different levels. At the first level, the case method is employed to study and understand the various factors related to the occurrence of a particular event, e.g., a few years ago there was a sudden panic in Hyderabad city. People from certain areas started leaving their homes and almost travelling by whatever mode of transport was available.

Later on, it came to be 'known', that the river Moosi in the city of Hyderabad had overflown and that several areas were being inundated. This wild rumor had spread. Actually there was not a drop of water in the river and the river certainly could not have overflown. Some drainage pipes had broken the previous night, and there was a scare in the public and there was no question of any place being inundated. But the previous night's fear scared them enough to fly away like crows. This is certainly an interesting event or phenomenon for social psychologists in particular to study. In such an instance, the case method would be the most suitable.

The social psychologists can collect all the necessary information, meet the people, talk to them, study how the rumor originated, how it was transmitted and finally what were' the different kinds of consequential behaviour. This may help not only to understand the course of events in the situation, but perhaps also help in dealing with an actual disaster in the future. A second level of application of the case method is at the level of organisations. Organisational psychologists make use of this method extensively. Let us imagine that there are a number of similar industrial units comparable in all respects like resources, technology etc. But one of them is faring badly in terms of performance and output.

The problem before the organisational psychologist is to understand why one unit alone should fare badly. Here again, the case method is probably the most helpful. The investigator tries to collect all possible information about the various factors, employs different types of sources like documented information, questionnaires, interviews and tries to understand what has gone wrong. Perhaps, it is the style of leadership, or some other motivational factors.

Such case studies can help us to understand 'idiosyncratic' behaviour. Similarly the case method can also be employed to understand organisations which do very well under even serious resource constraints. Such knowledge will help us to improve the performance of organisations, by creating suitable conditions and evolving appropriate behavioural systems. An outstanding example of such a type of research is the one carried out by Peterman and Water on excellence in successful leading American corporations. On certain occasions social psychologists have also been facing the need to study whole communities. For example, we have had the experiences of large groups of refugees who have been displaced from their traditional habitation, and moved to different places necessitating radical changes in their adjustment.

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The social psychologist is definitely interested in studying the process by which a whole group of people learn to readjust themselves to totally new surroundings. These people often have to change their attitudes and behavioural patterns. Probably they are shifted to surroundings which are totally strange or alien. A similar picture can be seen if a programme like 'Family Planning' is to be introduced to a remote rural community which has never thought in terms of family planning; where the belief has been that the greater the number of children, the greater is the security or that children are gifts of God.

Social psychologists usually make a study of the various beliefs, practices, attitudes and behaviour of the whole community, so that such conditions can be created, wherein positive futuristic attitudes can be introduced, without meeting with much of a resistance. Here again, questionnaires, rating scales, interviews and a variety of techniques can be used. Thus, it can be seen that the case study method can be used at different levels and for different purposes. In fact a number of such cases can often help generate ideas or more controlled, laboratory and field studies. Used carefully the method can help us get lot of insight into the nature of different kinds of behaviour.

Method # 7. Survey Method:

Another major method employed in psychology is the survey method. This method is commonly employed in social psychology though other branches of psychology also employ it. The survey method is employed whenever we are interested in knowing how a particular behaviour is distributed among a group of people.

For example, if we want to understand the study habits of college students, then a survey is undertaken. Similarly, if we want to understand the opinions of workers on a certain legislation then a survey is undertaken. Surveys can be general, relating to the people at large or to specific groups like students or workers or housewives.

Surveys can be of two types. In some instances we can study all the people belonging to a particular community that we are interested in. Thus, if we want to study the reading habits of high school students in Hyderabad city, we can visit all the schools and collect information from all the students.

This type of survey is known as population survey or a census. On the other hand if we do not have the time and the facilities, we can just visit some of the schools and meet only some of the students. We can then arrive at our conclusion, assuming that these findings will not differ very much from the findings of a population survey had we undertaken one. This type is called a sample survey and is a very common method. We have studied a sample (or one part) of the population. Manufacturing industries undertake consumer surveys to study the likes and dislikes of people on the basis of samples. While the sample survey is much easier, great care has to be exercised in selecting the sample. Otherwise the findings of sample survey may not be true of a population. A number of techniques have been developed for selecting the right type of samples.

The reader will learn more about this if and when he studies psychology at a more advanced level. Sample surveys have been found to yield very accurate findings and predictions when carried out carefully. An instance is the forecast of the election results based on sample surveys. In many researches, however, more than one method is

employed. There are researches where the survey method, the case study method and the experimental method can be used together. The choice depends on the purpose of the research, the resources available and the time available. The choice of the right method is very crucial in determining the quality of research. An outstanding example of this type are the Hawthorne Studies carried out by Elton Mayo and his colleagues where a variety of methods were employed.

1.6 PSYCHOLOGISTS AT WORK

Aviation Psychologists

These psychologists study the behavior of pilots and other flight crew members. Aviation psychologists also perform research on airline safety, develop new training equipment, and help select suitable employees.

For example, an aviation psychologist might select or even develop psychological tests used to screen applicants for elite pilot positions. Because of the highly specialized and delicate nature of the job, it is essential to choose candidates who are healthy, stable, and capable of coping with intense pressure. Aviation psychologists utilize their knowledge of psychology to ensure that only the best people are chosen for these critical roles.

Aviation psychologists might also work with other professionals, including engineers and human factors psychologists, to design different components of airplanes such as the cabins or flight decks. By taking human psychology into consideration during the design process, aviation psychologists can help ensure that these products are developed with perception, attention, memory, and other capabilities in mind.

Biopsychologists

These psychologists are also sometimes called biological psychologists or physiological psychologists. They study and perform research on the brain and behavior. By examining the neural bases of behavior, biopsychologists are able to understand different biological factors that might impact how people think, feel, and act.

This type of psychologist might also investigate how brain disease and injury impact behavior. By better understanding how people are affected by such injuries and diseases, researchers can also find new ways of preventing, treating, and managing serious brain illnesses and trauma.

Clinical Psychologists

Clinical psychologists assess, diagnose and treat individuals experiencing psychological distress and mental illness. They also perform psychotherapy and develop treatment plans.

Clinical psychologists often work in hospitals, mental health clinics, and private practice. They are trained in a variety of treatment techniques but may specialize in treating certain disorders or working with certain populations. For example, a clinical psychologist might specialize in an area such as substance abuse treatment, child mental health, adult mental health, or geriatric mental health.

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Cognitive Psychologists

Cognitive psychologists investigate how people think, including topics such as decision-making and problem-solving. This type of psychologist is interested in how the brain processes, learns, stores, recognizes, and utilizes information.

Cognitive psychologists may work in a variety of settings, including universities, research centers, rehabilitation facilities, hospitals, government agencies, and in private practice. Professionals in this field often perform a range of duties such as conducting research and working with patients.

As with other areas of psychology, cognitive psychologists often choose to specialize in a particular area such as memory, language development, attention, problem-solving, or learning disabilities.

Community Psychologists

This type of psychologist conducts research on community health issues. They also seek to educate the community and develop prevention programs. These professionals are focused on helping lead positive changes at both the individual and community levels.

You may find community psychologists working in a range of settings at universities, government agencies, community organizations, and private businesses as professors, consultants, policy advisors, program directors, and researchers.

Research in this area tends to be very action-oriented and focuses on developing real-world solutions that can immediately be put into practice. Community psychologists work to address social problems, promote health and wellness, and enact policies that improve people's lives.

Comparative Psychologists

Comparative psychologists study the behavior of different species, particularly how animal and human behavior differs. Why study animals? Because while there are obviously major differences, it is assumed that some things may hold true for all species.

Therefore studying the behaviors and responses of animals such as rats and dogs can provide insights into human behaviors as well. Such observations have proven important throughout much of psychology's history.

Consumer Psychologists

Also known as marketing psychologists, consumer psychologists research consumer behavior and develop marketing strategies to promote businesses. This type of psychologist is involved in helping businesses better understand what makes consumers purchase products and services. They research how buyers respond to marketing messages, analyze decision-making strategies, and investigate the role that emotions play in purchasing choices.

These professionals help businesses develop marketing messages, identify target audiences, develop products that appeal to specific consumers, and learn about how attitudes toward brands and products form and change. They accomplish these tasks through the use of market research surveys, experiments, naturalistic observations, and consumer focus groups.

Counseling Psychologists

Counseling psychologists provide psychotherapy to people experiencing psychological disturbances, behavioral problems, emotional difficulties, stress, and related issues. These professionals share many commonalities with clinical psychologists.

Cross-Cultural Psychologists

Cross-cultural psychologists look at how people vary across cultures and how cultural affiliations influence behavior. They often explore how different aspects of behavior may be either universal or varied across different cultures.

For example, cross-cultural psychologists might investigate how parenting styles differ between collectivist cultures versus individualist cultures as well as how these differences in upbringing influence adult behavior.

Developmental Psychologists

Developmental psychologists research human development across the entire lifespan. Some focus on a specific period such as early childhood, adolescence, adulthood, or old age. These professionals may perform tasks such as evaluating children who may have a developmental delay or disability, investigating issues associated with aging, and studying how language skills are acquired.

Some developmental psychologists may focus on research and add to our understanding of developmental issues that can arise throughout life. Other professionals may perform applied work with clients who need assistance in coping with developmental issues.

Educational Psychologists

These psychologists study how people learn and the educational process. This might involve developing instructional strategies and teaching techniques. Some educational psychologists study giftedness or learning disabilities.

This type of psychologist looks at how social, cognitive, and emotional factors impact the learning process. Some professionals in this field specialize in identifying and dealing with potential problems that might interfere with how children learn. Others specialize in researching the learning process, while some might instead focus on designing instructional materials that maximize learning outcomes.

Engineering Psychologists

Engineering psychologists are focused on discovering ways to enhance human abilities by improving machines, equipment, technology, and work environments. While some may focus on more basic research, this is most often a very applied field. Engineering psychologists work to solve real-world problems and develop solutions that can have practical applications in everyday life.

Engineering psychologists may be tasked with developing technology that can be used in the healthcare industry to help patients recover faster. They also help design and refine products that people use each and every day, including mobile phones and motor vehicles.

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Environmental Psychologists

Environmental psychologists explore the relationship between people and their surroundings, including natural environments as well as created environments. This might involve working on conservation projects, helping to protect endangered species, and investigating ways to halt global warming.

These professionals may work as researchers to study the impact that humans have on their environments. Some environmental psychologists also work in government to shape environmental policies.

Forensic Psychologists

Forensic psychologists focus on the relationship between psychology and the law. This might involve acting as a consultant in criminal cases or civil disputes, performing child custody evaluations, and offering psychotherapy services to crime victims.

Thanks to popular depictions in movies and television programs, interest in this field has grown tremendously in recent years. While these pop culture depictions often portray the forensic psychologist as a sleuth working to catch criminals, real forensic psychologists typically perform duties such as assessing juvenile and adult offenders for risk of recidivism, working with child witnesses, evaluating competency to stand trial, and offering professional testimony in court.

Health Psychologists

Health psychologists are centered on how psychology, biology, social groups, and behavior influence wellness, illness, and overall health. They work with clients to help maximize well-being and improve both mental and physical health.

Some professionals in this field perform clinical work where they assess and treat clients who are seeking assistance with a variety of health issues. This might involve providing psychotherapy, administering different psychological assessments, teaching people about different coping techniques, and educating clients about healthy behaviors.

Industrial-Organizational Psychologists

I-O psychologists study workplace behavior such as how to select the best employees for particular jobs and how to increase worker productivity. An I-O psychologist might utilize his or her knowledge of psychological principles to design assessments to screen candidates for specific job roles.

They may also be tasked with developing training programs for existing employees in order to increase knowledge, maximize efficiency, and minimize injury. I-O psychologists are also frequently asked to assess businesses on an organizational level and look for new ways to lower costs, improve efficiency, and increase employee satisfaction and retention.

Military Psychologists

Military psychologists practice psychology in a military setting. This can include such things as treating soldiers who have a mental illness or emotional distress, researching different aspects of military life, and helping soldiers transition back to civilian life.

Some military psychologists focus on performing psychotherapy within different branches of the military, while others apply their knowledge of the human mind and behavior toward recruiting, combating stress, training, decision-making, and leadership.

Personality Psychologists

Personality psychologists study the different aspects of personality and how individual traits influence an individual's life and behavior. Researchers in the field of personality psychology are interested in a wide range of topics that can have applications in everyday life.

For example, they might study how personality forms and whether it can be changed. They might also investigate whether certain personality traits are tied to specific illnesses or disorders, how personality influences the decisions people make, and the many factors that contribute to the development of personality.

School Psychologists

School psychologists help children cope with emotional, academic, social, and behavior problems in school settings. Professionals who work in this field of psychology play a vital role in the educational system, typically collaborating with parents, teachers, students, and other school staff to ensure that the learning environment is healthy, safe, supportive, and productive.

Children who are struggling with some sort of issue, whether it is behavioral, emotional, or academic in nature, can work with a school psychologist to come up with an effective plan to deal with the difficulty.2 School psychologists provide direct intervention or behavioral management when needed, or they may simply offer support and advice to students who need someone to talk to.

Social Psychologists

Social psychologists study the behavior of groups, including how people behave in social settings and how groups influence individual behavior. A social psychologist might investigate a wide range of topics, including attitudes, prejudice, communication, interpersonal relationships, aggression, and persuasion.

For some professionals, this largely involves conducting basic research designed to add to our understanding of social behavior. In other cases, social psychologists utilize their skills and knowledge to influence human behavior in order to foster healthier and more productive groups.

1.7 CHAPTER SUMMARY

Psychology is the scientific study of mind and behavior. The word "psychology" comes from the Greek words "psyche," meaning life, and "logos," meaning explanation. Psychology is a popular major for students, a popular topic in the public media, and a part of our everyday lives. Television shows such as Dr. Phil feature psychologists who provide personal advice to those with personal or family difficulties. Psychologists use a number of research methods and comb through vast amounts of data to test hypotheses and study complex issues in the real world. Quantitative psychologists are expert in designing methodologies and studies

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that reveal answers to research questions on topics as diverse as human performance, child development, memory and language retention. developmental psychologists often break down development according to various phases of life. Each of these periods of development represents a time when different milestones are typically achieved. People may face particular challenges at each point, and developmental psychologists can often help people who might be struggling with problems to get back on track. A psychologist follows a systematic scientific procedure which has sound theoretical base in order to explain and interpret the phenomenon. Psychology has various methodological ways or approaches to understand and explain psychological phenomena. These psychologists study the behavior of pilots and other flight crew members. Aviation psychologists also perform research on airline safety, develop new training equipment, and help select suitable employees.

1.8 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **Explain personality psychologist.**
2. **Discuss Industrial-Organizational Psychologists.**
3. **Write a short note on Aviation Psychologists.**
4. **Explain Health Psychology with a short note.**
5. **Explain Cognitive Developmental Theory.**

LONG ANSWER TYPE QUESTIONS

1. **Explain Approaches to the study of psychological processes in brief.**
2. **Write a brief note on Methods in psychology.**
3. **Write a brief note on Quantitative Psychology.**
4. **Define psychology in brief.**
5. **Discuss Developmental psychology.**

1.9 MULTIPLE CHOICE QUESTIONS

1. **Where the word "psychology" does come from?**
   a. Italian
   b. Greek
   c. Latin
   d. None of the above
2. **Psychology is said to be the scientific study of _____ and _____.**
   a. Behavior, mental processes
   b. Mental illness, Mental health
   c. Physical states, mental states
   d. None of the above
3. **Psychology is said to be the scientific study of _____ and _____.**
   a. Behavior, mental processes
   b. Mental illness, Mental health

c. Physical states, mental states
d. None of the above

4. According to the text, the lower level of explanation corresponds to _____ processes.
a. Social
b. Cultural
c. Biological
d. Interpersonal

5. A psychologist exploring the impact of a new drug on activity in the brain is working on the _____ level of explanation.
a. Lower
b. Middle
c. Upper
d. All of the above

6. A psychologist studying what makes people laugh in different countries around the world is working on the _____ level of explanation.
a. Lower
b. Middle
c. Higher
d. None of the above

7. Different people react differently to the same situation. This is referred to as:
a. Multiple determinants
b. Nativism
c. The Simpson effects
d. Individual differences

8. _____ is to nature as _____ is to nurture.
a. Environment, genes
b. Conscious, unconscious
c. Inaccuracy, accuracy
d. Biology, experience

9. The term "tabula rasa" highlights the importance of _____ in shaping behaviour.
a. Genes
b. Experience
c. Nature
d. Predestination

10. The Greek philosopher _____ believed that knowledge is acquired through experience and learning.
a. Archimedes
b. Rousseau

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c. Plato
d. Aristotle

♦♦♦♦♦

UNIT II

BEHAVIOUR

STRUCTURE

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2.1 LEARNING OBJECTIVE

After learning this Unit students will be able to:

- Know about the Behaviour Analysis.
- Understand Hardware.
- Know about The Neural Impulse.
- Know about the Myelin Sheath.
- Understand Human Nervous System.
- Understand Structure of brain and its functions.

2.2 INTRODUCTION

Behaviour analysis is the science of behaviour, consisting of basic research and an applied technology. The focus is on observable, measurable behaviour and the role of the environment in establishing and maintaining behaviours. 'Behaviour is a product of its circumstances, particularly the events that immediately follow the behaviour. Behaviour analysts have used this information to develop numerous techniques and treatment approaches for analysing and changing behaviour, and ultimately, to improve lives. Because this approach applied behaviour analysis (ABA) is largely based on behaviour and its consequences, techniques generally involve teaching individuals more effective ways of behaving and working to change the social consequences of existing behaviour'. Behaviour analysts use a variety of techniques to change behaviour. These include chaining, prompting, and shaping.

CHAINING

Chaining involves breaking a task into smaller components, and can be used to help people gain proficiency in complex, multi-step directions. The idea of chaining is based on the behaviour chains, which are strings of individual behaviours that, when connected together, create an end-behaviour. Chaining breaks a task down into small steps and then teaches each step within the sequence by itself. For example, a child learning to wash his/her hands independently may start with learning to turn on the faucet. Once this initial skill is learned, the next step may be getting his/her hands, etc.

PROMPTING

Prompting, meanwhile, involves using a prompt to trigger a desired response. It can be used in combination with chaining or shaping, and encourages the learner to perform a task until they learn how and when to do it. Prompts can involve instructions, demonstrations, touches, or other stimuli.

SHAPING

Shaping describes gradually altering a behaviour until it becomes the desired behaviour. For example, a language therapist may use shaping when they develop speech with a client by first reinforcing lip movements, then sound production, and finally words and sentences. The number of adjustments and approximations needed to create a desirable behaviour depends on that behaviour's complexity. Shaping can be useful in cases where

behaviours cannot be easily learned by instructions, incident experience, or prompts One technique that instructors can use in shaping is differential reinforcement.

Assumptions of Behaviour Analysis

1. Behaviour is not random, but is rather governed by lawful principles.
2. Principles of behaviour apply to all species.

Research in Behaviour Analysis

1. Single subject design versus statistical analysis of group differences.
2. Generalization across species, settings, and subjects.

Examples of Applied Behaviour Analysis

1. By observing and interviewing people who interact with an individual with disabilities, it is possible to hypothesize that the individual is hurting himself in order to get other people's attention. Following this assessment and hypothesis, the individual is taught a simple picture communication system which is easier to use than words for him. By then providing attention to the individual when he points to the appropriate picture card that communicates need for attention, the self-injury behaviour stops.
2. A student creates disruption and is sent out of the classroom frequently. A behaviour analysis indicates he is probably acting disruptively in order to be sent out of the room. Instead of sending him out of the room, he is asked to continue working if he wants to get a positive consequence later (e.g., get to go to recess). Now, he would rather work and get recess than have to stay in the class during recess. The disruptive behaviour no longer served the function of allowing escape and the required behaviour ended up serving the function more effectively.

   Behavioural principles are not static. They develop systematically across the years. Perhaps more than any other approach to psychology, behavioural psychology is self-consciously committed to being a progressive science in which worthwhile earlier work is sustained even while new frontiers are explored. We are not speaking of conservatism for its own sake, but rather for the creation of a field that knows how to keep its hard-won gains. A field that cannot do so will appear to renew itself by reinventing what was known earlier and forgotten. Scientific amnesia of that kind gives only the appearance of progress, not its essence. Built upon a century of research in behavioural psychology, in the last decades a coherent and progressive approach to the topic of human language and cognition has emerged from within behaviour analysis. This volume is designed to attempt to account for human psychopathology from the perspective of this comprehensive set of modern behavioural principles. To do that, it is necessary to describe these principles as well as the foundation upon which they rest. The purpose of this chapter is to describe a workable core set of basic behavioural principles that can be used to understand complex human behaviour. We will outline basic principles of learning and then extend those to the empirical analysis of human language and cognition. The next chapter will then describe how these fundamental principles are related to more middle-level constructs specifically focused on complex issues encountered in applied work, such as issues of relationship or sense of self. There are several opportunities for integrating behavioural psychology into practice. For instance, many psychologists research topics like conditioning to examine the

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nature of human behaviour. Often, they are able to apply findings to mental health disorders.

Behavioural psychology has had a major impact in clinical applications. For instance, mental health counsellors, substance abuse counsellors, and other professionals use therapeutic techniques from behaviourism to help people overcome specific issues. Even newer fields, like applied behaviour analysis, have emerged by adapting concepts from behavioural psychology.

The foundation to all those careers is an undergraduate degree in psychology. You can start your journey to becoming a psychologist, mental health counsellor, applied behaviour analyst and more with an online bachelor's in psychology from Riviera University. Gain the knowledge and skills needed to open up several career paths upon graduation.

Study in a fully online learning environment, which allows you to complete your education and maintain your current work and personal schedule. Multiple term starts, a generous transfer credit policy, and competitive tuition rates are all designed to help you start, and finish, faster. Riviera University has been educating students to transform the world for more than 80 years, so you can trust you will receive a high-quality education in a format designed to help you succeed.

CONCEPT OF BEHAVIOUR ANALYSIS

Several concepts in behaviourism are utilized in therapy.

- Systematic desensitization is used for clients who have a specific phobia, which is characterized by marked fear
- or anxiety about an object or situation, like an animal or airplanes. Therapy involves applying relaxation or coping techniques as people are gradually exposed to the object or situation.
- Exposure and response prevention is a strategy that involves exposure to fearful situations, and then not engaging in unhelpful coping strategies. This therapeutic technique is used for obsessive-compulsive disorder (OCD) and other types of anxiety disorders.
- Token economy reinforces target behaviour by giving children and adults symbols or tokens that can be exchanged for something else. It can be used for people with a wide range of mental health issues, as well as in educational settings.
- Modelling involves clients learning behaviour by imitation alone. It's used in developmental psychology and can be incorporated into clinical use.
- Applied behaviour analysis emerged in the 1960s as a way to modify behaviour. It is commonly used for children with an autism spectrum disorder, and is also relevant to fields like education, industrial safety, and criminal behaviour.
- Contingency management involves individuals receiving vouchers for retail goods and services, or the opportunity to win prizes. Often used for patients with substance abuse or related disorders, it typically takes the form of monetary-based rein forcers for drug-negative tests, according to The Psychiatrist.

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2.3 BIOLOGICAL BASIS OF BEHAVIOUR

HARDWARE

- Glia – Structural Support and Insulation
- Neurons –Communication
- Soma – Cell Body
- Dendrites –receive
- Axon – transmit away
- Terminal buttons – Secrete Neurotransmitters

GLIA: Glial cells, also called glial cells or neuroglia, are cell which are non-neuronal and are located within the central nervous system and the peripheral nervous system that provides physical and metabolic support to neurons, including neuronal insulation and communication, and nutrient and waste transport. Glial cells are a general term for many types of glial cell, for example microglial, astrocytes, and Schwann cells, each having their own functions within the body. Each type of glial cell performs specific jobs that keep the brain functioning.

- **NEURONS:** A neuron is a nerve cell that is the basic building block of the nervous system. Neurons are similar to other cells in the human body in a number of ways, but there is one key difference between neurons and other cells. Neurons are specialized to transmit information throughout the body. Neurons and other body cells both contain a nucleus that holds genetic information. Neurons and other body cells are surrounded by a membrane that protects the cell .Neurons stop reproducing shortly after birth. Generally, when neurons die they are not replaced, although neurogenesis, or the formation of new nerve cells, does occur in some parts of the brain.
- **SOMA:** The Soma is cell body of a neuron and contains the nucleus of the cell. The soma doesn't play an active role in transmitting neural signals, but it keeps the cell functioning and holds the cell's DNA. The Soma principle evidently adds to human Consciousness an affective dimension of intoxication, delight, joy and pleasure. As a god, Soma is associated with the Moon. Soma also has parallels with the Greek god, Dionysius. In the Vedas, Soma — the drink and the god — is associated with a vivifying, quickening and strengthening of consciousness. Because consciousness itself may be directed in many ways (e.g., sensation, thought, contemplation) so too the gifts of Soma are manifold.
- **DENDRITES:** Dendrites are appendages that are designed to receive communications from other cells. They resemble a tree-like structure, forming projections that become stimulated by other neurons and conduct the electrochemical charge to the cell body (or, more rarely, directly to the axons). The surface of the dendrites is filled with receptors that become enacted upon by neurotransmitters that traversed the synapse after the pre-synaptic neuron fired and released neurotransmitters into the synapse. Dendrites integrate this

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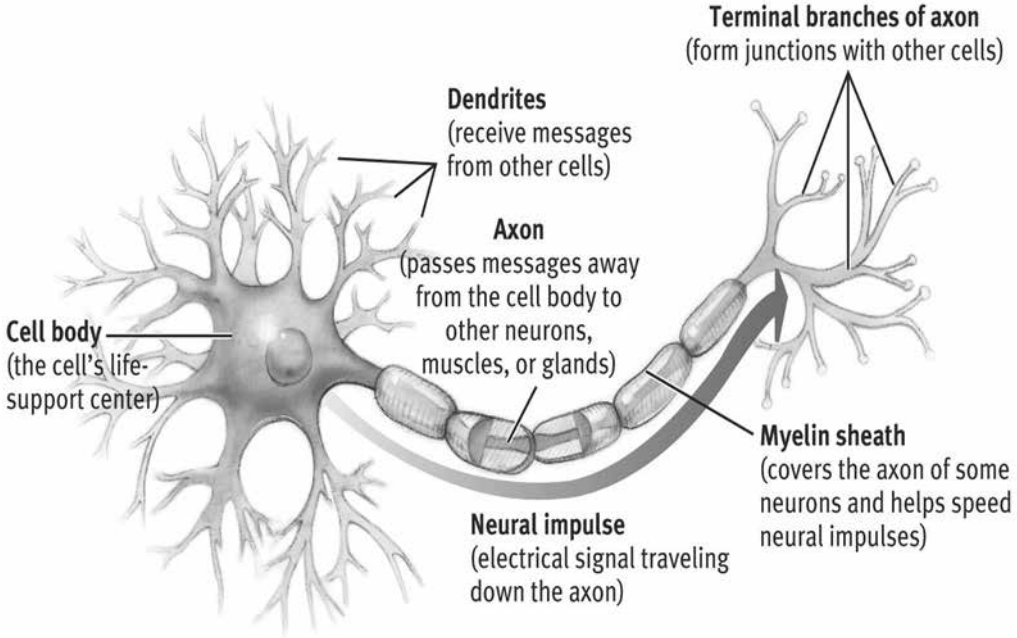
stimulation (from a multitude of receptors) and play a crucial role in determining the extent to which the received stimulation will result in an action potential.

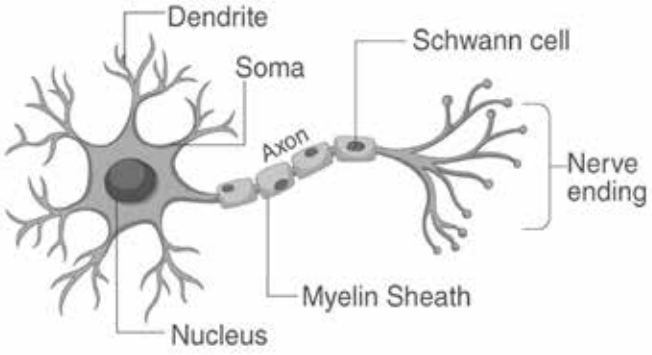
- **AXON:** The axon, also called a nerve fibre, is a tail-like structure of the neuron which joins the cell body at a junction called the axon hillock. The function of the axon is to carry signals away from the cell body to the terminal buttons, in order to transmit electrical signals to other neurons. Most neurons just have one axon which can range in size from 0.1 millimetres to over 3 feet. Some axons are covered in a fatty substance called myelin which insulates the axon and aids in transmitting signals quicker. Axons are long nerve processes that may branch off to transfer signals to many areas, before ending at junctions called synapses.
- **TERMINAL BUTTONS**: Axon terminals also called synaptic boutons, terminal boutons or end-feet are distal terminations of the telodendria branches of an axon. An axon, also called a nerve fibre, is a long, slender projection of a nerve cell, or neuron, that conducts electrical impulses called action potentials away from the neuron's cell body, or soma, in order to transmit those impulses to other neurons, muscle cells or glands. The terminal buttons are located at the end of the neuron and are responsible for sending the signal on to other neurons. At the end of the terminal button is a gap known as a synapse. Neurotransmitters are used to carry the signal across the synapse to other neurons.



STRUCTURE OF THE NEURON

Neurons are the communication links of the nervous system. This diagram highlights the key parts of a neuron, including specialized receptor areas (dendrites), the cell body (soma), the axon fibre along which impulses are transmitted, and the terminal buttons, which release chemical messengers that carry signals to other neurons. Neurons vary considerably in size and shape and are usually densely inter-connected. Neurons are

the information processing units of the brain which have a responsibility for sending, receiving, and transmitting electrochemical signals throughout the body. Neurons, also known as nerve cells, are essentially the cells that make up the brain and the nervous system. Neurons do not touch each other, but where one neuron comes close to another neuron, a synapse is formed between the two. The function of a neuron is to transmit nerve impulses along the length of an individual neuron and across the synapse into the next neuron. The central nervous system, which comprises the brain and spinal cord, and the peripheral nervous system, which consists of sensory and motor nerve cells all contain these information processing neurons.



THE NEURAL IMPULSE

A neural impulse is an electrochemical signal that is sent from neurons to other neurons, or to effectors, like muscles and glands that are controlled by neurons. Neural impulses are important because they allow neurons to communicate throughout the body. This controls bodily actions, from conscious movement like walking, to involuntary processes like digestion and breathing. Neural impulses also allow people to detect changes in their environment, such as temperature, or sights or sounds. Neural impulses also allow the brain to process all of this information and create thoughts and feelings. Neural impulses are conducted by neurons, the cells of the nervous system. Neurons are highly specialized cells of the nervous system.

Neural Impulses Generated

Neural impulses are generated in an "all or none" fashion, meaning that once the threshold to generate an action potential is reached, an action potential will occur. If this threshold is not reached, no action potential will occur. But how do neural impulses start? How do neurons reach this threshold for an action potential to fire? A neural impulse starts when there is a stimulus in the environment of the neuron. This stimulus might be a change in temperature, pressure, or neurotransmitter released from a neighboring neuron. Neurons can often respond to multiple stimuli via activation of receptors, which are proteins designed to elicit a response to something in the environment. Receptors are located on the dendrites of neurons. When a receptor is activated, it opens an ion channel. Different receptors let different ions into the cell. If the ions that enter are positive, the cell also becomes more positive and is said to be depolarized. If the cell becomes depolarized enough and reaches a voltage called threshold, a neural impulse will take place.

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Nerve Conduction

Nerve conduction is an electrochemical process, which means that it uses electricity made with chemical molecules. In other words, the electricity in the brain is not produced by electrons flowing the way they do through a household electrical wire. Instead, the brain's electricity is caused by the movements of electrically charged molecules through the neurons' membranes. The membrane of a neuron, like that of any other cell, contains tiny holes known as channels. It is through these channels that charged molecules pass through the neural membrane. Electric currents in the vastly complex system of billions of nerves in our body allow us to sense the world, control parts of our body, and think. These are representative of the three major functions of nerves. First, nerves carry messages from our sensory organs and others to the central nervous system, consisting of the brain and spinal cord. Second, nerves carry messages from the central nervous system to muscles and other organs. Third, nerves transmit and process signals within the central nervous system. The sheer number of nerve cells and the incredibly greater number of connections between them makes this system the subtle wonder that it is. Nerve conduction is a general term for electrical signals carried by nerve cells. It is one aspect of bioelectricity, or electrical effects in and created by biological systems.

MYELIN SHEATH

Myelin sheath is a substance which is found on neurons within the central nervous system (CNS) and the peripheral nervous system (PNS). Myelin sheath is the protective layer that wraps around the axons of neurons to aid in insulating the neurons, and to increase the number of electrical signals being transferred. Myelin sheath consists of lipids and proteins which make up a fatty substance and is white in appearance. This forms the protective sleeve that wraps around the axon of neurons. The sheath is made up of many concentric layers of plasma membrane, wrapped tightly around the axon. There are breaks of between 0.2 and 2 mm. in the myelin sheath, these are called nodes of Ranvier. Action potentials (nerve impulses) traveling down the axon "jump" from node to node. This speeds up the transmission. Myelin was discovered in the mid-19th century when scientists were observing neurons through a microscope, and they noticed a glistening white substance surrounding the axons. Rudolf Virchow, a German pathologist who made this observation, coined the term 'myelin' from the Greek word myelós, which means core. At the time, it was believed that the myelin was at the core of the axon, however, it was later found to be a substance which wraps around the axons of neurons.

Myelin Sheath Functions

Myelin sheath's primary function is to provide insulation to the axons of the neuron it surrounds. This insulation provides protection to these axons in the same way that electrical wires have insulation. Myelin sheath is a low electrical condenser and has high electrical resistance which means it can act as an insulator without disrupting the electrical signals traveling down the axon. Since myelin sheath provides insulation to axons, this allows these axons to conduct electrical signals at a higher speed than if they were not insulated by myelin. Thus, the more thoroughly myelinated an axon is, the higher the speed of electrical transmission. One of the most myelinated axons, for instance, can conduct impulses at a speed of approximately 70 to 120 m/s, the speed of

a race car. Similarly, myelin sheath around an axon is able to prevent electrical impulses from traveling through the sheath and out of the axon. It prevents the movement of ions into or out of the neuron, also known as depolarization. This means the current of action potential will only flow down the axon. The more action potential, the more neurons will be able to communicate to each other, transfer electrical and chemical messages, and keep the brain healthy and functioning properly.

Myelin Sheath Produced? – Myelination

Myelination is the formation of a myelin sheath, therefore axons which are covered by this insulating sleeve of protection are said to be myelinated axons. If an axon is not surrounded by myelin sheath, it is said to be unmyelinated.

The more myelinated axons someone has, the quicker their responses to stimuli will be, due to myelin sheaths increasing the conduction of nerve impulses.

NERVOUS SYSTEM

The Nervous system is a specialized system in animals. This system aids in the coordination of voluntary and involuntary actions, reflex actions in our body. The nervous system consists of nerve cells (neurons). They transmit messages in the form of electrical impulses through neurons and convey to our sense organs. Let us go into more detail on the neural system. Nervous coordination involves the participation of our sense organs, nerves, spinal cord, and brain. The changes, which occurs around us can be easily detectable by our sense organs. This is because the nervous system has neurons at their tips, which consist of dendrites, cell body, nucleus, and axon. The information detected by dendrites are converted into impulses and are passed onto the cell body. Axon collects these impulses. At the nerve ending, electrical impulses are converted into chemicals and released. The chemicals will be passed to the next neuron through a gap called a synapse. This is how one neuron transfers the messages to another neuron.

Central Nervous System (CNS) – Brain and Spinal Cord

The central nervous system (CNS) is comprised of the brain and spinal cord. The three broad functions of the CNS are to take in sensory information, process information, and send out motor signals. The CNS receives sensory information from the nervous system and controls the body's responses. The central nervous system plays a primary role in receiving information from various areas of the body and then coordinating this activity to produce the body's responses. The CNS has three main components: the brain, the spinal cord, and the neurons (or nerve cells). Each part of the CNS plays an important role in how the body functions, and the three components of the CNS work together to take in information and control how the body responds.

Brain

The brain controls many of the body's functions including sensation, thought, movement, awareness, and memory. The surface of the brain is known as the cerebral cortex. The surface of the cortex appears bumpy thanks to the grooves and folds of the tissue. Each groove is known as a sulcus, while each bump is known as a gyrus.

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Spinal Cord

The spinal cord connects to the brain via the brain stem and then runs down through the spinal canal, located inside the vertebra. The spinal cord carries information from various parts of the body to and from the brain.

Peripheral Nervous System – nerves that lie outside the central nervous system

The PNS is all the nerves that branch out from the CNS components and extend to other parts of the body – to the sense organs, muscles, and glands. The PNS connects the CNS to the rest of the body. The primary function of the peripheral nervous system is to connect the brain and spinal cord to the rest of the body and the external environment. The peripheral nervous system transmits information to and from the CNS. This is accomplished through nerves that carry information from sensory receptors in the eyes, ears, skin, nose and tongue, as well as stretch receptors and nociceptors in muscles, glands and other internal organs.

Somatic Nervous System – Voluntary Muscles and Sensory Receptors

The somatic nervous system (SNS) is part of the peripheral nervous system, and is associated with activities traditionally thought of as conscious or voluntary, such as walking. The somatic nervous system transmits sensory and motor signals to and from the central nervous system, and therefore, it consists of motor neurons and sensory neurons. The somatic nervous system controls voluntary movements, transmits and receives messages from the senses and is involved in reflex actions without the involvement of the CNS so the reflex can occur very quickly.

Voluntary Muscles: A voluntary muscle is a muscle that you choose to move, like those in the arms and legs, as opposed to the ones that move automatically, like the heart. Voluntary muscle (skeletal, striped, or striated muscle) Muscle that is under the control of the will and is generally attached to the skeleton. An individual muscle consists of bundles of long muscle fibres, each bounded by a sarcolemma and containing sarcoplasm, sarcoplasmic reticulum, and many nuclei. The whole muscle is covered with a strong connective tissue sheath (epimysium) and attached at each end to a bone by inextensible tendons.

Sensory Receptors: A sensory receptor is a type of specialized cell that responds to a specific type of sensory stimulation. Each type of sensory receptor is unique to the organ system it is associated with. For example, visual sensory receptors are different than touch and taste sensory receptors. The sensory receptors themselves are actually the nerve endings (or dendrites) of sensory neurons. The sensory receptors then convert different forms of stimulation into electrical impulses that are then transmitted to the brain via the nervous system. The process through which the physical energy from environmental stimuli is converted into an electrical neural signal that can then be transmitted to the brain is known as transduction.

Autonomic Nervous System (ANS): Controls Automatic, Involuntary Functions

The autonomic nervous system (ANS) is part of the peripheral nervous system, and is responsible for the control of vital functions such as heart beat, breathing and digestion. It is also involved in the acute stress response where it works with the endocrine system

to prepare the body to fight or flight. It can be further subdivided into the sympathetic and parasympathetic divisions. Examples of the types of functions controlled by the ANS are salivating, sweating, changing pupil size, managing heart rate, crying, and secreting hormones. The ANS works by receiving information from either external stimuli or the body. The hypothalamus uses this input to control much of the activity of the ANS.

Controls Automatic: are the two categories of cognitive processing. All cognitive processes fall into one or both of those two categories. The amounts of "processing power", attention, and effort a process requires is the primary factor used to determine whether it's a controlled or an automatic process. An automatic process is capable of occurring without the need for attention, and the awareness of the initiation or operation of the process, and without drawing upon general processing resources or interfering with other concurrent thought processes.

Involuntary Functions: Actions which take place without consciousness or willingness of an individual are called the involuntary action. Digestion, heart beating, sneezing, etc are few examples of involuntary actions. Both involuntary and voluntary actions are controlled by the same parts of the brain. Hindbrain and midbrain control involuntary actions like salivation, vomiting, etc. All the body's voluntary actions are controlled by the motor cortex in the frontal lobe of the cerebrum.

Sympathetic: Go(fight-or-flight)

The sympathetic nervous system (SNS) is a subdivision of the autonomic nervous system which is involved in regulating autonomic processes. The sympathetic nervous system is involved in preparing the body for stress-related activities, and it slows bodily processes that are less important in emergencies such as digestion. These are processes which are not under direct conscious control, occurring automatically without conscious thought.

The SNS also works alongside the parasympathetic nervous system to maintain homeostasis – this is the balance of internal physiological mechanisms essential for all living organisms.

Parasympathetic: Stop

The parasympathetic nervous system is a subdivision of the autonomic nervous system (ANS) which regulates bodily functions which are outside of voluntary control, therefore being automatic. The parasympathetic nervous system is also referred to as the 'rest and digest' system as it functions to conserves the body's natural activity, and relaxes the individual once an emergency has passed. The parasympathetic nervous system leads to decreased arousal.

ORGANIZATION OF THE HUMAN NERVOUS SYSTEM

The nervous system coordinates voluntary and involuntary actions in the body by sending and receiving information. The nervous system is comprised of an enormous number of cells (over 100 billion), primarily of two types: neurons (the signalling units) and glial cells (the supporting units). However, nervous system function is mostly a story of the neuron. The neuron is the functional unit of the nervous system and is designed to transmit information between cells. Interestingly, neurons with a particular function are

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found in a predictable location. This regularity in structure has permitted neurobiologists to categorically organize the nervous system based on location and function.

Thus, the nervous system can first be divided into two major parts: the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS consists of neurons associated with central processing and which are located in the brain and spinal cord. The peripheral nervous system (PNS) consists of neurons associated with sensory input (afferent) and motor output (efferent), and functions to connect the central nervous system to all other parts of the body. Stated another way, if the entire structure of the neuron is contained within the brain and/or spinal cord, the neuron would be considered part of the CNS. In contrast, if any part of the neuronal structure is located outside of the brain and/or spinal cord the neuron would be considered part of the PNS. For the most part, information is transmitted between these two systems following this basic pattern: stimulus, receptor, afferent pathway (input signal), control centre, efferent pathway (output signal), effector, and response.

In other words, sensory receptors located throughout the body constantly monitor the conditions of the environment and send this information via the PNS to the CNS for central processing. If a response is needed (i.e., to maintain homeostasis) the CNS will send new information through the PNS to target organs that will help adjust to the initial stimulus. It should be noted that some functions can be contained entirely within the CNS; for example, dreaming, thinking, or even information storage. Neurons of the efferent division of the PNS can be further subdivided into the somatic nervous system, which controls the voluntary movement of skeletal muscle and the autonomic nervous system which regulates involuntary functions of organs and tissues. Autonomic neurons are further subdivided into sympathetic and parasympathetic systems (see first figure). The autonomic nervous system will be addressed in a separate module. A third division of the PNS is a semi-independent nervous system called the enteric nervous system which controls the gastrointestinal tract (see first figure). This system is considered semi-independent because it can run independently, or through modulation by the autonomic nervous system. It is also interesting to note that the enteric nervous system contains more neurons than the entire spinal cord.

NEUROTRANSMITTER

A neurotransmitter is the body's chemical messenger. They are molecules that transmit signals from neurons to muscles, or between different neurons. The transmission of signals between two neurons occurs in the synaptic cleft. The electrical signals that travel along the axon are briefly converted into chemical signals through neurotransmitters. Neurotransmitters are often referred to as the body's chemical messengers. They are the molecules used by the nervous system to transmit messages between neurons, or from neurons to muscles. Communication between two neurons happens in the synaptic cleft (the small gap between the synapses of neurons). Here, electrical signals that have travelled along the axon are briefly converted into chemical ones through the release of neurotransmitters, causing a specific response in the receiving neuron. A neurotransmitter influences a neuron in one of three ways: excitatory, inhibitory or modulatory. An excitatory transmitter promotes the generation of an electrical signal called an action potential in the

receiving neuron, while an inhibitory transmitter prevents it. Whether a neurotransmitter is excitatory or inhibitory depends on the receptor it binds to. Neurotransmitter diseases are genetically inherited from their parents.

Types of Neurotransmitters

There are the following different types of neurotransmitters:

Excitatory Neurotransmitters

These types of neurons increase the chances of the neuron firing an action potential. Epinephrine and norepinephrine are the two excitatory neurotransmitters.

Inhibitory Neurotransmitters

These have inhibitory effects on the neurons and have fewer chances of the neuron firing an action potential. For e.g., serotonin and gamma-aminobutyric acid (GABA).

Modulatory Neurotransmitter

These can affect a large number of neurotransmitters at the same time. These can also influence the effect of other chemical messengers.

Neurotransmitter Diseases

The neurotransmitter diseases affect how the neurotransmitters are synthesised, transported and broken down in the brain.

The common neurotransmitter diseases include:

- Parkinson's disease
- Alzheimer's disease
- Depression

2.4 STRUCTURE OF BRAIN AND ITS FUNCTIONS

The human nervous system shows the relationships of its various parts and systems. The brain is traditionally divided into three regions: the hind brain, the midbrain, and the forebrain. The reticular formation runs through both the midbrain and the hind brain on its way up and down the brain stem. These and other parts of the brain are discussed in detail later in the chapter. The peripheral nervous system is made up of the somatic nervous system, which controls voluntary muscles and sensory receptors, and the autonomic nervous system, which controls the involuntary activities of smooth muscles, blood vessels, and glands. The brain structure is composed of three main parts: the forebrain, midbrain and hindbrain, each with multiple parts.

Hindbrain

- **The Cerebellum –** The cerebellum, or "little brain", is similar to the cerebrum with its two hemispheres and highly folded surface. It is associated with regulation and coordination of movement, posture, balance and cardiac, respiratory and vasomotor centres.
- **Pons –** The primary role of the pons is to serve as a bridge between various parts of the nervous system, including the cerebellum and cerebrum. Many important

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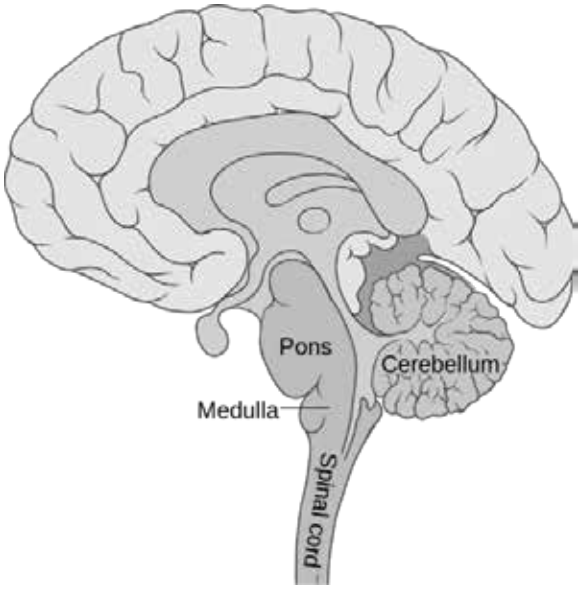
nerves that originate in the pons, such as the trigeminal nerve, responsible for feeling in the face, as well as controlling the muscles that are responsible for biting, chewing, and swallowing. It also contains the abducens nerve, which allows us to look from side to side and the vestibular cochlear nerve, which allows to hear. As part of the brainstem, a section of the lower pons stimulates and controls the intensity of breathing, while a section of the upper pons decreases the depth and frequency of breaths. The pons is also associated with the control of sleep cycles, and controls respiration and reflexes. It is located above the medulla, below the midbrain, and just in front of the cerebellum.

- **Medulla –** The primary role of the medulla is regulating our involuntary life sustaining functions such as breathing, swallowing and heart rate. As part of the brain stem, it also helps transfer neural messages to and from the brain and spinal cord. It is located at the junction of the spinal cord and brain.



MIDBRAIN

The second area of the brain is the midbrain, which lies on top of the brainstem. The midbrain is involved in auditory and visual processing. It is also responsible for eye movement. There are three parts to the midbrain: the colliculi, the tegmentum, and the cerebral peduncles. The colliculi processes visual and auditory signals before they are relayed to the occipital and temporal lobes. The tegmentum is involved in movement coordination and alertness. Lastly, the cerebral peduncles plays an important part in the central nervous system. Midbrain, also called mesencephalon, region of the developing vertebrate brain that is composed of the tectum and tegmentum. The midbrain serves important functions in motor movement, particularly movements of the eye, and in auditory and visual processing. It is located within the brainstem and between the two other developmental regions of the brain, the forebrain and the hindbrain; compared with those regions, the midbrain is relatively small.

BRAINSTEM: area at the base of the brain that lies between the deep structures of the cerebral hemispheres and the cervical spinal cord and that serves a critical role in regulating certain involuntary actions of the body, including heartbeat and breathing. The brainstem is divided into three sections in humans: the midbrain (mesencephalon), the pons (metencephalon), and the medulla oblongata (myelencephalon).The brainstem houses many of the control centres for vital body functions, such as swallowing, breathing, and vasomotor control. All of the cranial nerve nuclei, except those associated with olfaction and vision, are located in the brainstem, providing motor and sensory function to structures of the cranium, including the facial muscles, tongue, pharynx, and larynx, as well as supplying the senses of taste, equilibrium, and hearing.

PONS: A protruding part of the brain stem just above the medulla. The pons is part of the hindbrain, the oldest portion of the brain, and contains several components: (1) transverse fibres that run to and from the cerebellum, (2) the "pontine nuclei" within this band of fibres, (3) ascending and descending tracts connecting to various levels of the nervous system, and(4) the nuclei of the trigeminal nerve (the fifth cranial nerve) which receives sensations from the face and tongue and helps to control the movements of the mouth.

MEDULLA OBLONGATA: also called Medulla, the lowest part of the brain and the lowest portion of the brainstem. The medulla oblongata is connected by the pons to the midbrain and is continuous posteriorly with the spinal cord, with which it merges at the opening (foramen magnum) at the base of the skull. The medulla oblongata plays a critical role in transmitting signals between the spinal cord and the higher parts of the brain and in controlling autonomic activities, such as heartbeat and respiration.

BASILARY ARTERY: The basilar artery carries oxygenated blood to the cerebellum, brainstem, and occipital lobes. The cerebellum helps with voluntary processes such as posture, balance, coordination, and speech. The brainstem plays a role in regulating several vital functions, including heart rate, eating, sleeping, and breathing. Visual processing takes place in the occipital lobes. Several arteries branch from the basilar artery at the upper portion of the brainstem, delivering blood to various regions of the brain. Two posterior cerebral arteries lead to the temporal lobes (important for processing of sounds) and the outer layer of the occipital lobes.

VERTEBRAL ARTERIES: The vertebral arteries work their way along both sides of the neck, connecting the subclavian arteries in the shoulder up to the cranium. Running through the gaps in the vertebrae (foramen), they access the posterior fossa, a small space at the base of the skull near the brainstem and cerebellum, as well as the occipital lobes of the brain. These arteries not only provide blood to the neck but, along with the carotid arteries, they're the primary source of blood to the brain because these arteries are so essential, serious problems can arise if they're damaged due to blunt trauma or experience other disorders.

The vertebral artery can be divided into four divisions:

The first division runs poster cranial between the longus colli and the scalenus anterior. The first division is also called the 'pre-foramina division'.

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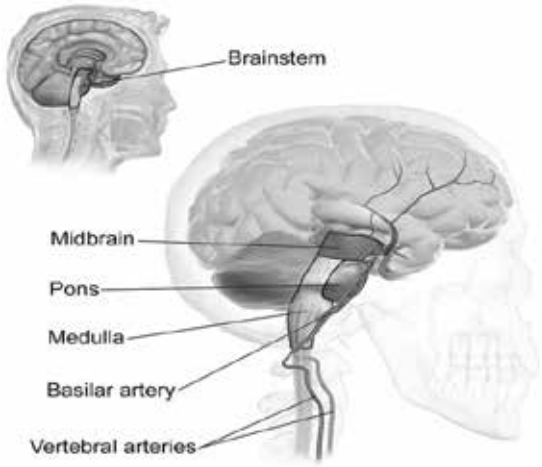
1. The second division runs cranial through the foramina in the cervical transverse processes of the cervical vertebrae C2. The second division is also called the foraminal division.
2. The third division is defined as the part that rises from C2. It rises from the latter foramen on the medial side of the rectus capitis lateralis, and curves behind the superior articular process of the atlas. Then, it lies in the
3. groove on the upper surface of the posterior arch of the atlas, and enters the vertebral canal by passing beneath the posterior atlantoöccipital membrane.
4. The fourth part pierces the dura mater and inclines medial to the front of the medulla oblongata.



Forebrain

The human brain can be divided up into three basic divisions: hindbrain, midbrain, and forebrain. The hindbrain and midbrain together are sometimes referred to as the reptilian brain as its structure and purposes are the same as what reptile animals have for their brains. The midbrain is located above the brain stem in the middle of the brain area and is involved in processing vision and hearing. The hindbrain controls automatic processes such as heartbeat, breathing, blinking, sleep, balance and coordination. As it is not part of the reptilian brain, then what is the forebrain? The forebrain is the thinking and processing centre of the brain. It is the part of the brain that enables us to think and reason above the ability of those animals that only have a reptilian brain. The forebrain is responsible for the voluntary actions we take and the processing and integrating of sensory input. The three basic parts of the brain can be clearly seen and discerned during embryonic development. Figure 1 shows the parts of the brain as an embryo. In the image the more specific names are used. The telencephalon and diencephalon together are the forebrain, the mesencephalon is the midbrain and the rhomb encephalon is the hindbrain.

Forebrain Function

The hindbrain and midbrain facilitate the processes that are necessary to sustain life, but all higher executive functioning occurs in the forebrain. As the specific structures within the forebrain are discussed later, the functions of each of those structures will also be discussed in more detail. The general overall forebrain function is that of interpreting

input and decision making. This includes functions such as planning, language processing from hearing or to speaking, interpreting information from touch, vision, smell, taste, and hearing, thinking, imagining, and reasoning. The forebrain also regulates hormones and biological cycles and executes motor functioning for voluntary movements. The forebrain is also the centre for emotions.

FOREBRAIN PARTS AND FUNCTIONS

THALAMUS: Thalamus is an egg-shaped structure in the middle of your brain. It's known as a relay station of all incoming motor (movement) and sensory information — hearing, taste, sight and touch (but not smell) — from your body to your brain. Like a relay or train station, all information must first pass through your thalamus before being routed or directed to its destination in your brain's cerebral cortex (the outermost layer of your brain) for further processing and interpretation.

HYPOTHALAMUS: region of the brain lying below the thalamus and making up the floor of the third cerebral ventricle. The hypothalamus is an integral part of the brain. It is a small cone-shaped structure that projects downward from the brain, ending in the pituitary (infundibular) stalk, a tubular connection to the pituitary gland. The hypothalamus contains a control centre for many functions of the autonomic nervous system, and it has effects on the endocrine system because of its complex interaction with the pituitary gland.

PITUITARY: The main function of the pituitary is related to the production of hormones as it is part of the Endocrine System. The pituitary gland is small and oval-shaped. It's located behind your nose, near the underside of your brain. It's attached to the hypothalamus by a stalk like structure. The hypothalamus is a small area of your brain. It's very important in controlling the balance of your bodily functions. It controls the release of hormones from the pituitary gland. The pituitary gland can be divided into two different parts: the anterior and posterior lobes. The pituitary gland is a part of your endocrine system. Its main function is to secrete hormones into your bloodstream. These hormones can affect other organs and glands, especially your: thyroid, reproductive organs, adrenal glands.

SYMPTOMS OF A PITUITARY GLAND CONDITION

Your pituitary gland is involved in a range of things, so any condition involving it can produce a diverse set of symptoms.

- Headaches
- Weakness or fatigue
- High blood pressure
- Unexplained weight gain
- Trouble sleeping
- Changes in psychological state, including mood swings or depression
- Memory loss
- Reproductive issues, including infertility, erectile dysfunction, and irregular periods

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- Excessive or unusual hair growth
- Lactating when you're not nursing

PITUITARY GLAND CONDITIONS

Several conditions can affect your pituitary gland. Most are caused by a tumor in or around the pituitary gland. This can impact the release of hormones. Examples of pituitary gland disorders include:

- **Pituitary tumors.** Pituitary tumors are usually noncancerous. However, they often interfere with the release of hormones. They can also press against other areas of your brain, leading to vision problems or headaches.
- **Hypopituitarism.** This condition causes your pituitary gland to produce very little or none of one or more of its hormones. This can affect things like growth or reproductive system function.
- **Acromegaly.** In this condition, your pituitary gland produces too much growth hormone. This can lead to excessive growth, especially of your hands and feet. It's often associated with pituitary tumors.
- **Diabetes insipidus.** This can be caused by a problem with the release of vasopressin. It's usually due to a head injury, surgery, or a tumor. As a result, people with this condition pass large amounts of heavily diluted urine. They may also feel like they need to drink a lot of water or other fluids.
- **Cushing's disease.** The pituitary gland releases too much adrenocorticotropic hormone in people with this condition. This can lead to easy bruising, high blood pressure, weakness, and weight gain. It's often caused by a tumor near or in the pituitary gland.
- **Hyperprolactinemia.** In this condition, your blood contains an unusually high amount of prolactin. This can lead to infertility and a decreased sex drive.
- **Traumatic brain injury.** This involves a sudden blow to your brain. Depending on the injury, it can sometimes damage your pituitary gland and cause problems with memory, communication, or behaviour.

CEREBRAL CORTEX

The cerebral cortex is necessary for memory storage, attention, awareness, thought, language and consciousness. The outer layers of the cerebrum are made from grey matter. Grey matter is formed by neurons and their unmyelinated fibres. The white matter below the grey matter of the cortex is formed predominantly by myelinated axons. The surface of the cerebral cortex is folded in mammals; more than two-thirds of the surface is within the grooves or "sulci". The cerebral cortex is connected to structures such as the thalamus and the basal ganglia, sending information to them along with different connections and receiving information from them via afferent connections. Most sensory information is routed to the cerebral mantle via the thalamus. The cortex is commonly described as comprising three parts; sensory, motor, and association areas. The cortex is also divided into two hemispheres, the right and left, which is separated by a large sulcus called the

medial longitudinal fissure. The two hemispheres are connected via bundles of nerve fibres called the corpus callosum, to allow both hemispheres of the cerebral cortex to communicate with each other and for further connections to be made. A vast array of functions are controlled by the cerebral cortex through the use of the lobes, which are divided based on the location of gyri and sulci. These lobes are called the frontal lobes, temporal lobes, parietal lobes, and occipital lobes.

LOBES OF THE BRAIN

The brain's cerebral cortex is the outermost layer that gives the brain its characteristic wrinkly appearance. The cerebral cortex is divided lengthways into two cerebral hemispheres connected by the corpus callosum. Traditionally, each of the hemispheres has been divided into four lobes: frontal, parietal, temporal and occipital. The lobes of the brain are the major identifiable zones of the cerebral cortex, and they comprise the surface of each hemisphere of the cerebrum. The two hemispheres, which are only roughly symmetrical in structure, are today considered as having six lobes each. The lobes are large areas that are anatomically distinguishable, and are also functionally distinct to some degree. Each lobe of the brain has numerous ridges, or gyri, and furrows, the sulci that constitute further subzones of the cortex. The expression "lobes of the brain" usually refers only to those of the cerebrum, not to the distinct areas of the cerebellum.

Functions of The Lobes:

- **Frontal Lobe –** The frontal lobe lies just beneath our forehead and is associated with our brain's ability to reason, organize, plan, speak, move, make facial expressions, serial task, problem solve, control inhibition, spontaneity, initiate and self-regulate behaviours, pay attention, remember and control emotions.
- **Parietal Lobe –** The parietal lobe is located at the upper rear of our brain, and controls our complex behaviours, including senses such as vision, touch, body awareness and spatial orientation. It plays important roles in integrating sensory information from various parts of our body, knowledge of numbers and their relations, and in the manipulation of objects. Portions are involved with our visuospatial processing, language comprehension, the ability to construct, body positioning and movement, neglect/inattention, left-right differentiation and self-awareness/insight.
- **Occipital Lobe –** The occipital lobe is located at the back of our brain, and is associated with our visual processing, such as visual recognition, visual attention, spatial analysis (moving in a 3-D world) and visual perception of body language; such as postures, expressions and gestures.
- **Temporal Lobe –** The temporal lobe is located near our ears, and is associated with processing our perception and recognition of auditory stimuli (including our ability to focus on one sound among many, like listening to one voice among many at a party), comprehending spoken language, verbal memory, visual memory and language production (including fluency and word-finding), general knowledge and autobiographical memories.

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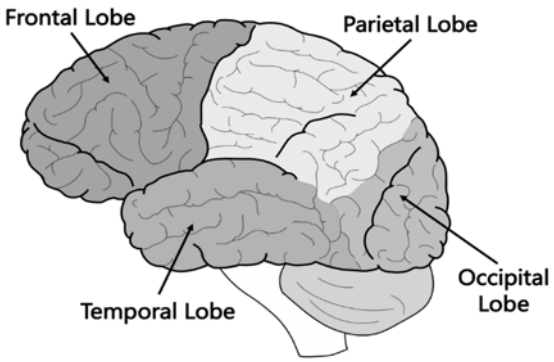
A deep furrow divides the cerebrum into two halves, known as the left and right hemispheres. And, while the two hemispheres look almost symmetrical, each side seems to function differently. The right hemisphere is considered our creative side, and the left hemisphere is considered our logical side. A bundle of axons, called the corpus callosum, connects the two hemispheres.



AREAS OF THE CEREBRAL CORTEX

The cerebral cortex can be characterised as being made up of three types of divisions, which serve different purposes: sensory, motor, and association areas. The combination of these three areas account for most of human's cognition and behaviour.

Sensory Areas

The sensory areas of the cerebral cortex receive sensory information from the senses and environmental stimuli. This information is also processed by the sensory areas to give meaning to this information. The sensory areas include the visual cortex, the somatosensory cortex, the auditory cortex, and the gustatory cortex. The visual cortex is an area within the occipital lobes which is essential to the conscious processing of visual stimuli. There are two visual cortices in the brain: the cortex in the left hemisphere receives signals from the right visual field, whereas the cortex in the right hemisphere receives signals from the left visual field. This information can include temperature, touch, and pain, all of which is then integrated in the somatosensory cortex to produce a 'map' of the body. The auditory cortex is an area within the temporal lobes which is responsible for processing auditory information. This cortex can perform basic and higher functions relating to hearing, including the ability for some people to language switch.

Motor Areas

The motor areas of the cerebral cortex are involved in the regulation and initiation of voluntary movement. These areas are primarily found within the frontal lobes and include the primary motor cortex, premotor cortex, and the supplementary cortex. The primary motor cortex is associated with the coordination and initiation of motor movements. Each cerebral hemisphere of the primary motor cortex contains a motor-related representation of the opposite side of the body. There is also a representational map of the body with the primary motor cortex, called a motor homunculus. The premotor cortex is involved in preparing and executing limb movements, as well as using information from other regions

of the cortex to select appropriate movements. The premotor cortex is also necessary for learning, especially through imitation, and social cognition, specifically empathy.

Association Areas

The association areas are spread throughout the cerebral cortex in the four lobes. These areas act by integrating information from these brain regions, often adding more complexity to their functions. These association areas can also form connections to sensory and motor areas to give meaning to and organise information in these areas. Association areas within the frontal lobes are involved in key processes such as planning, thinking, and feeling. These areas also play a role in personality and controlling emotional behaviours. Association areas within the parietal lobe are involved in spatial skills such as spatial awareness and reasoning, as well as being responsible for paying attention to visual stimuli in the environment. In the temporal lobes, association areas function primarily in memory processes such as helping to process procedural and episodic memories. These areas also communicate with other lobes of the cortex so they can complete memory-related processes.

CORPUS CALLOSUM

The corpus callosum is the largest collection of white matter within the brain, and it has a high myelin content. Myelin is a fatty, protective coating around nerves that facilitates quicker transmission of information. White matter should not be confused with gray matter. The brain uses gray matter for computation, thinking, memory storage, and more. White matter, like the corpus callosum, allows different parts of the brain to communicate with each other. Some birth irregularities may lead to some people lacking this neural tissue. In modern neurosurgery, some surgeons have surgically cut the corpus callosum to treat epileptic seizures. By disrupting contact between the two brain hemispheres, a seizure can be isolated and kept from spreading.

AGENESIS OF THE CORPUS CALLOSUM

Agenesis of the corpus callosum is a rare disorder characterized by the partial or complete absence of the corpus callosum. It's a congenital condition, meaning that it's present at birth, and can be genetic or caused by alcohol exposure, injury, or infection during pregnancy. About 60% Trusted Source of people with corpus callosum agenesis present with intellectual disabilities. Other common symptoms include: impaired vision delayed speech development seizures feeding problems.

AGENESIS OF THE CORPUS CALLOSUM MAY ALSO BE ASSOCIATED WITH SEVERAL OTHER CONDITIONS, INCLUDING:

- Hydrocephalus, or fluid build-up in the skull
- FG syndrome
- Andermann syndrome
- Acrocallosal syndrome
- Arnold-Chiari malformation
- Menkes disease

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- Mowat-Wilson syndrome
- Aicardi syndrome
- Shapiro syndrome
- Neural migration disorders

BRAIN ATROPHY

Brain atrophy — or cerebral atrophy — is the loss of brain cells called neurons. Atrophy also destroys the connections that help the cells communicate. It can be a result of many different diseases that damage the brain, including stroke and Alzheimer's disease. We naturally lose some brain cells, but this is a slow process. Brain atrophy associated with disease or injury occurs more quickly and is more damaging.

Atrophy can affect different parts of the brain.

Focal Atrophy affects cells in certain areas of the brain and results in a loss of function in those specific areas.

Generalized Atrophy affects cells all over the brain. Life expectancy among patients with brain atrophy can be influenced by the condition that caused the brain shrinkage. People with

Alzheimer's disease live an average of four to eight years after their diagnosis. Those with multiple sclerosis can have close to a normal life span if their condition is treated effectively.

INJURIES

- Stroke happens when blood flow to part of the brain is interrupted. Without a supply of oxygen-rich blood, neurons in the area die. Functions controlled by those brain areas — including movement and speech — are lost.
- Traumatic brain injury is damage to the brain that may be caused by a fall, motor vehicle accident, or other hit to the head.

DISEASES AND DISORDERS

Alzheimer's disease and other forms of dementia are conditions in which brain cells become progressively damaged and lose the ability to communicate with one another. It causes a loss of memory and thinking ability severe enough to be life-altering. Alzheimer's disease, typically beginning after age 60, is the leading cause of dementia. It's responsible for 60 to 80 percent of all cases.

- Cerebral palsy is a movement disorder caused by abnormal brain development in the womb. It causes a lack of muscle coordination, difficulty with walking, and other movement disorders.
- Huntington's disease is an inherited condition that progressively damages neurons. It usually begins in mid-life. Over time, it affects a person's mental and

physical abilities to include severe depression and chorea (involuntary, dance-like movements throughout the body).

- Leukodystrophies are a group of rare, inherited disorders that damage the myelin sheath — a protective coating that surrounds nerve cells. Usually beginning in childhood, it can cause problems with memory, movement, behaviour, vision, and hearing.
- Multiple sclerosis, which usually begins in young adulthood and affects women more often than men, is an autoimmune disease in which the immune system attacks the protective coating around nerve cells. Over time, the nerve cells become damaged. As a result, problems in sensation, movement, and coordination can occur. However, like other diseases noted, it can also lead to dementia and brain atrophy.

2.5 CHAPTER SUMMARY

Behaviour analysis is the science of behaviour, consisting of basic research and an applied technology. The focus is on observable, measurable behaviour and the role of the environment in establishing and maintaining behaviours. A student creates disruption and is sent out of the classroom frequently. A behaviour analysis indicates he is probably acting disruptively in order to be sent out of the room. Instead of sending him out of the room, he is asked to continue working if he wants to get a positive consequence later (e.g., get to go to recess). Now, he would rather work and get recess than have to stay in the class during recess. The disruptive behaviour no longer served the function of allowing escape and the required behaviour ended up serving the function more effectively. The electrochemical properties of the neuron allow it to transmit signals. The electric charge of a neuron can be measured with a pair of electrodes connected to an oscilloscope, as Hodgkin and Huxley showed with a squid axon. Because of its exceptionally thick axons, the squid has frequently been used by scientists studying the neural impulse. The human nervous system shows the relationships of its various parts and systems. The brain is traditionally divided into three regions: the hindbrain, the midbrain, and the forebrain. Th reticular formation runs through both the midbrain and the hind brain on its way up and down the brain stem. The Cerebrum: Also known as the cerebral cortex, the cerebrum is the largest part of the human brain, and it is associated with higher brain function such as thought and action.

Nerve cells make up the grey surface, which is a little thicker than our thumb. White nerve fibres beneath the surface carry signals between nerve cells in other parts of the brain and body. Its wrinkled surface increases the surface area, and is a six-layered structure found in mammals, called the neocortex. It is divided into four sections, called “lobes”. They are; the frontal lobe, the parietal lobe, the occipital lobe and the temporal lobe. The midbrain is located below the cerebral cortex, and above the hindbrain placing it near the centre of the brain. It is comprised of the tectum, tegmentum, cerebral aqueduct, cerebral peduncles and several nuclei and fasciculi. The primary role of the midbrain is to act as a sort of relay station for our visual and auditory systems. Portions of the midbrain called the red nucleus and the substantia nigra are involved in the control of body movement,

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and contain a large number of dopamine-producing neurons. The degeneration of neurons in the substantia nigra is associated with Parkinson's disease. The midbrain is the smallest region of the brain, and is located most centrally within the cranial cavity. the primary role of the pituitary gland is an important link between the nervous system and the endocrine system.

It releases many hormones which affect growth, metabolism, sexual development and the reproduction system. It is connected to the hypothalamus and is about the size of a pea. It is located in the centre of the skull, just behind the bridge of the nose. The nervous system coordinates voluntary and involuntary actions in the body by sending and receiving information. The nervous system is comprised of an enormous number of cells (over 100 billion), primarily of two types: neurons (the signalling units) and glial cells (the supporting units). However, nervous system function is mostly a story of the neuron. The neuron is the functional unit of the nervous system and is designed to transmit information between cells. Interestingly, neurons with a particular function are found in a predictable location. This regularity in structure has permitted neurobiologists to categorically organize the nervous system based on location and function.

2.6 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **What is Behaviour Analysis? Explain with its examples.**
2. **Explain Hardware. (any three)**
   a. **Glia**
   b. **Neurons**
   c. **Soma**
   d. **Dendrites**
3. **Explain and draw the structure of neuron.**
4. **Distinguish between Occipital Lobe and Temporal Lobe.**
5. **What is neural Impulse?**

LONG ANSWER TYPE QUESTIONS

1. **Explain Structure of brain and its functions.**
2. **What is Neurotransmitter? Explain with its examples.**
3. **Distinguish between Cerebellum and Medulla explain with the diagram.**
4. **Define Corpus Callosum with the help of diagram.**
5. **Explain Brain Atrophy with its examples.**

2.7 MULTIPLE CHOICE QUESTIONS

1. **Manipulating a student's chair in a classroom setting to avoid distraction from the window is an example of a manipulation of a _____.**
   a. Context variable
   b. Antecedent variable
   c. Confounding variable

d. Ecological variable

2. Which of the following is NOT an example of an ecological strategy to evoke appropriate behaviours?

a. Providing choice
b. Task variation
c. Teaching to ask for breaks
d. All of the above

3. By altering a variable between a setting event and a behaviour we are utilizing what dimension of behaviour analysis?

a. Applied
b. Analytic
c. General
d. Social

4. Dendrites and Axon are parts of which set?

a. Red blood cell
b. White blood cell
c. Nephron
d. Neuron

5. Which of the following is the main thinking part of the human brain?

a. Hind Brain
b. Cerebrum
c. Mid – brain
d. None of the above

6. Which part of the brain controls the heart?

a. Spinal Cord
b. Neuron
c. Medulla Oblongata
d. None of these

7. The autonomic nervous system is part of the _____.

a. Somatic nervous system
b. Sympathetic nervous system
c. Parasympathetic nervous system
d. Peripheral nervous system

8. The cerebral cortex covers the _____.

a. Cerebral hemispheres
b. Cerebellum
c. Great cerebral commissure
d. Brain

9. Neurons are specialized to receive, conduct and transmit:

a. Action potentials
b. Electrochemical signals

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c. Electrical signals
d. Chemical signals

10. An adult brain contains roughly how many neurons?

a. 10 million
b. 10 billion
c. 100 million
d. 100 billion

♦♦♦♦♦

UNIT III

LEARNING

STRUCTURE

NOTES 

3.1 LEARNING OBJECTIVE

After learning this Unit students will be able to:

- Understand Concept and Process of Learning.
- Know about the Types of Learning.
- Understand Processes of Observational Learning.
- Know about the Development of Cognition.
- Understand Schedules of Reinforcement

3.2 INTRODUCTION

Most of our behaviours are acquired through the process of learning. Learning may be defined as a relatively durable change in behaviour due to experience. Thus, if the change in behaviour is temporary, or due to instinct or maturation, it is not learning. The key feature of learning is experience. Any change in behavior in the absence of practice or experience does not qualify as learning. For example the maturational changes in the child, like crawling, standing and walking at certain ages are not included in learning. Similarly, illness and drug induced temporary changes are not due to learning. To qualify as learning, a change in behaviour must be relatively enduring. Learning helps us adapt to the surrounding environment. After living in a particular socio cultural environment for some time, we learn the norms of the society and all that is expected of us and become responsible citizen and members of family and work organization. All this is possible on account of learning. The process of learning is continuous which starts right from the time of birth of an individual and continues till the death. We all are engaged in the learning endeavours in order to develop our adaptive capabilities as per the requirements of the changing environment. For a learning to occur, two things are important:

1. The presence of a stimulus in the environment and
2. The innate dispositions like emotional and instinctual dispositions.

A person keeps on learning across all the stages of life, by constructing or reconstructing experiences under the influence of emotional and instinctual dispositions. Learning as relatively permanent behavioural modifications which take place as a result of experience. This definition of learning stresses on three important elements of learning:

- Learning involves a behavioural change which can be better or worse.
- This behavioural change should take place as a result of practice and experience. Changes resulting from maturity or growth cannot be considered as learning
- This behavioural change must be relatively permanent and last for a relatively long time enough.

CONCEPT AND PROCESS OF LEARNING

1. Learning is the process of being modified, more or less permanently, by what happens in the world around us, by what we do, or by what we observe.
2. Learning is the process by which behaviour is originated or changed through training procedure (whether in the natural environment or in the laboratory).

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3. Learning is a process by which the individual acquires various habits, knowledge and attitude that are necessary to meet the demands of the life in general.
4. "Learning is relatively permanent change in personality (including cognitive, affective, attitudinal, motivational, behavioural, and experiential) and reflects a change in performance usually brought about by practice although it may arise from insight or other factors, including memory." (Sahakian, 1976) These statements lead us to understand learning in three broad ways.

Learning can be considered as:

- The relatively permanent modification of behaviour.
- Acquisition of habits, knowledge and attitude necessary to meet the demands of life.
- The relatively permanent change in personality (all possible dimensions).

The key characteristics of the learning process are:

1. When described in the simplest possible manner, learning is described as an experience acquisition process.
2. In the complex form, learning can be described as process of acquisition, retention and modification of experience.
3. It re-establishes the relationship between a stimulus and response.
4. It is a method of problem solving and is concerned about making adjustments with the environment.
5. It involves all those gamut of activities which may have a relatively permanent effect on the individual.
6. The process of learning is concerned about experience acquisition, retention of experiences, and experience development in a step by step manner, synthesis of both old and new experiences for creating a new pattern.
7. Learning is concerned about cognitive, conative and affective aspects. Knowledge acquisition process is cognitive, any change in the emotions is affective and conative is acquisition of new habits or skills.

Types of Learning

1. **Motor Learning**: Our day to day activities like walking, running, driving, etc, must be learnt for ensuring a good life. These activities to a great extent involve muscular coordination.
2. **Verbal Learning**: It is related with the language which we use to communicate and various other forms of verbal communication such as symbols, words, languages, sounds, figures and signs.
3. **Concept Learning**: This form of learning is associated with higher order cognitive processes like intelligence, thinking, reasoning, etc, which we learn right from our childhood. Concept learning involves the processes of abstraction and generalization, which is very useful for identifying or recognizing things.
4. **Discrimination Learning**: Learning which distinguishes between various stimuli with its appropriate and different responses is regarded as discrimination stimuli.

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5. **Learning of Principles**: Learning which is based on principles helps in managing the work most effectively. Principles based learning explains the relationship between various concepts.
6. **Attitude Learning**: Attitude shapes our behaviour to a very great extent, as our positive or negative behaviour is based on our attitudinal predisposition.

3.3 DEFINITION OF LEARNING

1. "A change in human disposition or capability that persists over a period of time and is not simply ascribable to processes of growth."

   — Robert Gagne

2. "Learning is the relatively permanent change in a person's knowledge or behavior due to experience. This definition has three components:
   - The duration of the change is long-term rather than short-term;
   - The locus of the change is the content and structure of knowledge in memory or the behavior of the learner;
   - The cause of the change is the learner's experience in the environment rather than fatigue, motivation, drugs, physical condition or physiologic intervention."

     - Richard E. Mayer

3. "We define learning as the transformative process of taking in information that—when internalized and mixed with what we have experienced—changes what we know and builds on what we do. It's based on input, process, and reflection. It is what changes us."

   – Tony Bingham and Marcia Conner

4. "It has been suggested that the term learning defies precise definition because it is put to multiple uses. Learning is used to refer to
   - The acquisition and mastery of what is already known about something,
   - The extension and clarification of meaning of one's experience, or
   - An organized, intentional process of testing ideas relevant to problems. In other words, it is used to describe a product, a process, or a function."

     – R.M. Smith

5. "Acquiring knowledge and skills and having them readily available from memory so you can make sense of future problems and opportunities."

   -Peter C. Brown, Henry L. Roediger III, Mark A. McDaniel

6. "A process that leads to change, which occurs as a result of experience and increases the potential of improved performance and future learning."

   -Susan Ambrose, et al.

7. "The process of gaining knowledge and expertise."

   - Malcolm Knowles

8. "Learning involves strengthening correct responses and weakening incorrect responses.

   Learning involves adding new information to your memory. Learning involves making sense of the presented material by attending to relevant information,

mentally reorganizing it, and connecting it with what you already know."

- From eLearning and the Science of Instruction by Ruth C. Clark and Richard E. Mayer

9. "A persisting change in human performance or performance potential…[which] must come about as a result of the learner's experience and interaction with the world."

   - M. Drisco

10. "Learning is a process that occurs within nebulous environments of shifting core elements – not entirely under the control of the individual. Learning (defined as actionable knowledge) can reside outside of ourselves (within an organization or a database), is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing."

3.4 INSTRUMENTAL/OPERANT CONDITIONING LEARNING

Operant conditioning (also known as Instrumental learning) is a theory which assumes that you can learn human beings things by conditioning them by consequences. The original response will be influenced by a following consequence, which will change the future probability of that response. Furthermore, a process called conditioned reinforcement can be developed or can develop itself. This means that neutral stimuli that are being associated with a reinforcer or reinforcement can become reinforcers themselves in their own reight. These stimuli will encourage or discourage the behaviour, depending on the reinforcement. The term operant conditioning is introduced by B.F. Skinner in the 1930s. The theory of instrumental learning differs from normal conditioning, because this theory assumes that behaviour can be voluntary, instead of being a reflexive response to initiated external circumstances. Another important difference is that in the conditioning theory is that humans can›t learn, because consequences can›t be maintained. In the operant conditioning theory this is possible, because reinforcement can become reinforces themselves.

An example of operant conditioning is as following: "If an aggressive response by one child toward another child is followed by some positive event such as the aggressor getting to play with a desired toy, then the motivation to behave aggressively can be expected to increase in the future. Another example of operant conditioning is money. This is a reinforcement who became a reinforcer. "A piece of paper with numbers and intricate drawings on it can motivate all sorts of behaviour if that paper has previously been associated with important reinforcers such as food, clothing, sex, and so forth. Money is in effect a token of the things it can buy.

Operant Conditioning: Modification of Behaviour through Reinforcement

If a child completes the home work she is praised (rewarded) by the parents and the child learns to perform the task. If the child breaks a plate, he/she is scolded (punished) and she will learn not to repeat the behaviour. This is called Operant Conditioning or instrumental conditioning. In other words, we learn to perform behaviours that produce positive outcomes and avoid behaviours that yield negative outcomes. We may define

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operant conditioning as a process through which organisms learn to repeat behaviours that produce positive outcomes or avoid or escape from the negative outcomes. B.F. Skinner is considered as the most influential psychologist advocating the role of operant conditioning in learning. He developed an experimental chamber (called Skinner Box) to study learning process in rats. The chamber included a lever attached to the front wall. Pressing the lever is the response to be learned. The hungry rat is placed in the chamber and it starts doing random activity in it. After some time, the rat accidentally presses the lever and a pellet of food drops automatically in the plate and the rat eats it. After eating the pallet the rat again starts activity in the chamber. After some activity it again presses the lever and gets pellet (a reward). Gradually the random activity changes to more specific activity around the lever. Finally, the rat learns that pressing the lever results in dropping of the food, a satisfying outcome. In other words the pressing of lever by the rat is instrumental in providing food (reinforcement). The response (pressing the lever) is reinforced and the behaviour is acquired or learned. The pressing of lever by the rat is instrumental in getting the food, a satisfying consequence (positive reinforcement) and that is why this type of learning is also called instrumental learning. It is also called operant conditioning because the behaviour of rat or any organism is a kind of operation on the environment.

Much of the human learning could be explained with the help of operant conditioning method. For example, parents and other authorities attempt to discourage aggressive behaviours by punishing them and reward for good behaviours. The role of reinforcement is very crucial in operant conditioning. It can be positive or negative. Let us understand these two types of reinforcement.

Positive Reinforcement: Reinforcement is any operation or action that increases the rate of response. In Skinner's experiment the rat responded by pressing the lever and obtained food. This is called positive reinforcement. So, a positive reinforcement or reward (e.g., food, sexual pleasure, etc.) is the operation that increases the strength of a specific behaviour. Positive reinforcement is any stimulus that strengthens a response that precedes it (e.g., lever pressing is reinforced by food).

Negative Reinforcement: Another quite different way of increasing the rate of response is through negative reinforcement. Suppose that in the Skinner Box the rat receives electric shock to the feet every second. When the rat presses the lever, the shock is removed for 10 secs. This increases the rate of response. This procedure is called negative reinforcement which involves application of an aversive stimulus (e.g. heat, electric shock, scudding etc.). The word "negative" refers to the nature of the reinforcer (aversive stimulus). It is a "reinforcement" because it increases the rate of response. This procedure is called "escape" learning because the rat can escape the shock if it presses the lever. Another kind of negative reinforcement can result in conditioning called "avoidance" learning where the rat can avoid the shock by pressing the lever. In escape or avoidance learning the reinforcer is negative and the organism learns to escape or avoid its presence.

Schedules of Reinforcement: How do we reinforce the correct responses? It could be by using continuous or partial reinforcement. In the case of continuous reinforcement, every correct response is reinforced. For example, when the rat presses the lever every time it

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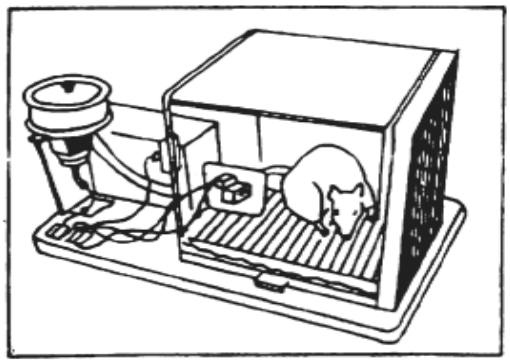
gets a food pellet (reinforcement). Alternatively, the responses are reinforced partially or intermittently (some times only). The continuous reinforcement is useful for establishing or strengthening new behaviours. The partial reinforcement, on the other hand, is more powerful in maintaining the acquired



ABSTRACT

Operant behavior is behavior "controlled" by its consequences. In practice, operant conditioning is the study of reversible behavior maintained by reinforcement schedules. We review empirical studies and theoretical approaches to two large classes of operant behavior: interval timing and choice. We discuss cognitive versus behavioral approaches to timing, the "gap" experiment and its implications, proportional timing and Weber's law, temporal dynamics and linear waiting, and the problem of simple chain-interval schedules. We review the long history of research on operant choice: the matching law, its extensions and problems, concurrent chain schedules, and self-control. We point out how linear waiting may be involved in timing, choice, and reinforcement schedules generally. There are prospects for a unified approach to all these areas. For example: Interval timing, choice, concurrent schedules, matching law, self-control.

Interval Timing

Interval timing is defined in several ways. The simplest is to define it as covariation between a dependent measure such as wait time and an independent measure such as interne enforcement interval (on fixed interval) or trial time-to-reinforcement (on the peak procedure). When interne enforcement interval is doubled, then after a learning period wait time also approximately doubles (*proportional timing*). This is an example of what is sometimes called a *time production* procedure: The organism produces an approximation to the to-be-timed interval. There are also explicit *time discrimination* procedures in which on each trial the subject is exposed to a stimulus and is then required to respond differentially depending on its absolute (Church & Deluty 1977, Stubbs 1968) or even relative (Fetterman et al. 1989) duration. Wait time is a latency; hence (it might be objected) it may vary on time-production procedures like fixed interval because of factors other than timing—such as degree of hunger (food deprivation). Using a time-discrimination procedure avoids this problem. It can also be mitigated by using the peak procedure and looking at performance during "empty" trials. "Filled" trials terminate with food reinforcement after (say) *T* s. "Empty" trials, typically

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3*T* s long, contain no food and end with the onset of the ITI. There is still some debate about the actual pattern of behavior on the peak procedure in each individual trial. Is it just wait, respond at a constant rate, then wait again? Or is there some residual responding after the "stop" [yes, usually (e.g., Church et al. 1991)]? Is the response rate between start and stop really constant or are there two or more identifiable rates (Cheng & Westwood 1993, Meck et al. 1984)? Nevertheless, the method is still widely used, particularly by researchers in the cognitive/psychophysical tradition. The idea behind this approach is that interval timing is akin to sensory processes such as the perception of sound intensity (loudness) or luminance (brightness). As there is an ear for hearing and an eye for seeing, so (it is assumed) there must be a (real, physiological) clock for timing. Treisman (1963) proposed the idea of an internal pacemaker-driven clock in the context of human psychophysics. Gibbon (1977) further developed the approach and applied it to animal interval-timing experiments.

Choice

Although we can devote only limited space to it, choice is one of the major research topics in operant conditioning (Mazur 2001, for recent statistics). Choice is not something that can be directly observed. The subject does this or that and, in consequence, is said to choose. The term has unfortunate overtones of conscious deliberation and weighing of alternatives for which the behavior itself—response A or response B—provides no direct evidence. One result has been the assumption that the proper framework for all so-called choice studies is in terms of response strength and the value of the choice alternatives. Another is the assumption that procedures that are very different are nevertheless studying the same thing. For example, in a classic series of experiments, Kahneman & Tversky (e.g., 1979) asked a number of human subjects to make a single choice of the following sort: between $400 for sure and a 50% chance of $1000. Most went for the sure thing, even though the expected value of the gamble is higher. This is termed *risk aversion*, and the same term has been applied to free-operant "choice" experiments. In one such experiment an animal subject must choose repeatedly between a response leading to a fixed amount of food and one leading equiprobably to either a large or a small amount with the same average value. Here the animals tend to be either indifferent or risk averse, preferring the fixed alternative (Staddon & Innis 1966b, Bateson & Kacelnik 1995, Kacelnik & Bateson 1996).

The fact that these three experiments (Kahneman & Tversky and the two free-operant studies) all produce different results is sometimes thought to pose a serious research problem, but, we contend, the problem is only in the use of the term *choice* for all three. The procedures (not to mention the subjects) are in fact very different, and in operant conditioning the devil is very much in the details. Apparently trivial procedural differences can sometimes lead to wildly different behavioral outcomes. Use of the term *choice* as if it denoted a unitary subject matter is therefore highly misleading. We also question the idea that the results of choice experiments are always best explained in terms of response strength and stimulus value.

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Concurrent Schedules

Bearing these caveats in mind, let's look briefly at the extensive history of free-operant choice research. In hungry pigeons pecked at two side-by-side response keys, one associated with variable-interval v_1 s and the other with variable-interval v_2 s (concurrent variable-interval–variable-interval schedule). After several experimental sessions and a range of v_1 and v_2 values chosen so that the overall programmed reinforcement rate was constant ($1/v_1 + 1/v_2$ = constant), the result was matching between steady-state relative response rates and relative obtained re-

Enforcement rates:

$$\frac{x}{y}=\frac{R(x)}{R(y)},$$

where x and y are the response rates on the two alternatives and $R(x)$ and $R(y)$ are the rates of obtained reinforcement for them. This relation has become known as Herrnstein's matching law. Although the obtained reinforcement rates are dependent on the response rates that produce them, the matching relation is not forced, because x and y can vary over quite a wide range without much effect on $R(x)$ and $R(y)$. Because of the negative feedback relation intrinsic to variable-interval schedules (the less you respond, the higher the probability of payoff), the matching law on concurrent variable-interval–variable-interval is consistent with reinforcement maximization (Staddon & Motheral 1978), although the maximum of the function relating overall payoff, $R(x) + R(y)$, to relative responding, $x/(x+y)$, is pretty flat. However, little else on these schedules fits the maximization idea. As noted above, even responding on simple fixed-T response-initiated delay (RID) schedules violates maximization. Matching is also highly over determined, in the sense that almost any learning rule consistent with the law of effect—an increase in reinforcement probability causes an increase in response probability—will yield either simple matching or its power-law generalization (Baum 1974, Hinson & Staddon 1983, Lander & Irwin 1968, Staddon 1968). Matching by itself therefore reveals relatively little about the dynamic processes operating in the responding subject. Despite this limitation, the strikingly regular functional relations characteristic of free-operant choice studies have attracted a great deal of experimental and theoretical attention.

Self Control

The prototypical self-control experiment has a subject choosing between two outcomes: not-so-good cookie now or a good cookie after some delay. Typically, the subject chooses the immediate, small reward, but if both delays are increased by the same amount, D, he will learn to choose the larger reward, providing D is long enough. Why? The standard answer is derived from Herrnstein›s matching analysis. The idea is that the expected value of each reward is inversely related to the time at which it is expected according to a hyperbolic function:

$$V_i=\frac{Ai}{1+kDi}$$

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Where A_i is the *undiscounted value* of the reward, D_i is the delay until reward is received, i denotes the large or small reward, and k is a fitted constant. Now suppose we set D_L and D_S to values such that the animal shows a preference for the shorter, sooner reward. This would be the case (k=1) if A_L=6, A_S=2, D_L= 6 s, and D_S= 1 s: V_L=0.86 and V_S=1—preference for the small, less-delayed reward. If 10 s is added to both delays, so that D_L= 16 s and D_S=11 s, the values are V_L=0.35 and V_S=0.17—preference for the larger reward. Thus, predicts that added delay—sometimes awkwardly termed *pre-commitment*—should enhance self-control, which it does. The most dramatic prediction from this analysis was made and confirmed by Mazur (1987, 2001) in an experiment that used an *adjusting-delay* procedure (also termed *titration*). "A response on the center key started each trial, and then a pigeon chose either a standard alternative (by pecking the red key) or an adjusting alternative (by pecking the green key) … the standard alternative delivered 2 s of access to grain after a 10-s delay, and the adjusting alternative delivered 6 s of access to grain after an adjusting delay" (2001). The adjusting delay increased (on the next trial) when it was chosen and decreased when the standard alternative was chosen. The relevant independent variable is TTR. When the subject is indifferent does not discriminate between the two choices, $V_L = V_S$.

$$D_L = \frac{Al}{As} \cdot Ds + \frac{Al - As}{kAs};$$

that is, an *indifference curve* that is a linear function relating D_L and D_S, with slope A_L/A_S > 1 and a positive intercept. The data (Mazur 1987; 2001) are consistent with this prediction, but the intercept is small.

It is also possible to look at this situation in terms of linear waiting. One assumption is necessary: that the waiting fraction, a, is smaller when the upcoming reinforcer is large than when it is small (Powell 1969 and Perone & Courtney 1992 showed this for fixed-ratio schedules; Howerton & Meltzer 1983, for fixed-interval). Given this assumption, the linear waiting analysis is even simpler than hyperbolic discounting. The idea is that the subject will appear to be indifferent when the wait times to the two alternatives are equal. According to linear waiting, the wait time for the small alternative is given by

$$t_S = a_S D_S + b_S,$$

where b_S is a small positive intercept and $a_S > a_L$. Equating the wait times for small and large alternatives yields

$$D_L = \frac{as}{aL} \cdot D_s + \frac{bs - bL}{aL},$$

which is also a linear function with slope > 1 and a small positive intercept. Equations are identical in form. Thus, the linear waiting and hyperbolic discounting models are almost indistinguishable in terms of these data. However, the linear waiting approach has three potential advantages: Parameters a and b can be independently measured by making appropriate measurements in a control study that retains the reinforcement-delay properties of the self-control experiments without the choice contingency; the linear waiting approach lacks the fitted parameter k in and linear waiting also applies to

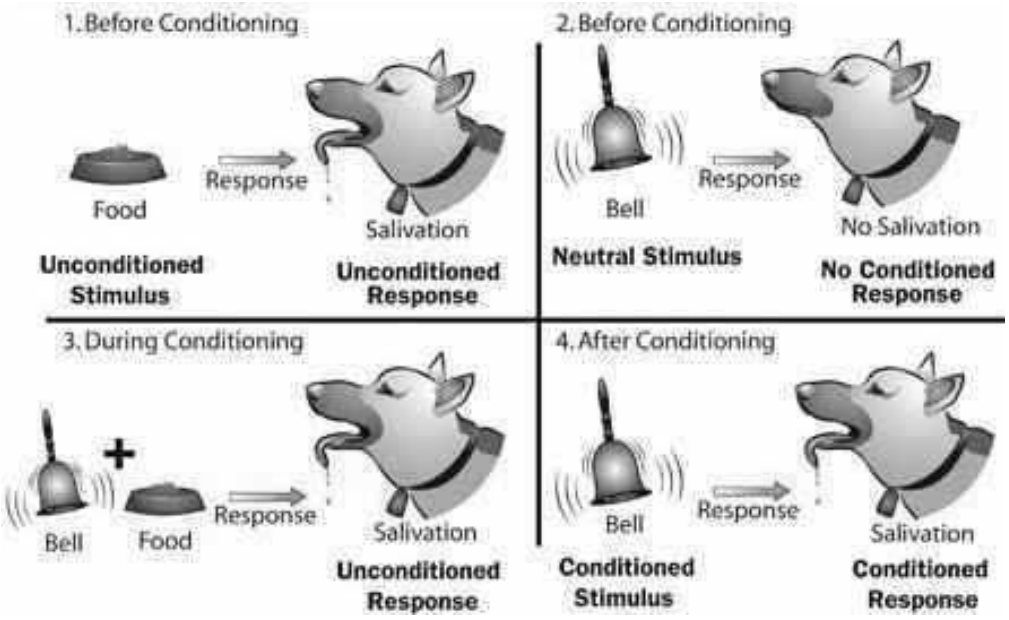
a wide range of time-production experiments not covered by the hyperbolic discounting approach.

CONCLUSION

Temporal control may be involved in unsuspected ways in a wide variety of operant conditioning procedures. A renewed emphasis on the causal factors operating in reinforcement schedules may help to unify research that has hitherto been defined in terms of more abstract topics like timing and choice.

CLASSICAL CONDITIONING

Learning through Association Classical conditioning is also known as Pavolovian conditioning because it was discovered by a Russian scientist Ivan P. Pavlov who was interested in studying stimulus-response relationship. He worked with dogs. The animal was harnessed and food was presented to the dog by a laboratory assistant. Pavlov realized that the salivary response had been learned by the dog. He proceeded to study this type of learning in detail. Pavlov presented to the dog a series of trials in which a tone (buzzer) was paired with food (biologically important stimulus). The learning trials consisted of pairing the tone, (Conditioned Stimulus or CS) with food (Unconditioned Stimulus or UCS). The tone presented was rather short and the time interval between the tone and presentation of food, was between 2 to 3 minutes.



During the initial trials the dog salivated when the food was presented. Secretion of saliva to food is a natural response and, therefore, the saliva is called Unconditioned Response (UR). Later, the buzzer was presented first. It was followed by food. After some pairing trials of buzzer and food, the dog started salivation at the ringing of buzzer alone. The buzzer is called Conditioned Stimulus (CS) because the dog has been conditioned to salivate at the presentation of the buzzer itself. The secretion of saliva on the presentation of buzzer is called Conditioned Response (CR).

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3.5 OBSERVATIONAL LEARNING

Observational learning is the third major way we learn. Acquiring new skills by observing the behaviour of others is very common. It is a part of everyday life. Observational learning depends on the existence of appropriate model in one's environment. That is, the child picks up behaviour while the appropriate model is performing an activity. For example, young people learn aggression through watching the actions of others (models). Television programmes and movies provide much of the learning to the young people. When children watch violence on TV they tend to learn such behaviours. We learn various social roles through observational learning. However, observational learning is a complex process, far more complex than mere imitation. Children acquire information and learn skills through observational learning but do not put it into immediate use. People, particularly youngsters, can often be influenced in positive ways when they have appropriate role models. **Observational learning is the process of learning by watching the behaviors of others.** The targeted behavior is watched, memorized, and then mimicked. Also known as shaping and modeling, observational learning is most common in children as they imitate behaviors of adults. While at times, we intentionally observe experts to learn new information, observational learning isn't always intentional. Especially in young children. A child may learn to swear or smoke cigarettes by watching adults. They are continually learning through observation, whether the target behavior is desirable or not.

Four Processes of Observational Learning

Canadian/American psychologist, Albert Bandura, was one of the first psychologists to recognize the phenomenon of observational learning. His theory, Social Learning Theory, stresses the importance of observation and modeling of behaviors, attitudes and emotional reactions of others. He found that, as social animals, humans naturally gravitate toward observational learning. Children watch their family members and mimic their behaviors. Even infants, at just 3-weeks old, start imitating mouth movements and facial expressions of adults around them.

According to Bandura's research, there are four processes that influence observational learning:

1. **Attention**
   To learn, an observer must pay attention to something in the environment. They must notice the model and the behavior occurring. Attention levels can vary based on the characteristics of the model and environment – including the model's degree of likeness, or the observer's current mood. In humans, it is likely the observer will pay attention to behaviors of models that are high-status, talented, intelligent, or similar to the observer in any way.

   For example, if you want to become a VP at your company, it makes sense that you'd observe the current VP's (or other renowned VP's in your industry) and try to mimic their behavior.

2. **Retention**
   Simple attention is not enough to learn a new behavior. An observer must also retain, or remember, the behavior at a later time. To increase chances of retention, the observer must structure the information in an easy-to-remember format. Maybe they use a mnemonic device. Or form a daily learning habit.

The behavior must be easily remembered so the action can be performed with little or no effort. Using our VP example above, let's say the current VP is giving a company-wide presentation. You notice that they are calm, confident, engaging, and use eye contact. You make a list of these attributes and remember them for the next time you give a presentation.

3. **Reproduction**
   The behavior is remembered. But can it be performed in real-life?

   Reproduction is the process where the observer must be able to physically perform the behavior in the real-world. Easier said than done. Often, producing a new behavior requires hours of practice to obtain the skills. You can't just watch your VP give a brilliant company-wide presentation, then use only the observed tactics in your own presentation 20-minutes later. Those skills take years to craft and perfect. Using our VP example again, you've observed and identified four skills that the current VP uses during presentations. To be able to perform these skills yourself, you need to deliberately practice these skills. Maybe you hold small team meetings to test your skills. Or you ask team members for feedback on your presenting skills. In a few months, you will have sharpened your presenting skills and may be ready to produce a behavior similar to the current VP.

4. **Motivation**
   All learning requires some degree of personal motivation. For observational learning, the observer must be motivated to produce the desired behavior.

   Sometimes this motivation is intrinsic to the observer. Other times, motivation can come in the form of external reinforcement – rewards and punishments.

   Using our VP example again, the motivation is intrinsic. You understand that the path to becoming a VP at your company requires a certain skill set.

SOME OTHER TYPES OF LEARNING

Verbal Learning: This is possible because of verbal learning. You have learned language. People in different parts of the world learn different languages. The process of learning language is called verbal learning. If you recollect your younger days you will notice that you started with identifying alphabets, then moved to words and finally sentences. When you learn a foreign language you use pairs of words. Psychologists study how various procedures like serial learning and paired associates learning are used.

Concept Learning: This is about developing categories of objects and events. It is very important in our life that we should discriminate between things on the basis of some criterion. For example, the terms 'boys', 'girls', 'fruits' and 'furniture' refer to concepts. A concept involves a variety of objects clubbed together. Use of categories or class names helps us to communicate and perform different activities. The concepts may be natural or artificial. They may be as abstract and concrete. Love, freedom and democracy are examples of abstract concepts. Cow, table, boy, girl, orange and rose are examples of concrete concepts. While learning a concept we make one response to all the stimuli belonging to that category. Thus we refer to all kinds of tables as table or all boys as boy. In fact all kinds of higher learning necessarily involves concept learning. Concepts help us to reduce the complexity of our world.

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Skill Learning: An important area of learning involves acquiring various types of skills like riding a bicycle, writing, car driving, piloting an air craft, leading a group and motivating others etc. All of these involve skills. Those who are able to learn these and other skills get opportunities in life. Once the skill is acquired one may over learn it. It may become automatic and one is able to perform it with ease and comfort. As a result people perform tasks spontaneously and can perform more than one task at a time (e.g. talking to a person and car driving).

Problem Solving Learning

The study of human and animal problem solving processes has provided much insight toward the understanding of our conscious experience and led to advancements in computer science and artificial intelligence. Essentially much of cognitive science today represents studies of how we consciously and unconsciously make decisions and solve problems. For instance, when encountered with a large amount of information, how do we go about making decisions about the most efficient way of sorting and analyzing all the information in order to find what you are looking for as in visual search paradigms in cognitive psychology. Or in a situation where a piece of machinery is not working properly, how do we go about organizing how to address the issue and understand what the cause of the problem might be.

PROBLEM-SOLVING STRATEGIES

When people are presented with a problem—whether it is a complex mathematical problem or a broken printer, how do you solve it? Before finding a solution to the problem, the problem must first be clearly identified. Problems themselves can be classified into two different categories known as ill-defined and well-defined problems (Schacter, 2009). Ill-defined problems represent issues that do not have clear goals, solution paths, or expected solutions whereas well-defined problems have specific goals, clearly defined solutions, and clear expected solutions. Problem solving often incorporates pragmatics (logical reasoning) and semantics (interpretation of meanings behind the problem), and also in many cases require abstract thinking and creativity in order to find novel solutions. Within psychology, problem solving refers to a motivational drive for reading a definite "goal" from a present situation or condition that is either not moving toward that goal, is distant from it, or requires more complex logical analysis for finding a missing description of conditions or steps toward that goal. Processes relating to problem solving include problem finding also known as problem analysis, problem shaping where the organization of the problem occurs, generating alternative strategies, implementation of attempted solutions, and verification of the selected solution. Various methods of studying problem solving exist within the field of psychology including introspection, behavior analysis and behaviorism, simulation, computer modelling, and experimentation.

Abstraction – refers to solving the problem within a model of the situation before applying it to reality.

Analogy – is using a solution that solves a similar problem.

Brainstorming – refers to collecting an analyzing a large amount of solutions, especially

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within a group of people, to combine the solutions and developing them until an optimal solution is reached.

Divide and conquer – breaking down large complex problems into smaller more manageable problems.

Hypothesis testing – method used in experimentation where an assumption about what would happen in response to manipulating an independent variable is made, and analysis of the affects of the manipulation are made and compared to the original hypothesis.

Lateral thinking – approaching problems indirectly and creatively by viewing the problem in a new and unusual light.

Means-ends analysis – choosing and analyzing an action at a series of smaller steps to move closer to the goal.

Method of focal objects – putting seemingly non-matching characteristics of different procedures together to make something new that will get you closer to the goal.

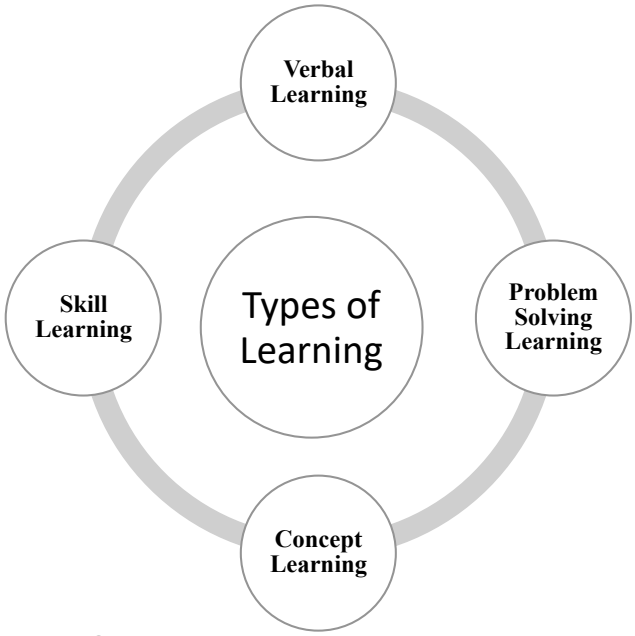
Morphological analysis – analyzing the outputs of and interactions of many pieces that together make up a whole system.

Proof – trying to prove that a problem cannot be solved. Where the proof fails becomes the starting point or solving the problem.

Reduction – adapting the problem to be as similar problems where a solution exists.

Research – using existing knowledge or solutions to similar problems to solve the problem.

Root cause analysis – trying to identify the cause of the problem.



TRANSFER OF TRAINING

It is interesting to note that learning of one task does not remain confined to that specific task only. That learning is used in other situations also. A person's ability to utilize

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knowledge, skills and any kind of learning is highly appreciated. If a child learns to multiply or divide, she can use the process not only in the class but also in the market place or at home if it is required. Transfer of training refers to the process of using earlier learning in a new situation. It is positive if the first learning helps the second learning. It can be negative if the first learning interferes with the second learning. It can be zero if the first learning neither helps nor interferes with the second learning.

3.6 COGNITIVE PROCESS IN LEARNING

The word cognitive is derived from "cognition", which describes your ability to think, perceive, remember and solve problems. Cognitive learning is a learning process that results from the effective use and application of the brain. It focuses on helping you learn ways to maximize your brain's potential. When you master cognitive learning, you inculcate a habit of lifelong continuous learning. Cognitive learning helps you become an efficient team member, a resourceful leader and a powerful speaker. With cognitive learning, you help your organization achieve its business goals and objectives. Cognitive learning theory explains how internal and external factors influence an individual's mental processes to supplement learning. Delays and difficulties in learning are seen when cognitive processes are not working regularly. These processes are such as attention, observation, retrieval from long-term memory, and categorization. Several researchers have made significant contributions to this theory. Jerome Bruner focused on how mental processes are linked to teaching. Another researcher by the name Jean Piaget recognized that the environment plays a huge role and also focused on changes that take place in the internal cognitive structure.

SOCIAL COGNITIVE THEORY

This theory helps us understand how people are influenced and their influence on the environment. One of the major components of social cognitive theory is observational learning. It is the process of learning others' desirable and undesirable behaviors through observation. It is a quick way of acquiring information when you individually take action. A person who demonstrates behavior for another person is known as a model. These may be real people such as teachers, our peers, and supervisors, or symbolic models, also known as fictional characters that influence an observer's behavior. Observational learning teaches people both positive and negative behaviors. For example, a manager within a company can teach the employees how they are supposed to behave ethically and be socially conscious when interacting and dealing with rude customers. Moreover, the manager can also train his/her employees on the different procedures that they can take in case of fire or other low probability hazardous scenarios.

COGNITIVE BEHAVIORAL THEORY

This theory mainly refers to our mental processes, such as our thoughts and interpretations of life events. It explains how the thoughts, feelings, and behavior of a person interact with each other. Thoughts lead to particular emotions, which in turn lead to specific behavioral responses. When we change our thoughts, we can change our emotions and then our behaviors. It also works in reverse where changing how we behave leads to changes in our feelings and, ultimately, our thoughts. An example of a developer who encounters a

problem in a particular sphere and automatically believes that the task is difficult for him/her right away. The employee is automatically likely to have a negative attitude towards this particular task, and his performance will likely be poor.

BENEFITS OF COGNITIVE LEARNING

Cognitive learning is an excellent way to foster a learning culture for continuous improvement in the workplace. Cognitive learning can benefit your career in the following ways:

Increases Confidence

As you no longer memorize things, you know how to handle workplace challenges. With an in-depth understanding of your new skills, you can approach the work confidently.

Ensures Faster Learning

Through cognitive learning, you can build upon your previous knowledge and ideas. Every new piece of information you learn gets added to your previous knowledge, increasing your storehouse of information. This ensures you learn and retain new concepts faster.

Promotes Comprehensive Learning

As cognitive learning focuses on a hands-on learning approach instead of memorization, it promotes immersive learning and promotes your comprehension of acquiring new concepts. It helps you understand the learning material.

Enhances Problem-Solving Skills

In an organization, problem-solving skills are a must because you may encounter unique challenges each day. That is where cognitive learning comes helpful. It helps in sharpening your problem-solving skills and lets you apply them in your job. As this core skill is mandatory for leadership, you can become a better leader with cognitive learning.

Fosters Innovation

Cognitive learning is about perception and concept formation. It teaches employees novel concepts and helps in interpreting complex information. Once concepts are clear, it leads to creativity, which eventually fosters innovation at the workplace.

PROCESSES OF COGNITIVE LEARNING

Perception

Perception is the interpretation of learning through the sensory experience. It involves recognizing the environmental stimuli along with your action when responding to the environmental stimuli. It is an essential cognitive learning process as it processes information such as recognizing colleagues' faces or actively listening during a meeting. The quality of learning depends on your nature of perception. The more you are attentive or have a clear perception in the meeting, the better is your learning. Also, prior experience affects your perception.

Concept formation

A concept is something that helps organize information into different categories. For example, the concept "resignation letter" refers to an official document, but a "letter to

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your mother" lacks this category's critical defining features. Therefore, concept formation is a cognitive process that helps the brain structure a new concept.

Memory

Another cognitive learning process is the memory which allows employees to store and recover information they previously learn. Memory is the basic process of learning, as it helps create a sense of identity. Cognitive learning does not advocate cramming information because it is neither stored in your short-term memory nor long-term memory. It focuses on creating an environment of mastering the concept, which helps employees relate to their previous experience. Instead of memorizing concepts, they can take a practical approach.

Application

Cognitive learning advocates the application of interpreting information in current and future situations. As cognitive learning supports the mastering of concepts, it helps you solve workplace problems efficiently. It helps you sharpen your problem-solving skills, leadership skills and critical thinking skills.

STRATEGIES OF COGNITIVE LEARNING

Learner-Centered Strategy

In a learner-centered strategy, learners accumulate their own knowledge, education, previous experience and ideas. This affects the way they learn new information. The learner-centered approach is more about relating new information to what you already know. Organizations that nourish curiosity and give importance to insights are the places where employees love to work. Employees prefer learning new skills in such an environment because they are directly involved and the trainer has a passive role.

Learning Through Discovery Strategy

In learning through discovery strategy, you are building your knowledge by exploring ideas and testifying them. The learning process is not about absorbing information from your training. Instead, it focuses on actively seeking answers to workplace problems. This type of learning increases your analytical skills as you analyze a problem and develop the best solution. It puts you in a real-world situation and ensures you recollect past information for applying to your current situation. This learning strategy improves your workplace performance as you do not just rely on the training material. You have hands-on experience in analyzing and solving potential problems.

EXAMPLES OF COGNITIVE LEARNING

Explicit learning

Explicit learning is when you intentionally seek new information to learn a new skill or concept essential for your job. For explicit learning, you must take the desired action and remain attentive to grasp the information. An example would be enrolling in a Selenium testing course to improve your web testing knowledge.

Implicit learning

Implicit learning is when you do not intentionally seek new information or concepts. It

is accidental learning because you passively gain knowledge without realizing that your brain is retaining new information.

Cooperative and collaborative learning

Cooperative learning is when you learn new concepts, information and processes as a team. This type of learning brings out the best from each team member and deepens collaboration. For cooperative learning to be effective, you should actively participate and interact with your team members.

Collaborative learning

Collaborative learning is when a team member teaches the team how to develop their ideas, knowledge and skills. For example, organizations usually train one colleague about the new software to pass on the information to the others.

Emotional learning

Controlling emotions at the workplace is essential to maintain a healthy relationship with your team members and managers. Emotional learning helps you achieve your goal. It is through this cognitive learning that you learn to control your emotions and understand others. The essence of emotional learning comes down to understanding and maintaining healthy work relationships while solving problems under pressure.

Experiential learning

Often, you learn best through the experience of your team members and managers. Experiential learning is all about taking valuable lessons from the experiences (both positive and negative). For example, a software development intern may learn the best coding practices, code development standards, log file preparation and everything else that would help them excel at their job from a senior developer.

Receptive learning

Receptive learning is cognitive learning, where the speaker or lecturer talks about a subject and takes notes. It is like classroom teaching and is a passive learning method because the speaker is the one delivering information. An example of receptive learning in organizations is conducting workshops and calling guest speakers to train you and your team on a specific topic.

Observation learning

Observation learning is the process where you watch the behaviour of others. You watch, memorise and mimic the same behaviour at your workplace. For example, you may mimic your manager's leadership skills or imitate other good habits of your team members.

TEACHING FOR DEVELOPMENT OF COGNITION

The dictionary meaning of cognition is the art of knowing. Usually it is concerned with knowing, understanding, processing and using information and these are considered as mental abilities or components of intelligence. Cognitive development refers to the stages and processes involved in child's intellectual development. There are several theories of development of cognition. Among all the theories, Piaget's theory provides a comprehensive picture of cognitive development from birth to the age of 14 or 15 when

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cognitive development attains the peak. Piaget conceives of cognitive development as consisting of a series of stages, each characterized by certain kinds of behaviours and certain ways of thinking and solving problems. All the age specific stages have been grouped under four broad stages:

- Sensory-motor (0 – 2 years of age),
- Pre-operational (2 – 7 years),
- Concrete operational (7 – 11 or 12 years) and
- Formal operational (11or 12 – 14 or 15 years)

The descriptions of the characteristics of the child's behaviour at each stage can be valuable in helping you as a teacher to understand your students' level of cognition. Knowing the cognitive status is important as any form of learning is greatly influenced.

STAGE	APPROXIMATE AGE	SOME MAJOR CHARACTERISTICS
Sensorimotor	0 – 2 years	Intelligence related motor activities. Concerned with present and nearby incidents and objects. No language and no thought. No idea of objective reality.
Preoperational Pre-conceptual Intuitive	2 – 7 years 2 – 4 years 4 – 7years	Egocentric thought. Reason dominated by perception. Intuitive rather than logical solutions. Inability to conserve.
Concrete Operations	7 – 11 or 12years	Ability to conserve. Logic of class and relations. Understanding of numbers. Thinking bound to concrete objects and experiences. Development of reversibility in thought.
Formal Operations	11 or 12 – 14 or 15 years	Complete generality of thought. Propositional thinking. Ability to deal with hypothetical ideas and situations. Development of strong idealism.

Piaget's theory tells us that the child is born with a mental/cognitive structure which develops and attains maximum growth around the age 14 or 15 years. The major trends of the cognitive development during the four stages are as follows:

- During the first two years of life, the child performs activities mostly driven by sense organs and some motor activities. For an infant at this stage, objects exist when they can be seen, heard, touched, tasted or smelled and when they are removed from the infant's immediate sensory experience, they cease to exist.
- Towards the end of this sensorimotor period, the child can identify the objects around him/her and can imitate several actions of others. And at a later stage, the child can imitate the actions in absence of the actions or objects (called deferred imitation). This indicates that the child can observe the action minutely, internalize The actions and reproduce it signifying the early form of intentional action. Intentional actions are also part of intelligent activity.
- Piaget defines 'operations' as mental activities subject to certain rules of logic. According to him, operations in true form do not appear before 7 years of age. But with development of language ability, the child tries to reason out in a crude way during the pre-operation period. These reasoning are mostly pre-logical – egocentric (everything moving around the self), and intuitive, mostly driven by emotion and passion.
- The intelligence as is commonly understood begins to appear towards the end of the pre-operation stage i.e., around age of 6 or 7 years (incidentally this is the beginning of schooling). It is during the concrete operation period i.e. from 7 – 11 or 12 years of age, children make a fundamentally important transition from a pre-logical form of thought to logical thinking that apply to real, concrete objects and events. Three important mental abilities develop during this period with manipulation of concrete objects and events. They are conservation, classification and seriation.

Conservation

Conservation is the realization that quantity or amount does not change when nothing has been added to or taken away from and object or collection of objects, despite changes in form or arrangement in space. For example, to test the conservation of number, expose the children to two collections of marbles/beads as shown below. If these two arrangements of marbles are shown to children in pre-operation stage, almost all would say that the collection (b) has more marbles because they have not yet developed the ability of conservation of numbers. Similar conservation tasks in area, volume and mass have revealed that it is during the concrete operation stage, children develop this ability.

Classification

Classification is to group objects according to their similarities and differences. Classification involves comparing and contrasting the objects on different characteristics like size, shape, colour, weight, use, material etc. A child in pre-operation stage is not capable of classifying objects and cannot compare more than two objects at a time.

Seriation

Seriation is the ability to arrange similar objects in a definite order (increasing or decreasing). Besides these three, the ability to deal with numbers, a direct product of

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classification and seriation, develops during the stage of concrete operations. The stage of formal operation is the final stage of cognitive development. It is formal because the subject matters with which children can now deal are mostly imaginary or hypothetical, abstract and free from concrete objects and events. The thinking process at this stage involves propositional reasoning following the "If, then..." logic like "If A>B and B>C, then what is the relation between A and C?" Such problems involving abstract and propositional logic cannot be solved by children in concrete operation stage. Lev Vygotsky, the famous Russian psychologist, adds two elements in his theory of cognitive development. He stresses the impact of culture and language on the cognitive development. According to him, without culture, our intellectual functioning is limited to apelike, elementary mental functions. With intensive interaction with the elements of culture and a healthy language development, we become capable of higher mental functions involved in thinking, reasoning, remembering and so on.

3.7 CHAPTER SUMMARY

Learning may be defined as a relatively durable change in behaviour due to experience. If the change in behaviour is temporary, or due to instinct or maturation, it is not learning. • Learning helps us adapt to our environment. • The two basic types of learning are classical conditioning and operant conditioning or instrumental learning. • Classical conditioning involves pairing of a neutral stimulus and a natural stimulus (CS and UCS) leading to formation of association between neutral stimulus and response. • Operant conditioning is a process through which organisms learn to repeat behaviours that produce positive outcomes or avoid or escape from the negative outcomes. • Skinner defined reinforcement as any operation or action that increases the rate of response. • In escape or avoidance learning the reinforcer is negative and the organism learns to escape or avoid its presence. • In the case of continuous reinforcement, every correct response is reinforced. • The process of learning language is called verbal learning. • An important area of learning involves acquiring skills like riding a bicycle, writing, car driving, piloting an air craft, leading a group, motivating others etc. • Observational learning is also used in acquiring new skills by observing the behaviour of others. • Transfer of training refers to the process of using earlier learning in a new situation. It is positive if the first learning helps the second learning. • Learning transforms a person in many ways and occurs throughout one's life. Good learners utilize each and every opportunity as an occasion for learning.

Operant conditioning (also known as Instrumental learning) is a theory which assumes that you can learn human beings things by conditioning them by consequences. The original response will be influenced by a following consequence, which will change the future probability of that response. Furthermore, a process called conditioned reinforcement can be developed or can develop itself. This means that neutral stimuli that are being associated with a reinforcer or reinforcement can become reinforcers themselves in their own reight. These stimuli will encourage or discourage the behaviour, depending on the reinforcement. The term operant conditioning is introduced by B.F. Skinner in the 1930s. The theory of instrumental learning differs from normal conditioning, because this theory assumes that behaviour can be voluntary, instead of being a reflexive response to initiated

external circumstances. Another important difference is that in the conditioning theory is that humans can›t learn, because consequences can›t be maintained. In the operant conditioning theory this is possible, because reinforcement can become reinforces themselves. This theory helps us understand how people are influenced and their influence on the environment. One of the major components of social cognitive theory is observational learning. It is the process of learning others' desirable and undesirable behaviors through observation. It is a quick way of acquiring information when you individually take action. A person who demonstrates behavior for another person is known as a model. This theory mainly refers to our mental processes, such as our thoughts and interpretations of life events. It explains how the thoughts, feelings, and behavior of a person interact with each other. Thoughts lead to particular emotions, which in turn lead to specific behavioral responses. When we change our thoughts, we can change our emotions and then our behaviors. It also works in reverse where changing how we behave leads to changes in our feelings and, ultimately, our thoughts. An example of a developer who encounters a problem in a particular sphere and automatically believes that the task is difficult for him/her right away.

The employee is automatically likely to have a negative attitude towards this particular task, and his performance will likely be poor. The dictionary meaning of cognition is the art of knowing. Usually it is concerned with knowing, understanding, processing and using information and these are considered as mental abilities or components of intelligence. Cognitive development refers to the stages and processes involved in child's intellectual development. There are several theories of development of cognition. Among all the theories, Piaget's theory provides a comprehensive picture of cognitive development from birth to the age of 14 or 15 when cognitive development attains the peak. Piaget's theory tells us that the child is born with a mental/cognitive structure which develops and attains maximum growth around the age 14 or 15 years. During the first two years of life, the child performs activities mostly driven by sense organs and some motor activities. Piaget defines 'operations' as mental activities subject to certain rules of logic. According to him, operations in true form do not appear before 7 years of age. Conservation is the realization that quantity or amount does not change when nothing has been added to or taken away from and object or collection of objects, despite changes in form or arrangement in space.

3.8 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **What is learning? Give an example.**
2. **Describe the Concurrent Schedules**
3. **Explain learning by Observation.**
4. **Explain concept learning, skill learning and transfer of training.**
5. **Describe the nature of classical Conditioning.**

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LONG ANSWER TYPE QUESTIONS

1. **What are the main types of reinforcement? What is the role of reinforcement in operant conditioning?**
2. **Describe the process of teaching for development of cognition.**
3. **Explain the definition of learning.**
4. **What is the significance of problem-solving strategies?**
5. **What is Abstract?**

3.9 MULTIPLE CHOICE QUESTIONS

1. **Reinforcement is a part of which of the following process?**
   a. Teaching
   b. Learning
   c. Instructions
   d. None of the above
2. **Which of the following theories is related to learning by consequences?**
   a. Operant Conditioning
   b. Insight Learning
   c. Classical Conditioning
   d. Cognitive learning
3. **Learning Outcomes mean-**
   a. Completion of Content
   b. Change in teaching method of the teacher
   c. Change in the behaviour of the student
   d. Recognization of the subject – matter
4. **The result of learning is –**
   a. Storing new knowledge in mind
   b. Acquiring more information
   c. Utility to use old experiences
   d. Modification and development
5. **Groups of learning strategies that are more task- specific are called_____.**
   a. Cognitive
   b. Positive attitude
   c. Drafting
   d. Metacognitive
6. **Which of the following gives stress on the ability of an individual to perceive and understand instinctively?**
   a. Imitation
   b. Trial and error
   c. Insight theory
   d. Exercise

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7. How many types of reinforcement is there?

a. Two
b. Four
c. Eight
d. Twelve

8. If a response is responsible for the extinction of unpleasant stimuli, it is_____.

a. Extinction
b. Positive reinforcement
c. Negative reinforcement
d. Punishment

9. Learning by trial and error is called _____.

a. Classical conditioning
b. Positive reinforcement
c. Operant conditioning
d. None of these

10. In Pavlov's experiments, the meat powder acted as _____.

a. An unconditioned response
b. An unconditioned stimulus
c. Conditioned stimulus
d. None of these

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UNIT IV

MEMORY

STRUCTURE

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4.1 LEARNING OBJECTIVE

After completion of this unit, student will be able to:

- Understand the different theories of memories.
- Learn about short- and long-term memory.
- Know about TOT.
- Understand encoding and storing long-term memories.
- Learn about the role of imagery.
- Would be able to describe the role of constructive processes.
- Understand forgetting and motivated forgetting.

4.2 INTRODUCTION

Memory can be tricky sometimes!

It is not just the story of Garfield only you might also have experienced a similar situation. Memory is tricky because it has mysterious nature. Psychologists have also tried to uncover its mystery and investigated how it affects human behavior. In this unit, we are going to discuss various aspects of memory such as its nature, types and, different models to understand its structure. We will further see why sometimes our memory betrays us and what are the different ways to reduce these memory failures.

4.3 MEANING AND NATURE OF MEMORY

What did you eat for dinner yesterday? What is the name of your best friend? Do you know how to drive a car or a cycle? How did you feel when you got the highest marks in your high school? The mental process you used to answer all of these questions is known as memory. It refers to the ability to retain information and reproduce it over a period of time when required to perform a cognitive task. It has been conceptualized as a process comprised of three stages;

- Encoding
- Storage
- Retrieval

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All information received by our senses goes through these stages:

- **Encoding:** It is the process of converting sensory information into a form that can be processed further by the memory systems.
- **Storage:** In this second stage, received information from memory systems is stored so that it can be used later.
- **Retrieval:** It refers to locating and bringing the stored material information to one's awareness when required to complete a task.

However, any issue or hindrance in the completion of any of these stages can lead to memory failure.

4.4 THEORIES OF MEMORY: INFORMATION PROCESSING THEORIES

Whatever we have learnt needs to be stored properly so that we are able to retrieve it when we want to. This process involves memory. There are different theories or models of memory.

Information-processing Model

From the1960s onwards, cognitive approaches were based on the model of the computer as an information-processing mechanism. In 1968, American psychologists Richard Atkinson and Richard Shiffrin (1968) proposed the Atkinson-Shiffrin Model of memory which is very similar to the way computer handles the input and storage of data. This model involves various steps to store information.

a. **The sensory register or memory:** This receives information from the various sensory receptors from the environment. Here, the information is held for a very brief period of time, perhaps a few seconds. The information passes from the sensory register to the short-term memory, only if attention is paid to it.

b. **Short-term store or memory:** This is also known as working memory. William James referred to it as primary memory. Here, the information is kept for 20 to 30 seconds. The information that is attended to, is processed here in a rehearsal buffer and repeated again and again. It has a very limited capacity to store information. G. A. Miller (1956) suggested that the capacity of working memory was about seven items (plus or minus two), by items, Miller argued that a lot of information could be packed in a single item. This strategy was called chunking and the basic unit of information in working memory is known as the chunk. Chunking can help to store more information in a short-term store.

   Several pieces of information can be combined into chunks and stored in a short-term store and later retrieved. It stores the sound of the speech, visual images, words, and meaningful sentences. Since the storage is very small, most of the new incoming information displaces the previously stored information. Information that is rehearsed well then moves to the long-term memory. Rehearsal here means actively maintaining the item in working memory. Rehearsal can be made in two ways. In maintenance rehearsal, the information is repeated again and again. This information may not be passed on to the long-term memory. In elaborative rehearsal, strategies are used to organize and give meaning to the material to some other concept that is encoded. Elaborative rehearsal associates the item in working memory with existing long-term memory structures.

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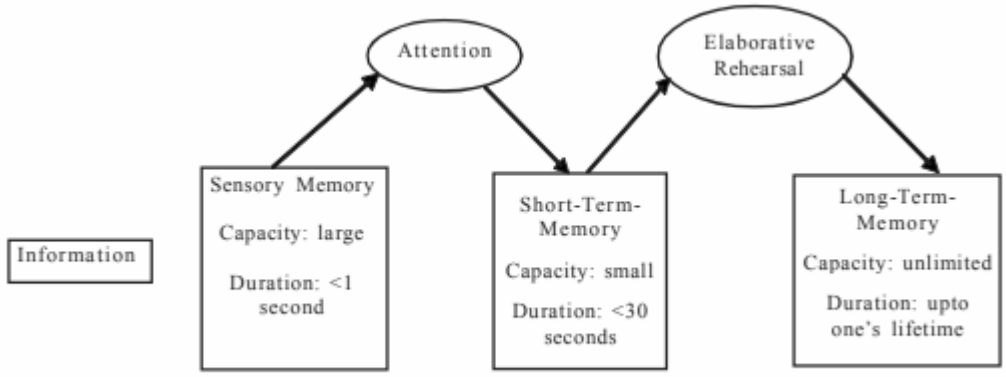
c. Long-term store or memory: Information that is rehearsed well, then moves to the long-term memory and the information that is not rehearsed is lost. The information is organized in different ways in long-term stores for days, months, years, and maybe forever. Long-term memory has unlimited capacity to store information. Information is generally not forgotten from long-term stores, and if any forgetting occurs, it is because the information has not been retrieved or organized properly. The information that is stored in the long-term store consists of meaningful words, sentences, ideas, and various experiences of our life.



Information-Processing Model

An Integrative Model: Working Memory

The concept of STM propounded by Atkinson and Shiffrin was very narrow. They considered STM only as a short-term memory storehouse but later studies disapproved of it. Later studies suggested that STM is dynamic in nature i.e., it works not just as a storehouse of information but is also responsible for the manipulation of incoming information for the completion of a cognitive task. Baddeley & Hitch (1974), after incorporating the idea of the level of processing (LOP) proposed a new model for STM and termed it working memory. Thus, working memory can be defined as "a limited-capacity system for temporary storage and manipulation of information for complex tasks such as comprehension, learning, and reasoning" (Goldstein, 2011). Baddeley's model of Working Memory (WM) consists of four components: the central executive, the phonological loop, the visuospatial sketch pad, and the episodic buffer.

- The central executive, as the name suggests, works as an executive in our working memory. It coordinates and regulates cognitive operation between subordinate systems namely, phonological loop, visuospatial sketch pad and episodic buffer. It decides which of the memory will become part of long-term memory and which will fade away.
- The phonological loop is responsible for storing verbal and auditory information. The information stored in the phonological loop will decay within 2 seconds unless it is not rehearsed. It consists of two components, the phonological store, which stores information for a few seconds; and the articulatory rehearsal process,

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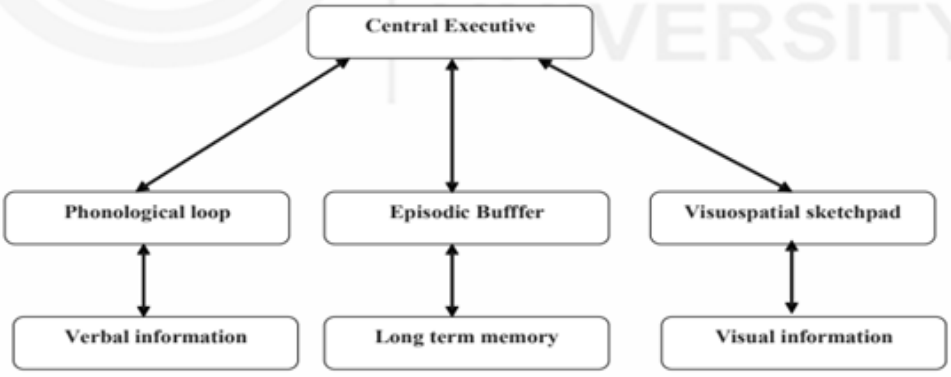
responsible for rehearsing the information in order to keep the information stored in the phonological store from decaying. For instance, trying to remember a phone number, you have just been told by your friend, involves a phonological loop.

- The visuospatial sketch pad keeps visual and spatial information stored. For instance, the mental picture that comes up in your mind while listening to a story or solving a puzzle involves using your visuospatial sketch pad.



Baddeley's Model of Working Memory

- The episodic buffer is responsible for combining information from the phonological loop, visuospatial sketch pad and long-term memory to generate a unitary episodic representation of information. Thus, this component helps us in making a sense of the received information.

4.5 SENSORY REGISTER

The sensory register or sensory memory is the shortest-term element of memory. Roughly speaking, it concerns memories that last no more than about a second or two.Sensory memory acts as a kind of buffer for stimuli received through the five senses of sight, hearing, smell, taste and touch, which are retained accurately, but very briefly. For example, the ability to look at something and remember what it looked like with just a second of observation is an example of sensory memory.

Iconic memory refers to visual sensory memory, and echoic memory to auditory sensory memory. The sensory memory for touch is known as the haptic memory.Information that makes it through the sensory register has one of four futures:

1. It may be forgotten almost immediately as we do with much of the information that we do not regard as important at that time. Iconic memory lasts for less than a second while echoic memory lasts for less than four seconds.
2. It may be held briefly (up to roughly 20 seconds) through simple attention and repetition, as we do with the number to the local pizza place after we've looked it up; this is often referred to as our "short term" memory.
3. It may be held a little longer (for a few minutes) through frequent repetition or simple "chunking" of the information into smaller items, as we might do with the phone number of a girl or boy, we met at the dance (e.g., 555-6789 becomes 55-56-

789); we often call this our "working" memory. Working memory also comes into play when we recall previously learned information from our long-term memory.

4. Through "elaborative rehearsal" association, reorganization, repetition, and testing oneself become part of our long-term memory.

4.6 SHORT-TERM MEMORY

You have just seen that information from the sensory register is passed on to short-term term memory. In this sub-section, we shall deal with short-term memory in more detail. Information is held, in the STM store for up to about 30 seconds, but the length can be very dependent upon many factors. Short-term memory has very limited storage capacity, six to seven items can be stored at one time. With new stimulus input, the original items get erased or fade away. The storage capacity can be increased by chunking i.e., combining several items. Unfamiliar items fade out faster than familiar items. Items can be recalled at will while the information is in a short-term memory store. Coding for short-term memory involves speech sounds, visual images and words.

Generally, visual stimuliare translated into sounds, for example, if a card of unfamiliar letters is flashed forhalf a second and after 15 seconds you are asked to repeat it, chances are that you would reproduce the sound resembling that letter. Some experiments have also demonstrated that the material presented at the beginning of the text and at the end are recalled relatively well than those appearing in the middle. This is called the serial position effect. When the recall is better at the beginning of the text which contributes to the serial position effect then it is known as a primary effect. While if the recall is better than the last part of the text, then it is called the recency effect.

4.7 REHEARSAL

Rehearsal means repeating items of information, silently or aloud and it helps to keep these items of information in the centre of attention. Experiments have shown that rehearsal could be maintenance rehearsal wherein information is just repeated as it is. This is not very helpful in remembering for a longer duration. Elaborative rehearsal organizes the material and gives meaning while rehearsing. 'This is an active process of transferring material from short-term memory to long-term memory. The amount of rehearsal given to items is important in the transfer of information from short-term to long-term memory, the more an item is rehearsed, the more likely it is to become part of long-term memory. In elaborative rehearsal, people use strategies that give meaning and organization to the material so that it can be fitted in with existing organized long-term memories.

4.8 LEVELS OF PROCESSING THEORIES

This model refutes the claim of Atkinson and Shiffrin's model that memory consists of different subsystems. According to the level of processing (LOP), whether the information will be retrieved successfully or not depends on its level of processing. LOP refers to the fact that more meaning-based handling of information leads to the better encoding of information.

According to this model, the information that is encoded is processed at different levels. The manner in which information is first encountered and rehearsed leads to a different

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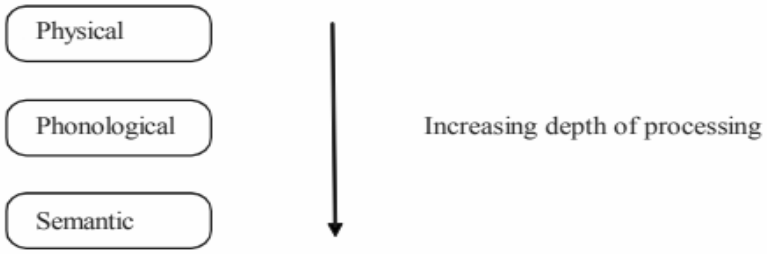
depth of processing. Fergus Craik and Robert Lockhart (1972) have proposed that elaborative rehearsal leads to deeper processing and maintenance rehearsal leads to shallow processing. Craik and Tulving (1975) proposed three LOP;

a. **Physical/Structural Processing:** Encoding of information based on its physical attributes-shallow processing.
b. **Phonological Processing:** Encoding based on how it sounds. Such as, 'Hat' rhymes with 'Cat'-shallow process.
c. **Semantic Processing:** Encoding done based on its meaning and/or concept deep processing.

Studies on this model have suggested that the deeper the level of processing, the higher will be its probability to be retrieved successfully (better retention of the information than shallow processing).



Level of Processing (Craik & Tulving, 1975)

4.9 TOT

The tip-of-the-tongue state (TOT) is the feeling that accompanies temporary inaccessibility of an item that a person is trying to retrieve. TOTs have been studied experimentally since the seminal work of Brown and McNeill (1966). TOTs are experiences that accompany some failed or slow retrievals, and they can result in changes in retrieval behavior itself, allowing us to study the interplay among experience, retrieval, and behavior. We often attribute the experience of the TOT to the unretrieved target, but TOTs are based on a variety of cues, heuristics, or sources of evidence, such as partial information, related information, and cue familiarity, that predict the likelihood of overcoming retrieval failure. We present a synthesis of the direct-access view, which accounts for retrieval failure, and the heuristic–metacognitive view, which accounts for the experience of the TOT. We offer several avenues for future research and applications of TOT theory and data.

TOTs play an important role in a number of areas within cognitive psychology, including theories of memory, language production, and meta-cognition. From the point of view of memory, the study of TOTs has contributed to our understanding of the effects of interference on recall. From the point of view of language production, TOTs have alerted researchers to retrieval efforts that have stalled or failed, as well as providing insight into the structure of the lexicon. From the meta-cognitive view, TOTs are feelings that arise when retrieval fails. The latter view distinguishes the feeling of the TOT from the retrieval failure itself. One of our goals of this review article is to synthesize these disparate

perspectives. From the meta-cognitive perspective, we consider it possible that the TOT and retrieval processes are dissociable.

Because TOTs are produced by meta-cognitive processes, it should be possible to find experimental variables that will affect them without affecting recall and variables that will affect recall without affecting TOTs. We will return to evidence bearing on these dissociations later. But considering TOTs as meta-cognition opens up a number of avenues of inquiry. We suggest that TOTs serve a monitoring function, alerting us to the possibility of remembering when retrieval apparently has failed. In this sense, TOTs enhance the functioning of the retrieval system rather than being an annoying glitch in this system. From the meta-cognitive perspective, feeling states are of functional significance. Consider the following analogy between TOTs and problems with your car.

You turn on the ignition and notice that your "low tire pressure" signal is activated. The light informs you that there is a problem, but the light is not the problem itself. The TOT experience is like the signal it alerts you to a problem with your retrieval system but is not the problem itself. Crucial to the analogy is that the "low pressure" signal is not the same thing as a tire low on air. Moreover, the analogy also illustrates the concept of meta-cognitive control. Your awareness of a problem allows you to do something about it you can bring the car to the shop when you see the warning light, and with retrieval failure and you can continue searching and cuing yourself for the missing word when you feel the TOT. Finally, it is possible that there could be something wrong with your "low pressure" signal system; it may light up when there is no problem with your tires.

The problem now is not the tires, but the monitoring system. This is analogous to an illusory TOT in which the monitoring system signals retrieval failure when none has occurred. This article is a progress report on the state of meta-cognitive research on TOTs. Since Brown and McNeill's (1966) first empirical study on TOTs, there has been a steady stream of research. More than 40 years later, we have a handle on why TOTs occur (their functional significance) and the mechanisms that underlie the TOT experience. Moreover, in recent years, neuroimaging studies have begun to reveal the brain mechanisms responsible for TOTs.

Although the emerging story of TOTs has grown, consistent with the general pattern that we see for many meta-cognitive phenomena, much still remains to be learned about them. In this article, we review the problem (why some researchers choose to study TOTs), the impact (what TOTs tell us about the relation of subjective experience, cognition, and behavior), and the trajectory (where TOT research is going in the near future). TOTs as a case study of phenomenology We have chosen to study TOTs because they provide a case study that can help us understand the nature of phenomenological experience (henceforth, simply experience) and its relation to cognition and behavior. We present four arguments as to why TOTs are ideal for the purpose of studying meta-cognitive experience.

Impact

We focus on the role that TOTs play in understanding the heuristic nature of meta-cognition and the role that the cues and clues play in producing TOTs. We also focus on the give and take between monitoring and control in meta-cognition and what TOTs can

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tell us about the control of retrieval. In both of these areas, TOT research has uncovered results that challenge how we think about the nature of retrieval and the nature of meta-cognition. In reviewing these topics, we will first need to review the differences between direct-access theories of TOTs and inferential theories, as well as to describe a synthesis of the two views.

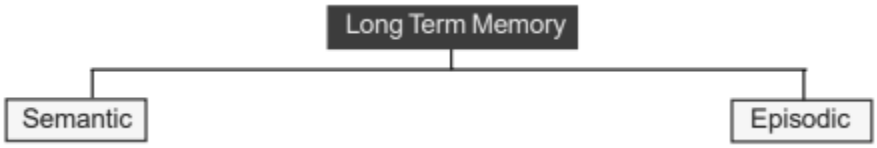
- The direct-access view
- The heuristic meta-cognitive account

TOTs allow us to explore the nature of word retrieval and the workings of retrieval failure, as well as providing a case study in phenomenology. Thus, TOTs offer great value in terms of their theoretical interest. The study of TOTs has practical value as well, since understanding them may be useful in designing learning tools, helping older adults overcome memory problems, and diagnosing neurological illnesses.

4.10 LONG-TERM MEMORY

Long-term memory seems to be very complex as it stores many different aspects of our experiences. The storage capacity has no known limits and one can remember information for days, months, and years. It records the salient features of sensory inputs and files these according to various memory categories. It also creates an auditory representation of the input and it also records how to reproduce the information when required.

Long-term memory contains two different categories of information:



4.11 SEMANTIC AND EPISODIC MEMORY

Semantic Memory

Contains the meaning of words and concepts, and rules for using these in language. Semantic memory is not easily forgotten as the information is stored in a highly organized way in logical hierarchies, from general to specific ones. Such organization makes it possible for us to make logical inferences from the information stored in semantic memory.

Episodic Memory

It contains personal experiences of long-term memories. It is a record of what has happened to us, our remembrances of past things. Episodic memory seems to be organized with respect to when certain events happened in our lives. The episodes do not have to have a logical organization. It is less organized, episodic memory seems more susceptible to being forgotten than does semantic memory. Long-term memory is highly organized. Information is categorized in a number of ways. One of the evidence of organization is seen in the tip of the Tongue phenomenon.

You all would have experienced while trying to retrieve a person's name you cannot quite remember it but the name is on your tongue. If we look at this tip-of-the-tongue (TOT)

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phenomenon in greater detail, we find evidence for the organization of long-term memory. In an important experiment, Brown & McNeill (1966) found that the search through the memory store in the TOT state is not random. If the name we are looking for is Shalu, we may come up with Shalini or Shobha, but not Meena. In the experiment, when the subjects were in the TOT state, on hearing the definition but not able to hit the "target" word, they tended to retrieve words from their tong term memories that

- Sounded like the target word
- Started with the same letter as the target word
- Contained the same number of syllables as the target word
- And had a meaning similar to that of the target word. The TOT phenomenon indicates that information is organized in long-term memory

4.12 ENCODING AND STORING LONG-TERM MEMORIES

Encoding (Input of Information to Memory)

We get information into our brains through a process called **encoding**, which is the input of information into the memory system. Once we receive sensory information from the environment, our brains label or code it. We organize the information with other similar information and connect new concepts to existing concepts. Encoding information occurs through both automatic processing and effortful processing. For example, if someone asks you what you ate for lunch today, more than likely you could recall this information quite easily. This is known as **automatic processing**, or the encoding of details like time, space, frequency, and the meaning of words. Automatic processing is usually done without any conscious awareness.

Recalling the last time you studied for a test is another example of automatic processing. But what about the actual test material you studied? It probably required a lot of work and attention on your part to encode that information; this is known as **effortful processing**. When you first learn new skills such as driving a car, you have to put forth effort and attention to encode information about how to start a car, how to brake, how to handle a turn, and so on. Once you know how to drive, you can encode additional information about this skill automatically.

Storage (Retaining Information in Memory)

Once the information has been encoded, we have to retain it. Our brains take the encoded information and place it in storage. Storage is the creation of a permanent record of information. In order for a memory to go into storage (i.e., long-term memory), it has to pass through three distinct stages:

- Sensory Memory
- Short-Term Memory
- Long-Term Memory

These stages were first proposed by Richard Atkinson and Richard Shiffrin (1968). Their model of human memory, called Atkinson-Shiffrin (A-S), is based on the belief that we process memories in the same way that a computer processes information.

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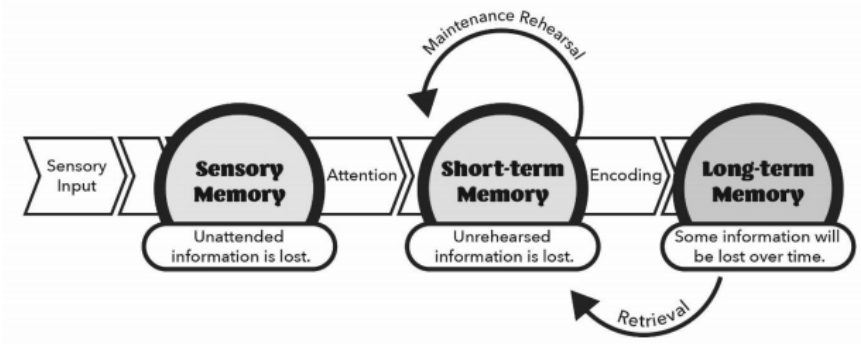


According to the Atkinson-Shiffrin model of memory, information passes through three distinct stages in order for it to be stored in long-term memory.

4.13 THE ROLE OF IMAGERY

Imagery is simply the formation of any mental pictures. This simple process has great benefit when it comes to memory. By using imagery, we can enhance the processing of information into the memory system. For example, trying to remember a phone number by repeating it in your head is a common method, but what might enhance your processing of the information might be to use imagery - maybe visualize the numbers being written on a chalk board. This allows you to create a mental picture of the numbers that may be processed more completely.

4.14 THE ROLE OF CONSTRUCTIVE PROCESSES

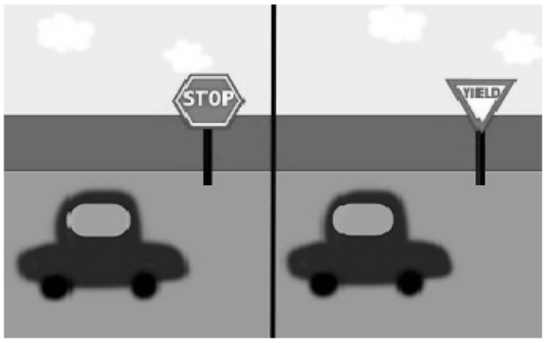
When we remember an event, is the memory an exact reproduction or is it altered by our current frame of reference? Here we'll discuss the constructive nature of memory and how the way we process information impacts decision making.

If Memory Serves Me

When you remember a distant event, is the memory colored by the things you've since experienced? Research has shown that memories are not always a literal reproduction of actual events. Think about the differences in courtroom testimony between two witnesses: what is the reality? The concept of constructive memory holds that we use a variety of information (perceptions, beliefs, attitudes, etc.) to fill in gaps, and that the accuracy of our memory may be altered.

Distortions of memory through various means can also alter our recollection of events. The misinformation effect says that we can use newly acquired information (valid or not) to reconstruct our memory, such as a police detective's leading questions influencing an eyewitness's testimony.

Hindsight bias is the tendency to look at the past through our present perceptions: ''He was probably cheating back then too, we just didn't know it.'' There's also the overconfidence effect where people give themselves credit for a better memory than they actually have.



If a policeman remembers something different than you, would you question yourself?

Recall and Decision Making

How we remember events can influence our present ability to generalize and make abstractions. Studies have shown there is an overlap between our brains processes for remembering events and imagining future ones. This means that sometimes memories and imagination can be confused. Imagination inflation speaks to how imagining an event can lead to a false memory of its occurrence.

Our episodic memories (memories of events) are used to make informed decisions and relied on in times of risk. So if those memories of events are colored or distorted in some way, it can directly affect the decisions we make today. Studies have also shown that simulating future events in our minds (call it visualization) can increase prospective memory, which is the probability of carrying out intended actions in the future.

So if visualization (a specific anticipated situation) leads to a higher probability of carrying out a future action, it stands to reason it would also benefit goal setting (science calls it implementation intentions). In less lofty terms, imagining success in specific terms has real benefits.

4.15 RETRIEVAL FROM LONG-TERM MEMORY

Once the information has been encoded and stored in memory, it must be retrieved in order to be used. Memory retrieval is important in virtually every aspect of daily life, from remembering where you parked your car to learning new skills.

There are many factors that can influence how memories are retrieved from long-term memory. Obviously, this process is not always perfect. In order to fully understand this process, it is important to learn more about exactly what retrieval is as well as the many factors that can impact how memories are retrieved.

Memory Retrieval Basics

So, what exactly is retrieval? Simply put, it is a process of accessing stored memories. When you are taking an exam, you need to be able to retrieve learned information from your memory in order to answer the test questions.

There are four basic ways in which information can be pulled from long-term memory. The type of retrieval cues that are available can have an impact on how information is

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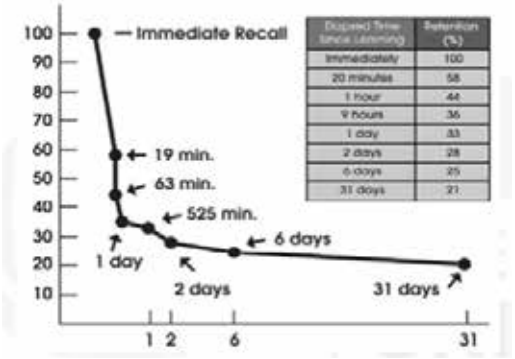
retrieved. A retrieval cue is a clue or prompt that is used to trigger the retrieval of long-term memory.

- **Recall:** This type of memory retrieval involves being able to access the information without being cued. Answering a question on a fill-in-the-blank test is a good example of recall.
- **Recollection:** This type of memory retrieval involves reconstructing memory, often utilizing logical structures, partial memories, narratives or clues. For example, writing an answer on an essay exam often involves remembering bits of information and then restructuring the remaining information based on these partial memories.
- **Recognition:** This type of memory retrieval involves identifying information after experiencing it again. For example, taking a multiple-choice quiz requires that you recognize the correct answer out of a group of available answers.
- **Relearning:** This type of memory retrieval involves relearning information that has been previously learned. This often makes it easier to remember and retrieve information in the future and can improve the strength of memories.

4.16 FORGETTING

Why do we tend to forget the names of the people we just met? Or why do we forget the phone number we just dialed few minutes ago? We all have experienced forgetting in one's day-to-day life, but what are the causes behind it? Psychologists have defined forgetting as our inability to recall already encoded and stored information from our memory system. To understand the nature of forgetting, Hermann Ebbinghaus, a German psychologist (discussed in the first section), conducted the first systematic experiment in 1879. He created many CVC (constant vowel constant) nonsense syllabuses such as NAK or PUD and administered them to himself (The method of conducting experiments on one self only and using your own experience is known as the introspective method).

To investigate the nature of memory and forgetting, first, he memorized lists of nonsense syllabi until he had reached a pre-defined criterion and then measured the number of syllables retained by him after the variable time intervals. Further, he also noted the number of trials taken by him to relearn the same list of syllables again at a variable time interval. Based on his observations, he came up with the following curve for explaining the nature of forgetting;



This curve is famously known as the Ebbinghaus forgetting curve. You can see from the graph that the rate of forgetting is the maximum in the starting but after a few hours, it becomes slow. Recent studies have reported similar results. The main theories available in the literature, explaining the causes of forgetting are as follows:

a. Theory of Interference

According to this theory, forgetting occurs due to interference with other memories. This interference can be of two types: Proactive Interference (Pro-forward) - Forgetting of newly acquired information due to interference from previously learned information. Retroactive Interference (Retro-backward) - Forgetting previously stored information due to learning new information. The experiments of both types may be conducted in the following manner:

Retro-active inhibition

Groups	Original Learning	Interpolated Activity	Recall
Control	Learning of list A of 10 Nonsense syllables	Rest for 5 minutes	List A
Experimental	Learning of List B of 10 Nonsense syllables	Learning of list C of 10 Nonsense syllables for 5 minutes	List B

Pro-active inhibition

Groups	Original Learning	Interpolated Activity	Recall
Control	Learning of list A of 10 Nonsense syllables	Rest for 5 minutes	List A
Experimental	Learning of List B of 10 Nonsense syllables	Learning of list C of 10 Nonsense syllables	List C

b. Trace Decay Theory

It is an older theory, also known as the disuse theory. Trace decay theory proposes that learning causes change in the central nervous system leading to the formation of memory traces or physical changes in the brain due to learning (Brown, 1958). When these memory traces are not used for a long time, they fade away leading to forgetting. Thus, the underlying mechanism of this theory is "use it or lose it", i.e., if you do not use your stored information at a regular interval of time, then you may be at the risk of losing it.

c. Cue Dependent Forgetting Theory

According to this theory, forgetting can also occur due to the absence of an appropriate cue or the presence poor cue. Suppose you were given a list of objects to buy from the market. By mistake, you lost the list. Now, you are trying your best to recall all the items from the list, but there are good chances that you will

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forget many. Studies have suggested that if participants were given a hint or clue about the category of those items, then it improved their recall. Studies have even suggested that the physical attributes of the environment also play a positive role in retrieval.

d. Encoding failure

As discussed in the earlier section, encoding is an important process in memory. There are many events or objects that are not encoded properly and do not go beyond sensory memory. Thus, it results in failure to process information to memory. Encoding failure is also one of the reasons why people forget things.

4.17 MOTIVATED FORGETTING

Emotional factors also play an important role in forgetting. If we encode information while in one emotional state and try to recall it while in another, our recall suffers. Many lapses of memory in daily life illustrate motivated forgetting. We may forget the names of people we do not like. Repression theory holds that we forget because the retrieval of memories would be painful or unacceptable in some way to the person. Freud, in his book "The Psychopathology of Everyday Life" illustrated many examples of repression in forgetting. Repression includes retrieval failure for the associations of threatening, anxiety-provoking information.

Anxiety or guilt-producing material is more often forgotten than pleasant experiences. Supposing in a particular class you were scolded by the teacher, chances of forgetting what happened in that class would be higher. Psychologists have also found that some persons cannot forget unpleasant experiences easily, they have related this phenomenon to personality. Some stored information is so threatening and anxiety arousing that its retrieval is possible only under special circumstances like hypnosis, and free associations.

Zeigarnik, a Russian psychologist demonstrated through experiments that uncompleted tasks are remembered longer than the completed tasks. This is sometimes called the "Zeigarnik effect", "ego-oriented" persons remember more completed tasks as uncompleted tasks generate more anxiety. On the other hand, "task-oriented" persons remember more the uncompleted tasks, as for them, the incomplete task is more painful while completed tasks are not so. All these findings are related to the "tension theory" of Kurt Levin.

4.18 INTERFERENCE

According to this explanation, what we do in the interval between learning and recall, determines the course of forgetting. Experimental studies have shown that learning new things interferes with the memory of what is learned earlier and prior learning interferes with memory of things learned later.

Retroactive Inhibition

This is a technical name for new learning that may interfere with material previously learned. This has been demonstrated in experiments as follows:

GROUPS	ACTIVITY		
Experimental	Learn A	Learn B	Recall A
Control	Learn A	Unrelated Activity	Recall A

As an example, you may learn one chapter of physiology in activity I, then learn one chapter of Anatomy in activity and I, and then try to recall what you had learned in physiology. The amount of information you forget would be due to interference caused by learning anatomy.

Pro-active Inhibition

When prior learning interferes with the learning and recall of new material, it is called proactive inhibition. To demonstrate this type of interference experiment is designed as follows:

GROUPS	ACTIVITY		
Experimental	Learn A	Learn B	Recall B
Control	Rest or unrelated activity	Learn B	Recall B

Supposing you learn English, then French and recall French, you would find that study of English interferes with your recall of French. Here what you learned earlier, interferes with the subsequent memory. Even though lots of experiments have been conducted, the process of interference is not very clear, one idea is that the interferences disrupt the various kinds of associations between stimuli and responses formed.

Another idea is that interference has its greatest effect on the memory of retrieval cues. You have seen in the earlier section that memory depends on retrieval cues, so if interference results in problems with the use of these cues, forgetting will result. In both types of interference, it has been found that the effect of interference is less with meaningful material and after attaining some mastery in the subject.

4.19 THE DECAY THEORY OF FORGETTING

According to the trace theory of memory, physical and chemical changes in the brain results in a memory "trace." Information in short-term memory lasts several seconds and if it is not rehearsed, the neuro-chemical memory trace quickly fades. According to the trace decay theory of forgetting, the events that happen between the formation of a memory and the recall of the memory have no impact on recall.

The idea that memories fade over time is hardly new. The Greek philosopher Plato suggested such a thing more than 2,500 years ago. Later, experimental research by psychologists such as Ebbinghaus bolstered this theory.

One of the problems with this theory is that it is difficult to demonstrate that time alone is responsible for declines in recall. In real-world situations, many things happen between the formation of a memory and the recall of that information. A student who learns something in class, for example, might have hundreds of unique and individual experiences between learning that information and having to recall it on an exam.

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Was forgetting the date that the American Revolutionary War began due to the length of time between learning the date in your American History class and being tested on it? Or did the multitude of information acquired during that interval of time play a role? Testing this can be exceedingly difficult. It is nearly impossible to eliminate all the information that might have an influence on the creation of the memory and the recall of the memory.

Another problem with decay theory is it does not account for why some memories fade quickly while others linger. Novelty is one factor that plays a role. For example, you are more likely to remember your very first day of college than all of the intervening days between it and graduation. That first day was new and exciting, but all the following days probably seem quite similar to each other.

4.20 TECHNIQUES OF IMPROVING MEMORY

Techniques for improving memory include:

- **Mnemonics**
  With training practice and motivation memory can be improved. There are variety of mnemonics or memory tricks to remember things better. People with super memories sometimes use mnemonics, and we can also learn to do so. One of it is to associate link whatever you want to recall with something already established in your memory bank e.g. colours of rainbow are associated with name "Roy G. BIV" i.e. Red, Orange, Yellow, Green, Blue, Indigo and Violet.

- **Method of Loci**
  The Method of Loci says that you visualize a scene and fit the items to be remembered in that scene. The scene can be a street, a building with rooms, the layout of a college campus, a kitchen, or just about anything that can be visualized clearly and contains a number of discrete items in specific locations to serve as memory pegs. Supposing you want to remember for examination classical conditioning then start by imagining a dog, experimental room, food, bell and any person as an experimenter. Rehearse this image over and over until it is well established in your mind. After you have formed your image, associate the events like stimulus substitution, extinction with this. The trick is to make associations with as many concepts as needed.

- **Rhyming**
  Like the method of loci, number and letter-peg systems is to establish, main idea in your long-term memory, a well-organized set of images to which the to-be-remembered items can be linked. In number systems, you form an image with each number. For instance, a rhyming system can be used for the numbers I through 10. For letter systems you can establish mnemonic pegs by forming strong distinctive images of words that start with the sounds of the letter of the alphabet.

- **Make a Story**
  You can make a story and in that you can fit the facts, like you read in elaborative rehearsal. The important thing for good memory is your motivation and ability to organize the material. One strategy in remembering things well is to organize, or arrange, the input so that it fits into existing long term memory categories, is grouped in some logical manner, or is arranged in some other way that makes sense. The organizational encoding may be inherent in the input itself or it may be supplied by individuals as they learn and remember new things.

- **Chunking**
  This mnemonic technique illustrates systematic ways of encoding information. If you want to remember a long list of digits, e.g., 19891609065 you can break the numbers into chunks, the first four digits could remember as the year you passed your school or associate with any significant thing that happened in that year. Next four digits could also be taken as date e.g., for some one's birthday. The next 3 digits are the last digits of SGVU address codes. Like this chunk can be associated with some important thing for lasting memory. Here are some tips to help you to improve your memory:

  1. Plan your study content and make a time schedule to cover that content. Stick to this schedule firmly.
  2. As you have seen rehearsal is important to transfer information into long term memory and elaborative rehearsal is more effective than maintenance rehearsal. So make notes of important points as all the details of information cannot be remembered. Revise these notes. You can use imagery to visualize the material you are learning and give auditory stimulation by reading aloud. For example, while studying nervous system, visualize the structure of nervous system with minute's details and also read loudly. Multi-channel stimulation would improve your memory.
  3. Try to organize your material with retrieval cues or reminders make a map of contents in your mind.
  4. Give feedback to yourself by testing your memory. Revise areas where you could not remember.
  5. Review before examination. Try to over-learn but do not 'get anxious as you have seen high anxiety level would interfere with your remembering.
  6. Give some short rest pauses between your study time. It would help to consolidate the material you are learning.

4.21 CHAPTER SUMMARY

Memory as ability to remember is a very important process for our learning. The memory process is divided into three main stages encoding, storage and retrieval. There are two types of memory short term memory, wherein information is stored for maximum 30 seconds and has limited capacity. In long term memory store, information is organized in semantic memory or in episodic memory. There are four main causes of forgetting: Interference due to similar material. Faulty encoding storage and retrieval. If the sensory registration or input of inform is faulty then memory will not be established. Similarly, each of these stages is important for good memory, Motivated forgetting, Amnesias which could be due to diseases of the brain or psychological, Memory could be improved with good planning, organization, review and feedback.

4.22 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **List the techniques of improving memory.**
2. **Explain cue dependent forgetting theory.**

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3. **What do you understand by motivated forgetting?**
4. **Explain retrieval from long term memory.**
5. **Define semantic and episodic memory.**

LONG ANSWER TYPE QUESTIONS

1. **Explain chunking in detail.**
2. **What is the role of constructive processes?**
3. **Discuss forgetting.**
4. **Describe Long term memory in detail.**
5. **Discuss information-processing model in detail.**

4.23 MULTIPLE CHOICE QUESTIONS

1. **What is the full form of TOT?**
   a. Tip-of-the-tongue
   b. Tip-of-the-teeth
   c. Top-of-the-tongue
   d. None of these

2. **The Method of _____ says that you visualize a scene and fit the items to be remembered in that scene.**
   a. Rhyming
   b. Loci
   c. Mnemonics
   d. None of these

3. **_____ is a type of memory retrieval involves being able to access the information without being cued.**
   a. Recollection
   b. Recognition
   c. Relearning
   d. Recall

4. **_____ is a type of memory retrieval involves reconstructing memory, often utilizing logical structures, partial memories, narratives or clues.**
   a. Recollection
   b. Recognition
   c. Relearning
   d. Recall

5. **_____ is simply the formation of any mental pictures.**
   a. Memory
   b. Relearning
   c. Imagery
   d. Mnemonics

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6. _____ seems to be very complex as it stores many different aspects of our experiences.

a. Sensory Memory
b. Short-Term Memory
c. Semantic Memory
d. Long-term memory

7. The _____ is the shortest-term element of memory.

a. Sensory Memory
b. Short-Term Memory
c. Semantic Memory
d. Long-term memory

8. _____ refers to locating and bringing the stored material information to one's awareness when required to complete a task.

a. Encoding
b. Storage
c. Retrieval
d. None of these

9. _____ is a type of memory retrieval involves relearning information that has been previously learned.

a. Recollection
b. Relearning
c. Recognition
d. Recall

10. When prior learning interferes with the learning and recall of new material, it is called _____.

a. Recollection
b. Relearning
c. Recognition
d. Proactive Inhibition

♦♦♦♦♦

UNIT V

INTELLIGENCE

STRUCTURE

NOTES

5.1 LEARNING OBJECTIVE

After completion of this unit, student will be able to:

- Understand intelligence.
- Learn about the theories of intelligence.
- Know about emotional intelligence.
- Would be able to describe fluid and crystallized intelligence.

5.2 INTRODUCTION

Man has constantly worried about individual disparities in skills since the dawn of civilization, but it was not until the third quarter of the nineteenth century that efforts could be made to appreciate its complicated nature. Intelligence is a broad phrase used by laypeople to describe the existence of attributes such as alertness, sharpness of thought, level of scholastic accomplishment, occupational standing, or attainment of eminence in a particular field of endeavour, and so on. In this unit we will deal with the nature and meaning of intelligence. We will also discuss some of the most important theoretical models of intelligence so as to understand its nature.

We will begin with some definitions to bring home the point that even among the psychologists there is a lack of unanimity about this term. We will also briefly outline a historical perspective on individual differences and human abilities. Following this there will be a discussion on the Spearman's two factor theory consisting of G and S factors, and a critical appraisal of the theory. We would also be dealing with Thurstone's theory of intelligence Gardner's Theory of Multiple Intelligences, Triarchic Theory of Intelligence, etc.

5.3 DEFINATION OF INTELLIGENCE

What Is Intelligence?

Despite substantial interest in the subject, there still isn't a consensus among experts about the components of intelligence or whether accurate measurements of intelligence are even possible. Although contemporary definitions of intelligence vary considerably, experts generally agree that intelligence involves mental abilities such as logic, reasoning, problem-solving, and planning. Specifically, current definitions tend to suggest that intelligence is the ability to:

- **Learn from experience**: The acquisition, retention, and use of knowledge is an important component of intelligence.
- **Recognize problems**: To use knowledge, people first must identify the problems it might address.
- **Solve problems**: People must then use what they have learned to come up with solutions to problems.

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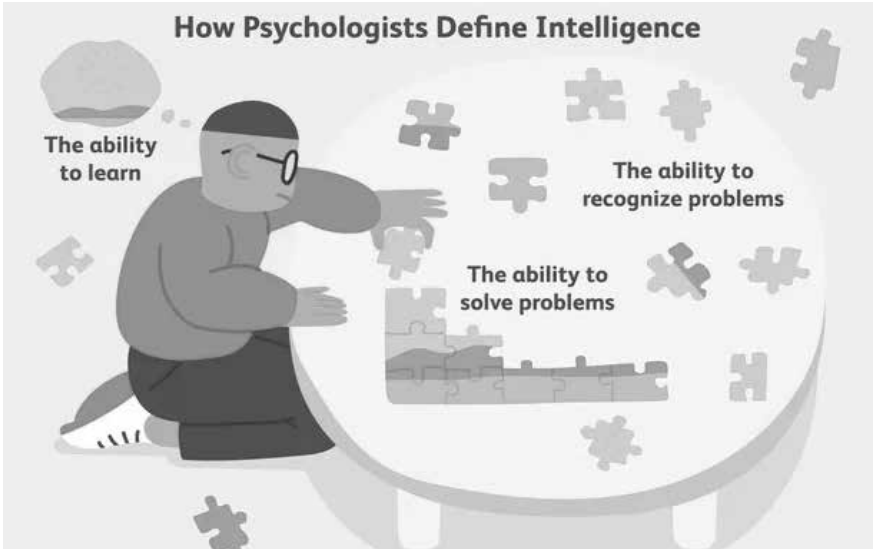

5.4 THEORIES OF INTELLIGENCE

Intelligence is one of the most talked-about subjects in psychology, but no standard definition exists. Some researchers have suggested that intelligence is a single, general ability. Other theories of intelligence hold that intelligence encompasses a range of aptitudes, skills, and talents. Research on intelligence plays a significant role in many areas including educational program funding, job applicant screening, and testing to identify children who need additional academic help.

History of Intelligence in Psychology

Given the intense interest in the concept of intelligence, some of the field's greatest minds have explored it from numerous angles. Following are some of the major theories of intelligence that have emerged in the last 100 years.

General Intelligence

British psychologist Charles Spearman (1863–1945) described the concept of general intelligence, or the "g factor." After using factor analysis to examine mental aptitude tests, Spearman concluded that scores on these tests were remarkably similar.

People who performed well on one cognitive test tended to perform well on other tests, while those who scored badly on one test tended to score badly on others. He concluded that intelligence is a general cognitive ability that researchers can measure and express numerically.

Primary Mental Abilities

Psychologist Louis L. Thurstone (1887–1955) focused on seven primary mental abilities rather than a single, general ability.These include:

- **Associative memory**: The ability to memorize and recall
- **Numerical ability**: The ability to solve mathematical problems
- **Perceptual speed**: The ability to see differences and similarities among objects

- **Reasoning**: The ability to find rules
- **Spatial visualization**: The ability to visualize relationships
- **Verbal comprehension**: The ability to define and understand words
- **Word fluency**: The ability to produce words rapidly

Multiple Intelligences

Among more recent ideas about intelligence is Howard Gardner's theory of multiple intelligences. He proposed that traditional IQ testing does not fully and accurately depict a person's abilities. He proposed eight different intelligences based on skills and abilities that are valued in various cultures:

- **Bodily-kinesthetic intelligence**: The ability to control body movements and handle objects skillfully
- **Interpersonal intelligence**: The capacity to detect and respond appropriately to the moods, motivations, and desires of others
- **Intrapersonal intelligence**: The capacity to be self-aware and in tune with inner feelings, values, beliefs, and thinking processes
- **Logical-mathematical intelligence**: The ability to think conceptually and abstractly, and to discern logical or numerical patterns
- **Musical intelligence**: The ability to produce and appreciate rhythm, pitch, and timbre
- **Naturalistic intelligence**: The ability to recognize and categorize animals, plants, and other objects in nature
- **Verbal-linguistic intelligence**: Well-developed verbal skills and sensitivity to the sounds, meanings, and rhythms of words
- **Visual-spatial intelligence**: The capacity to think in images and visualize accurately and abstractly

SPEARMAN'S TWO FACTOR THEORY OF INTELLIGENCE

Charles Spearman (1863-1945), an English psychologist and the originator of factor analysis was the first to claim that intelligence consists of general 'g' factor and specific's' factors. His theory is known as 'Two Factor Theory' (1904).One of his major contributions to the history of psychology is the development and use of 'factor analyses. He used the techniques of factor analysis and co relational analysis to find out the 'g' and's' factor. Factor analysis involves finding out the correlation of related variables, and then grouping the variables to form clusters and derive the underlying factors. Thus a larger number of variables are reduced to a lesser number of factors. In his book, 'The Abilities of Man' (1927), Spearman elaborated that all intellectual activities share a single common factor that runs through all the activities a person performs during his life.

Spearman called this general factor as 'mental energy' which is determined innately. A person cannot be trained to have a higher 'g'factor. It is a part of who they are. People possess general intelligence or 'g' in varying degrees. On the basis of this general

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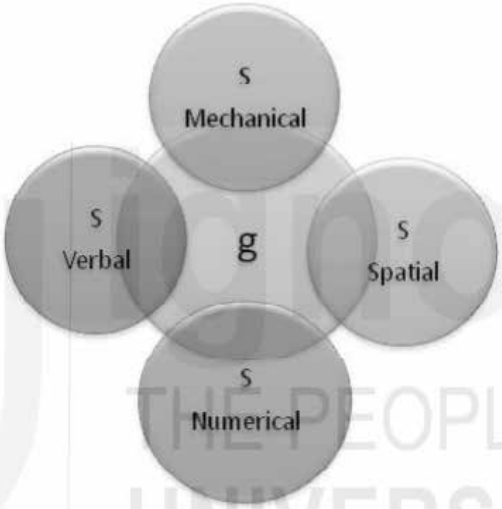
intelligence, we describe a person as either intelligent or dull. This 'g' is the major determinant of one's score in any intelligence test. In addition to this general or 'g' factor, he recognized the specific factors, each called's', which are specific to different abilities. For example, test of arithmetic, spatial relationships, verbal fluency, each of these specific intelligence measure a separate's'. An individual's intelligence score reflects the amount of 'g' plus the magnitude of various's' factors possessed by the individual. For example, one's performance in spatial intelligence test would be a function of a person's general intelligence (g) and his spatial ability (s).

Spearman statistically analyzed the interrelation among various scores obtained by different individuals on various tests. A positive correlation between any two test or mental function implies a factor common to both or 'g' and two specific factors 's'. Let us assume that, the two tests are M (mechanical) and N (numerical), the common factor in these tests is 'g' and the specific factors are sM and sN. Similarly, let V (verbal) and S (spatial) be two other tests with 'g' as the common factor and sV and sS are the specific factors as shown in Figure below (In the Figure 4aF, g refers to 'general ability' and s refers to 'Specific abilities'). Spearman's theory states that the objective of psychological tests should be to measure individual's 'g'as it runs through all the abilities and predicts individual's performance. Individuals differ on the basis of 'g' they possess.



'g' and 's' factors of Spearman's Two Factor Theory

Spearman has often been criticized for his factor analytic approach to intelligence which was purely psychometric and ignored the cognitive basis of intelligence. Louis Thurstone (1935) objected to Spearman's emphasis on general intelligence. He suggested that intelligence can be divided into a number of primary abilities by using factor analysis. However, the contribution of Spearman to the field of psychology remains valuable as his model of two factor theory introduced factor analysis in psychology.

THURSTONE'S THEORY OF INTELLIGENCE

Louis Leon Thurstone (May 29, 1887 – September 30, 1955) proposed that intelligence is a synthesis of seven separate fundamental mental talents. His method was distinct from

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Spearman's general intelligence theory. Rather than focusing on a single aspect of general intelligence, as Spearman proposed, Thurstone (1935) asserted that intelligence is made up of a number of main mental talents. He appreciates the variety of human capacities. He created a new factor model of intelligence using improved statistical approaches. He found seven criteria by analyzing the inter-correlation of the scores of 57 tests on a broad sample of people. These were referred to as primary mental abilities, or PMA. The following are examples:

Inductive Reasoning: The ability to discover rules or to reason logically. It is the ability to deduce general laws and principles from given data.

Memory: The ability to memorize and recall. It is the ability to memorize events, list of words, mathematical formulas, dates, definitions etc. z Numerical Ability: The ability to solve arithmetic problems. It is the ability to use numbers with speed and accuracy, to compute answers to mathematical problems. It measures the speed and accuracy of computational skills.

Perceptual Speed: The ability to visualize details rapidly. It is the ability to perceive or grasp perceptual details quickly and accurately, to see differences and similarities among things.

Spatial Relations: The ability to understand relationship. The ability to visualize and manipulate different geometric patterns, forms and imaginary objects in space.

Verbal Comprehension: The ability of reading comprehension; define and understand words, concepts, ideas; verbal reasoning

Word Fluency: The ability to produce words rapidly, i.e., to use words quickly and fluently in performing tasks like naming word, rhyming, solving cross word puzzles.

Thurstone regards each of these mental talents as distinct from the others. Each of them can be evaluated independently, and there is no such thing as a single intelligence score. Instead of a single IQ score, he recommends a cognitive ability profile for the individual.

GARDNER'S THEORY OF MULTIPLE INTELLIGENCES

The theory of multiple intelligences was presented by Howard Gardner (1983), an American Psychologist. He stated in his book 'Frames of Mind' that he did not believe there was "one style of cognition that cut through all human thought." There are various intelligences with autonomous intelligence capabilities." As a result, intelligence cannot be considered as a single entity. There are various sorts of intelligence that are distinct from one another. People may also have different mixtures of these intelligences.

According to Gardner (1999), intelligence is much more than IQ as high IQ in the absence of productivity does not equate to intelligence. Gardner initially proposed eight types of intelligence which later on the increased to nine. Thus Gardner views each individual as a unique combination of various intelligences, hence we cannot say that one is more intelligent and another is less intelligent. Each one of us is talented in unique ways. The utility and value of each type of intelligence is culturally determined in the sense that individual's intelligent performance is determined according to the high desirability,

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usefulness and demands of society for particular types of intelligence. For instance, one type of intelligence highly valued in a particular society may be of little significance in another.

Let us briefly discuss the nine types of intelligence as given by Gardner.

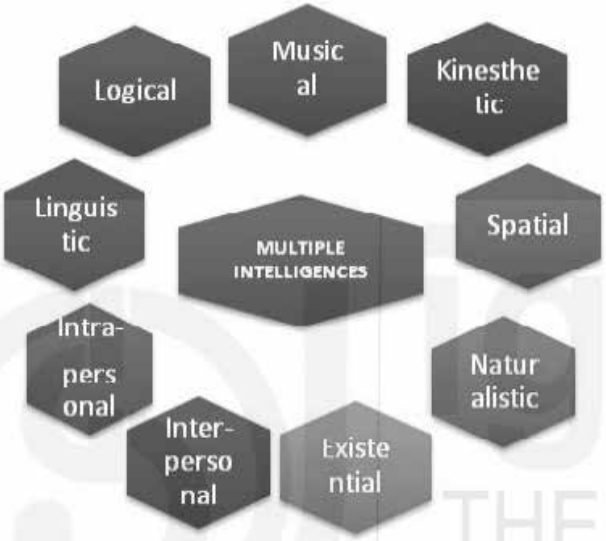

Figure 4cF: Gardner's Theory of Multiple Intelligences

Linguistic Intelligence refers to the ability to use language. It is the capacity to use spoken and written words in a skilled way. Individuals with high verbal/linguistic intelligence are very good in using words and language to express themselves, articulate things and create. They can use language fluently and flexibly and creatively. They can learn various languages easily. Poets, writers, lawyers, journalists, teachers, politicians, philosophers and speakers are very strong in this component of intelligence. Robert Frost, William Wordsworth, William Shakespeare, Gulzar, R.K. Narayan, Chetan Bhagat are some people high on linguistic intelligence.

Logical-mathematical Intelligence is the ability to use logical reasoning and mathematical ability. Individuals high on this intelligence have good abstract reasoning, critical thinking, and good in dealing with numbers. This type of intelligence correlates well with the traditional notion of intelligence. Scientists, engineers, physicist, economists are people with high logical-mathematical intelligence. They are good in mathematics, calculations, numbers and computer programming. Albert Einstein, Archimedes, C.V. Raman and Amartya Sen are examples of people high in this area of intelligence.

Musical Intelligence is the ability to use rhythms, sounds and patterns to create, compose and perform music. It involves sensitivity to music, and the ability to recognize and manipulate musical patterns. People with high musical intelligence are likely to be singers, music composers, instrumentalists and musicians. Yehudi Menhuin, Ludwig van Beethoven, Michael Jackson, W.A. Mozart, M.S. Subhalaxmi, Lata Mangeshkar, R.D. Burman, Zakir Hussain are some examples of people with high musical intelligence.

Bodily-kinesthetic Intelligence is the ability to use and control one's body movements and actions. Dancers and sports persons are usually high in such intelligence. Further, it is also required in surgery and crafts making as it involves skills and dexterity for fine motor movements. People with high bodily-kinesthetic intelligence can become good athletes, actors, sports persons, acrobats, yoga practitioners, surgeons, police officers and soldiers. Cricketers like Bradman, Tendulkar, dancer Pt. Birju Maharaj, Sonal Mansingh, Sanjukta Panigrahi, Madhuri Dixit, Rekha, acrobat Rosa Maria Ritcher, Olympic medallist P.T. Usha, Vijendra Singh demonstrate high bodily-kinaesthetic intelligence.

Spatial Intelligence is the capacity to perceive, understand and use spatial and visual information effectively. Such people are good in spatial orientation, forming visual images and patterns. They can easily visualize the world with the mind's eye, modify the surrounding based upon their perception and recreate aspects of their visual experiences. They are good at remembering images, figures, faces, fine details and visualize things from different angles. People with high visual/spatial intelligence are likely to be architects, painters, interior designers, surgeons, pilots, drivers and sailors. M. F. Husain, Amrita Sher-gil, Michael Angelo, Leonardo da Vinci and I.M. Pei are examples of some people with good spatial intelligence.

Interpersonal Intelligence refers to the ability to understand others and social interactions. They can understand the emotions and the perspectives of others and relate well to others. They are able to establish good interpersonal relationships with others. They have good and effective communication skills. They also show sensitivity and empathic understanding towards others. People with high interpersonal intelligence tend to be social workers, managers, psychologists, nurses, counsellors, politicians, leaders, teachers, reformers and spiritual gurus. Some examples of such people are Mother Teresa, Mahatma Gandhi, Sarvepalli Radhakrishnan, Raja Rammohun Roy, Sri Sri Ravi Shankar and Mata Amritan and amayee.

Intrapersonal Intelligence is the ability to understand oneself and know one's thoughts, emotions, feelings, motives and desires, and how these influence their behaviour. It includes awareness about one's strengths, limitations, goals and ambitions in life. Such intelligence includes one's introspective and self-reflective capacities. Such people are usually introverted, intuitive type, love to work alone and are least affected by any external events. Various people-oriented careers require intrapersonal intelligence, e.g., psychologists and spiritual leaders like Swami Vivekananda, Ramakrishna Paramahansa and Sri Aurobindo. Philosophers and writers also have strong intrapersonal intelligence.

Naturalistic Intelligence is the ability to recognize and understand the various patterns in nature. It includes sensitivity to the nature with all its features including flora, fauna and all the biodiversity. Gardner has added this eighth type of intelligence to his original seven intelligences. Such people appreciate the beauty of nature and the subtle aspects of nature. Hunters, farmers, bird watchers, botanists, biologists, tourists and gardener are high in this aspect of intelligence. Charles Darwin, a naturalist and best known for his contribution to the science of evolution with his book 'On the Origin of Species' is an example of a person with high naturalistic intelligence.

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Existential Intelligence Gardner (1998) added existential intelligence as the ninth intelligence which refers to the sensitivity and capacity to tackle deep questions beyond sensory data and about human existence such as meaning of one's life, why have we come to this world, why do we die, where do we go after death etc. It concerns the 'big picture' in life and the ultimate truth of life. Cosmologists and philosophers are high on this aspect of intelligence.

According to Gardner, each of these "intelligences" has a specific set of observable and measurable abilities. The first two abilities, i.e., linguistic and logical-mathematical intelligence, strongly contribute to the performance in traditional school system and in the academic achievement; usually promoted more in our societies. The next three intelligences, namely, bodily-kinaesthetic, musical and spatial intelligence are usually associated with arts and is high among people like singers, musicians, dancers, athletes, architects, designers, actors and others who make the world beautiful with these capacities and skills.

Our traditional school system usually ignores these intelligences, and thus many children high on these capacities do not get enough scope to pursue their interest. Gardner's theory suggests that equal focus should be given to other intelligences and for optimal use of one's potentials. His theory is applied in an experimental program called project spectrum spanning from 1984 – 1993 by Gardner which aims at developing a comprehensive educational system where the elementary school children get an opportunity to explore their strengths and weaknesses by being assigned into different sections of specific intelligences.

TRIARCHIC THEORY OF INTELLIGENCE

Robert Jeffrey Sternberg (born December 8, 1949), is an American psychologist and psychometrician. He received his B.A. degree from the Yale University and Ph.D. from the Stanford University under the supervision of Gordon Bower. He was Provost at Oklahoma State University. He was formerly the Dean of Arts and Sciences at Tufts University, IBM Professor of Psychology and Education at Yale University and the President of American Psychological Association. He holds ten honorary doctorates from one North American, one South American, and eight European universities, and additionally holds an honorary professorate at the University of Heidelberg in Germany. He is also a Distinguished Associate of The Psychometrics Centre at the University of Cambridge.

The triarchic theory of intelligence developed by Sternberg is "a comprehensive theory, because it takes into account social and contextual factors apart from human abilities" (Li, 1996). Sternberg (1985) felt that the theories that preceded him were not incorrect, but rather, incomplete. Consequently, his theory, like Gardner's, takes into account creative or musical intelligence. But as for the other six intelligences from Gardner's theory, Sternberg classified them into two different types of intelligences: analytic (or academic) and practical. These two types of intelligence differ and are defined as follows:

Analytic problems tend to have been formulated by other people, be clearly defined, come with all information needed to solve them, have only a single right answer, which

can be reached by only a single method, be disembodied from ordinary experience, and have little or no intrinsic interest.

Practical problems tend to require problem recognition and formulation, be poorly defined, require information seeking, have various acceptable solutions, be embedded in and require prior everyday experience, and require motivation and personal involvement. If an individual could solve one or the other of these types of problems well, then that individual would have a high analytic or practical intelligence, respectively. Also, there exist virtuosos, or individuals who are extremely talented in the fine arts, these people would have a high creative intelligence.

Sternberg's triarchic theory includes three facets or sub-theories:

a. The componential sub-theory which outlines the structures and mechanisms that underlie intelligent behavior categorized as meta-cognitive, performance, or knowledge acquisition components.

b. The experiential sub-theory that proposes intelligent behaviour be interpreted along a continuum of experience from novel to highly familiar tasks/situations.

c. The contextual sub-theory which specifies that intelligent behaviour be defined by the socio-cultural context in which it takes place and involves adaptation to the environment, selection of better environments, and shaping of the present environment.

According to Sternberg, a complete explanation of intelligence entails the interaction of these three sub-theories. The componential sub-theory specifies the potential set of mental processes that underlies behaviour (i.e., how the behaviour is generated) while the contextual sub-theory relates intelligence to the external world in terms of what behaviours are intelligent and where. The experiential sub-theory addresses the relationship between the behaviour in a given task/situation and the amount of experience of the individual in that task/situation.

Triarchic Theory

Componential Subtheory	Experiential Subtheory	Contextual Subtheory
Metacomponents	Novelty	Adaptation
Performance	Automation	Selection
Acquisition		Shaping
Acquisition		Shaping

5.5 EMOTIONAL INTELLIGENCE

What is Emotional Intelligence?

Emotional intelligence (EI) refers to the ability to perceive, control, and evaluate emotions. Some researchers suggest that emotional intelligence can be learned and strengthened, while others claim it's an inborn characteristic. The ability to express and

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control emotions is essential, but so is the ability to understand, interpret, and respond to the emotions of others. Imagine a world in which you could not understand when a friend was feeling sad or when a co-worker was angry. Psychologists refer to this ability as emotional intelligence, and some experts even suggest that it can be more important than IQ in your overall success in life.

How Emotional Intelligence Is Measured

A number of different assessments have emerged to measure levels of emotional intelligence. Such tests generally fall into one of two types: self-report tests and ability tests. Self-report tests are the most common because they are the easiest to administer and score. On such tests, respondents respond to questions or statements by rating their own behaviors. For example, on a statement such as "I often feel that I understand how others are feeling," a test-taker might describe the statement as disagree, somewhat disagree, agree, or strongly agree.

Ability tests, on the other hand, involve having people respond to situations and then assessing their skills. Such tests often require people to demonstrate their abilities, which are then rated by a third party. If you are taking an emotional intelligence test administered by a mental health professional, here are two measures that might be used:

- **Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)** is an ability-based test that measures the four branches of Mayer and Salovey's EI model. Test-takers perform tasks designed to assess their ability to perceive, identify, understand, and manage emotions.
- **Emotional and Social Competence Inventory (ESCI)** is based on an older instrument known as the Self-Assessment Questionnaire and involves having people who know the individual offer ratings of that person's abilities in several different emotional competencies. The test is designed to evaluate the social and emotional abilities that help distinguish people as strong leaders.

There are also plenty of more informal online resources, many of them free, to investigate your emotional intelligence.

Components

Researchers suggest that there are four different levels of emotional intelligence including emotional perception, the ability to reason using emotions, the ability to understand emotions, and the ability to manage emotions.

1. **Perceiving emotions**: The first step in understanding emotions is to perceive them accurately. In many cases, this might involve understanding nonverbal signals such as body language and facial expressions.
2. **Reasoning with emotions**: The next step involves using emotions to promote thinking and cognitive activity. Emotions help prioritize what we pay attention and react to; we respond emotionally to things that garner our attention.
3. **Understanding emotions**: The emotions that we perceive can carry a wide variety of meanings. If someone is expressing angry emotions, the observer must interpret the cause of the person's anger and what it could mean. For example, if your boss

is acting angry, it might mean that they are dissatisfied with your work, or it could be because they got a speeding ticket on their way to work that morning or that they've been fighting with their partner.

4. **Managing emotions**: The ability to manage emotions effectively is a crucial part of emotional intelligence and the highest level. Regulating emotions and responding appropriately as well as responding to the emotions of others are all important aspects of emotional management.

The four branches of this model are arranged by complexity with the more basic processes at the lower levels and the more advanced processes at the higher levels. For example, the lowest levels involve perceiving and expressing emotion, while higher levels require greater conscious involvement and involve regulating emotions.

Impact of Emotional Intelligence

Interest in teaching and learning social and emotional intelligence has grown in recent years. Social and emotional learning (SEL) programs have become a standard part of the curriculum for many schools. The goal of these initiatives is not only to improve health and well-being but also to help students succeed academically and prevent bullying. There are many examples of how emotional intelligence can play a role in daily life.

Thinking Before Reacting

Emotionally intelligent people know that emotions can be powerful, but also temporary. When a highly charged emotional event happens, such as becoming angry with a co-worker, the emotionally intelligent response would be to take some time before responding. This allows everyone to calm their emotions and think more rationally about all the factors surrounding the argument.

Greater Self-Awareness

Emotionally intelligent people are not only good at thinking about how other people might feel but they are also adept at understanding their own feelings. Self-awareness allows people to consider the many different factors that contribute to their emotions.

Empathy for Others

A large part of emotional intelligence is being able to think about and empathize with how other people are feeling. This often involves considering how you would respond if you were in the same situation. People who have strong emotional intelligence are able to consider the perspectives, experiences, and emotions of other people and use this information to explain why people behave the way that they do.

How to Use

Emotional intelligence can be used in many different ways in your daily life. Some different ways to practice emotional intelligence include:

- Being able to accept criticism and responsibility
- Being able to move on after making a mistake
- Being able to say no when you need to

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- Being able to share your feelings with others
- Being able to solve problems in ways that work for everyone
- Having empathy for other people
- Having great listening skills
- Knowing why you do the things you do
- Not being judgemental of others

Emotional intelligence is essential for good interpersonal communication. Some experts believe that this ability is more important in determining life success than IQ alone. Fortunately, there are things that you can do to strengthen your own social and emotional intelligence. Understanding emotions can be the key to better relationships, improved well-being, and stronger communication skills.

5.6 FLUID AND CRYSTALLIZED INTELLIGENCE

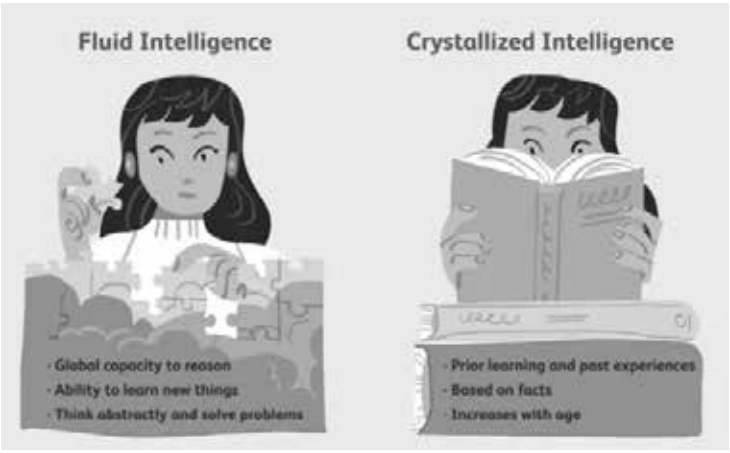
When you think about intelligence, what sort of things comes to mind? Intelligence is more than simply the accumulation of facts. It also encompasses the ability to learn new things. Psychologists have different definitions that they use to identify the various ways that we gain and use information.

Different Types of Intelligence

When you think of intelligence, you might think of having a lot of knowledge about different subjects. But you also might consider quick thinking and the ability to reason. Such factors represent what psychologists refer to as fluid intelligence and crystallized intelligence.

People often claim that their intelligence seems to decline as they age. However, research suggests that while fluid intelligence begins to decrease after adolescence, crystallized intelligence continues to increase throughout adulthood.

Psychologist Raymond Cattell first proposed the concepts of fluid and crystallized intelligence and further developed the theory with his student John Horn. The Cattell-Horn theory of fluid and crystallized intelligence suggests that intelligence is composed of different abilities that interact and work together to produce overall individual intelligence.



Fluid Intelligence

Cattell defined fluid intelligence as "the ability to perceive relationships independent of previous specific practice or instruction concerning those relationships."

Examples of the use of fluid intelligence include solving puzzles and coming up with problem-solving strategies. This aspect of intelligence involves the ability to solve problems and reason about things independent of previously existing knowledge. When you encounter an entirely new problem that cannot be solved with your existing knowledge, you must rely on fluid intelligence to solve it. Fluid intelligence tends to decline during late adulthood. Certain cognitive skills associated with fluid intelligence tend to decline as people reach later adulthood.

Crystallized Intelligence

Crystallized intelligence involves knowledge that comes from prior learning and past experiences. Situations that require crystallized intelligence include reading comprehension and vocabulary exams. As you might expect, this type of intelligence tends to increase with age. The more learning and experience you have, the more you build up your crystallized intelligence.

Differences and Interrelationship

Is one of these variables more essential than the others? In ordinary life, both intelligence factors are equally significant. For example, when taking a psychology exam, you may need to use fluid intelligence to devise a strategy to answer a statistics issue, but crystallized intelligence is required to recollect the exact formulas you must use. Both fluid intelligence and crystallized intelligence are components of what Cattell referred to as general intelligence. While fluid intelligence refers to our current ability to reason and deal with complex information around us, crystallized intelligence refers to lifelong learning, knowledge, and abilities.

That being said, fluid and crystallized intelligence are inextricably linked. When information is learned, crystallized intelligence is generated through the investment of fluid intelligence. By reasoning and thinking about problems with fluid intelligence, knowledge can be transferred to long-term memory and crystallized intelligence.

Changes in Intelligence

Fluid and crystallized intelligence evolve over time, with different mental talents peaking at different times. Fluid intelligence has traditionally been thought to peak in childhood, but new research published in 2015 reveals that some characteristics of fluid intelligence may peak as late as age 40. Crystallized intelligence does seem to peak later in life, around the age of 60 or 70. Some things to remember about fluid and crystallized intelligence:

- Both types of intelligence increase throughout childhood and adolescence.
- Crystallized intelligence continues to grow throughout adulthood.
- Many aspects of fluid intelligence peak in adolescence and begin to decline progressively beginning around age 30 or 40.

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5.7 CHAPTER SUMMARY

Intelligence has been regarded and conceptualized in a variety of ways, from a unitary concept to numerous intelligences. It has primarily been regarded as a de-contextualized entity involving logical reasoning, abstract reasoning, and problem-solving. Cross-cultural research has revealed cultural disparities in how intellectual ability is reflected. You've probably seen your neighborhood grocery store owner conduct simple math calculations even if he hasn't attended school. Similarly, rural and tribal cultures may not be as skilled with paper and pencil as their urban counterparts, but they may be skilled in oral or other forms of expression. As a result, there are cultural variances in how intelligence is conceptualized and expressed. The western culture values abstraction and generalization more than the eastern culture.

Intelligence is a concept that is so commonly referred by each one of us, but which is so difficult to define. There is a general agreement that thinking, reasoning, problem solving and decision making are all of relevance to intelligence. However, there is less agreement about the extent to which each component contributes to it. Much research on intelligence during the first half of the twentieth century was based upon the factor-analytic approach. This approach was pioneered by Spearman and his two-factor theory achieved the desired success in stimulating a whole host of researches in identifying the factors of intelligence.

Robert Jeffrey Sternberg (born December 8, 1949) is a psychologist and psychometrician from the United States. Sternberg's triarchic theory of intelligence is "a comprehensive theory, because it takes into consideration social and contextual aspects in addition to human capacities" (Li, 1996). Sternberg (1985) believed that previous theories were not erroneous, but rather incomplete. As a result, his theory, like Gardner's, considers creative or musical intelligence.

5.8 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **What is emotional intelligence?**
2. **What is intelligence? Briefly describe multiple intelligences.**
3. **What do you understand by fluid intelligence and crystallized intelligence?**
4. **How is emotional intelligence measured?**
5. **Define interpersonal intelligence and naturalistic intelligence.**

LONG ANSWER TYPE QUESTIONS

1. **Discuss different types of intelligence in detail.**
2. **Describe 'Triarchic Theory of Intelligence' in detail.**
3. **Elaborately discuss 'Gardner's Theory of Multiple Intelligences'.**
4. **Describe the different levels of emotional intelligences.**
5. **Explain 'Thurstone's Theory of Intelligence' in detail.**

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5.9 MULTIPLE CHOICE QUESTIONS

1. What is the full form of SEL?
- a. Social and Emotional Learning
- b. Spatial and Emotional Learning
- c. Social and Emotional Loci
- d. None of these

2. _____ refers to the ability to perceive, control, and evaluate emotions.
- a. Fluid Intelligence
- b. Emotional intelligence
- c. Crystallized Intelligence
- d. Musical Intelligence

3. _____ is the ability to recognize and understand the various patterns in nature.
- a. Naturalistic Intelligence
- b. Existential Intelligence
- c. Intrapersonal Intelligence
- d. Interpersonal Intelligence

4. _____ is the capacity to perceive, understand and use spatial and visual information effectively.
- a. Existential Intelligence
- b. Intrapersonal Intelligence
- c. Interpersonal Intelligence
- d. Spatial Intelligence

5. What is the full form of ESCI?
- a. Emotional and Spatial Competence Inventory
- b. Emotional and Social Competence Invention
- c. Emotional and Social Competence Inventory
- d. None of these

6. _____ is the ability to use rhythms, sounds and patterns to create, composes and performs music.
- a. Musical Intelligence
- b. Existential Intelligence
- c. Intrapersonal Intelligence
- d. Interpersonal Intelligence

7. What is the full form of PMA?
- a. Primary Musical Abilities
- b. Primary Mental Assessment
- c. Primary Mental Abilities
- d. None of these

NOTES 

8. Who proposed that intelligence is a synthesis of seven separate fundamental mental talents?

a. Louis Leon Thurstone
b. Robert Jeffrey Sternberg
c. Howard Gardner
d. Robert Jeffrey Sternberg

9. Psychologist _____ first proposed the concepts of fluid and crystallized intelligence.

a. Louis Leon Thurstone
b. Robert Jeffrey Sternberg
c. Howard Gardner
d. Raymond Cattell

10. The ability to see differences and similarities among objects is called _____.

a. Perceptual speed
b. Spatial visualization
c. Verbal comprehension
d. Numerical ability

♦♦♦♦♦

ANSWER KEY

UNIT I

QUESTION	ANSWER	QUESTION	ANSWER
1	b.	6	c.
2	a.	7	d.
3	c.	8	d.
4	c.	9	b.
5	a.	10	d.

UNIT II

QUESTION	ANSWER	QUESTION	ANSWER
1.	a	6.	c
2.	c	7.	d
3.	b	8.	a
4.	d	9.	b
5.	b	10.	d

UNIT III

QUESTION	ANSWER	QUESTION	ANSWER
1.	b	6.	c
2.	a	7.	a
3.	c	8.	b
4.	d	9.	c
5.	a	10.	b

UNIT IV

QUESTION	ANSWER	QUESTION	ANSWER
1	a.	6	d.
2	b.	7	a.
3	d.	8	c.
4	a.	9	b.
5	c.	10	d.

UNIT V

QUESTION	ANSWER	QUESTION	ANSWER
1	a.	6	a.
2	b.	7	c.
3	a.	8	a.
4	d.	9	d.
5	c.	10	a.

NOTE

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