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General Psychology

About The Author

Amit Abraham is Associate Professor and Head of the Postgraduate Department of Psychology at St. John's College, Agra. He is actively involved in various offbeat research works related to the human psyche and is also supervising various research works. His Ph.D. is in the area of personality as determined and influenced by the Zodiac signs of individuals. Dr Abraham did his schooling from St. Joseph's College, Nainital, and post-graduation in psychology from Delhi University. He has been the Coordinator of the National Commission for Minority Educational Institutions, New Delhi (under the Ministry of Human Resource Development, Government of India) for three consecutive terms (2005–2008). He is also the Recipient of the 'U.P. Shikshak Samman' for the year 2006 awarded by Bright Organization for Youth, Agra.

Dr Abraham has done extensive work on human sexuality and sexual attitudes. He has developed scales for the measurement of attitudes towards premarital sex, polygamy, pornography, lesbianism, and homosexuality as well as for the measurement of values and vocational interest. He has published various research papers and articles in diverse areas in magazines and newspapers and has also authored various books, which include textbooks, books for competitive examinations, books on general interest and self-help books. He is also associated with the local print and electronic media as a consultant psychologist.

Dr Abraham is also the Founder and Head of Samvaidna, a mental health welfare organization registered under the Societies Registration Act. This organization provides free guidance, counseling, and therapy for various psychological problems. He is also actively involved in offering psychological guidance and counseling through newspaper and magazine columns and also via the Internet.

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To
All my teachers
and
The teaching fraternity at large

PREFACE

It gives me immense pleasure in bringing forth this book on general psychology. However, the journey has been a challenging one. Though I have authored textbooks, books for competitive examinations and many other self-help books in the past, this book was an altogether new learning experience for me. I also need to mention at the outset that this book is not the outcome of my knowledge as much as my creative writing ability and experience in teaching graduate and postgraduate students and supervising research work.

With the advancement of technology, study material for students is available round the clock at the click of the mouse. However, the authenticity of the information provided is not always beyond doubt. Thus, even today the value of a book and the information provided through it hold strong ground.

The market is flooded with books on psychology and there are many available on introductory and general psychology, mostly authored by eminent psychologists from abroad. I hold these books and their authors in high esteem and acknowledge their contributions towards the cause of psychology. Their books are definitely the source of information for thousands of students studying psychology in India, and I too have consulted these books during my student days. These books are highly informative, condensed and illustrated; cover a wide range of topics, including the latest researches; and have a universal appeal. However, they lack the requirements of an Indian student—an examination-oriented approach. There is no Indian adaptation of these books, though South Asian editions are available. As a student of psychology, I always felt the need for a psychology book written specifically for Indian students. While pursuing my graduation, I consulted various books of foreign authors to prepare notes on different topics because one particular book was not sufficient for framing long answers. Keeping this in mind, I ventured into writing this book for the students who opt for psychology at the graduation level and even for those who take up psychology as an optional subject for various competitive examinations.

The approach to the subject matter presented in this book ascends from the basic information to its critical analysis. The critical analysis of the basic concepts is essential as it helps in stimulating the thought process

of the students and enables them to think divergently. This critical thinking is a must for the students of psychology as it empowers them to contribute in a much broader framework for the growth and development of psychology and its application to real-life situations.

The book comprehensively covers most of the syllabus prescribed by the major Indian universities. I have provided a rich theoretical base and included the latest theories related to the subject. The latest researches and developments have been mentioned wherever possible and all references have been provided for the same. Interesting research studies related to the topics discussed have also been provided in boxes. There are a number of illustrations to help the students diagrammatically understand the topic being discussed. Important information and tips are also given throughout the text. A detailed glossary and a list of references are provided at the end of the book.

Keeping in view the size of the book, I intentionally did not elaborate some of the very basic concepts. The introductory chapter is very extensive, covering a historical background to psychology, its scope, fields, application, schools, modern perspective, development of behavior, research methods and report writing. The chapter on Biological Foundation of Behavior (Chapter 2) has been kept very simple keeping in mind that most of the students of psychology do not have a science background. Some topics, such as attention, perception, states of consciousness, learning and memory, have been extensively discussed in the light of modern developments. The chapter on Intelligence (Chapter 11) contains the latest theories that have hardly found mention in any other textbook. The chapters on Motivation (Chapter 9) and Emotions (Chapter 10) have been presented in a unique manner with a lot of critical analysis. The chapter on Personality Theories (Chapter 12) has been presented in a very condensed manner and most of the theories have been covered. The chapter on Thinking and Language (Chapter 8) has been contributed by my learned friend, Professor (Dr.) Chavi Bhargava Sharma, and in my view this is one of the finest chapters of this book.

The information provided in this book is based upon my previous books, the numerous notes I prepared during my days as a student and the various research studies published in national and international journals with a high-impact factor. I have also taken pain to get the work checked, reviewed and critically analyzed by students, professional psychologists and my friends who are professors and associate professors of psychology at esteemed educational institutions. Their suggestions, comments and modifications have been duly honored and incorporated in the text.

Although we have taken the male gender in the book, one should read it as incidental and neutrality of gender is automatic, unless specifically mentioned.

A final word of advice to the students who are studying psychology at undergraduate or postgraduate level or those who have opted for psychology as an optional subject for competitive examinations: *Remember to always look up, aim high and work hard to achieve your goals and never forget to strengthen your foundations upon which will rest the colossal structure that you plan to erect. The foundation of psychology begins with its basics, taught mostly under general psychology at the graduation level. So, work hard and lay a solid foundation and see what a magnificent structure you will build for yourself.*

I wish the readers all the best in life and hope that they find this book rewarding. My ultimate reward lies in their success.

Amit Abraham

Acknowledgements

There are a lot of people behind the completion of this book and acknowledging their contribution will give me a feeling of accomplishment. All the knowledge I have imparted through this book is ultimately because of these people. I say so because we are not born learned but acquire knowledge through education and experience. My teachers, right from nursery to post-graduation, deserve my humble reverence and heartfelt gratitude for imparting knowledge to me. Whatever I have achieved in the academic sphere is because of their learned guidance and no amount of words will ever suffice to thank them.

The countless research studies and articles presented in this book have been taken from various research papers and journals and at a few places have been transcribed word for word as I did not feel like meddling with their clear and concise language. I would like to extend my heartfelt thanks to all those researchers upon whose works I have drawn. Their works have enabled me to include the latest researches in this book.

I wish to thank Dr. Chavi Bhargava Sharma for contributing the chapter on Thinking and Language and also for reviewing some of the chapters. Her suggestions, comments, criticism, and appreciation all together helped and guided me in improving upon the work.

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motivating as well as open to the suggestions from my end. Tata McGraw-Hill also needs to be thanked for procuring the resource material related to the researches undertaken in psychology in the last decade from McGraw-Hill, USA, and providing me with the same.

I need to thank my colleagues in the Department of Psychology at St. John's College, Agra, for their constant motivation and encouragement. Special thanks are due to Dr. Preeti Masih and Dr. Priyanka Masih for helping me draw out the chapter outline upon which I developed the chapters.

Last but not least, I wish to thank my wife, Dr. Lisy Abraham, and my daughter, Ms. Swarnim Abraham, who had to make a lot of sacrifices during the long periods of my writing work. Without their cooperation, I would not have been able to complete the book.

Amit Abraham

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INTRODUCTION

CHAPTER OBJECTIVES

After reading this chapter, you will learn

- Origin and the evolution of the discipline and various sub-disciplines of psychology and also the development of the discipline in India.
- Connection of psychology with other disciplines.
- Various approaches of studying psychology.
- Modern perspectives in psychology.
- Various research methodologies in the study of psychology, and application areas of each of these.
- Objective and process of writing research reports.

GODDESS PSYCHE: AN ANCIENT MYTH

In the myths of the ancient Greeks, Psyche was a mortal woman of rare loveliness and the admiration and attention she inspired in men detracted them from their worship of Venus, the goddess of beauty. Jealous over her loss of affection, the angry Venus dispatched her son, Cupid, to wreak vengeance upon Psyche. However, Cupid failed to complete his mission, for he too found Psyche extraordinarily attractive, and fell in love with her. Instead of punishing her, Cupid arranged a secret dwelling place where he visited her every night. His only command was that she must never try to look at him.

For a while, Psyche obeyed and was happy, but her jealous sisters, whom Cupid had reluctantly allowed to keep her company during the lonely daylight hours, aroused her curiosity. They suggested that her ardent lover was not a handsome god, but some ugly creature that hid his repulsiveness in the darkness. Unable to resist temptation, she looked at Cupid by candlelight while he slept. Although she was delighted with

what she saw, Psyche carelessly awakened her lover by spilling hot candle wax on him. Since she had disobeyed his command, Cupid left her.

Psyche despairingly set out to search for her godly lover, at last coming before Venus herself to plead for reunion with Cupid. The goddess set for Psyche a series of tasks and trials that seemed impossible to complete successfully, including a journey to the underworld to bring back a box of beauty from the queen of Hades. The tasks were too hard for a mortal to accomplish. Just when it seemed that Psyche was failing utterly, Cupid begged Jupiter to take a benevolent hand in the matter. Jupiter granted Psyche immortality and equal status with the gods, Cupid and Psyche were reunited forever, and the ancient story comes to a happy end.

Goddess Psyche

In the fifth century BC, the figure of Psyche came to personify for the Greeks as the human soul, a ghostly immortal substance within the individual. Later, the word 'psyche' came to mean not only soul but also mind—a spiritual entity within the person that perceives, thinks, wills and remembers. Mind, in turn, was equated with consciousness or awareness.

Today, the term *psychology* has lost the romance of its association with the myth of the immortal lovers. But still reflects, albeit often dimly, its early significance as the study of mind, soul or consciousness. The notion that he has a mind or psyche often implies to western man that the power of thought endows him with godlike status and enables him to transcend the limits of nature and mortality, as Psyche ultimately achieved equality with the gods and goddesses of ancient Greece.

ORIGIN OF PSYCHOLOGY

The roots of psychology go back thousands of years and reach into many areas of knowledge. Folkways, magic, religion, philosophy and science have all contributed to the origin of psychology. It is likely that every culture had its own psychology in order to postulate causes for certain human thoughts, action and events. However, the early history of psychology primarily is known to us through the writings of the Greek philosophers.

While speculating on the nature of the universe, the Greek philosophers of the sixth century BC were already discussing certain psychological problems as pointed out by **Esper** (1964). They were of the view that nature is animate. Matter, animals and men were thought to be alive because they moved. **Thales** (625 BC), for instance, allowed a magnet to be a soul because it moved iron. **Anaximander** (610–547 BC) proposed an evolutionary theory suggesting that life arose from sun-heated mud. He also thought that water was basic to all substance, because it was universal, appeared in many forms and produced movement when changing its aggregate state. **Heraclitus** (535–475 BC) considered fire as the primary force and 'soul-substance', because it moved and transformed matter. All matter were thought to be in constant state of flux, and only the orderliness in which change occurred presented constancy, rationality, or 'Logos'. **Heraclitus** believed that all knowledge must come through the senses, a notion that formed the basis for the psychological thinking of the British empiricist philosophers of the eighteenth century, and in turn the basis for present day methods of conditioning, reconditioning and behavior modification.

Democritus (460–370 BC) presented the first atomic view of the universe, when he said that matter, like humans, was composed of small, mobile atoms that entered the body to give it life or soul. Different parts of the body were thought to be formed by different types of atoms responsible for a variety of functions. He described the brain as the organ of thought, the heart as that of anger and the liver as that of disease. He did not distinguish sensing from thinking, since both were based on atomic motion (**Diels** 1934).

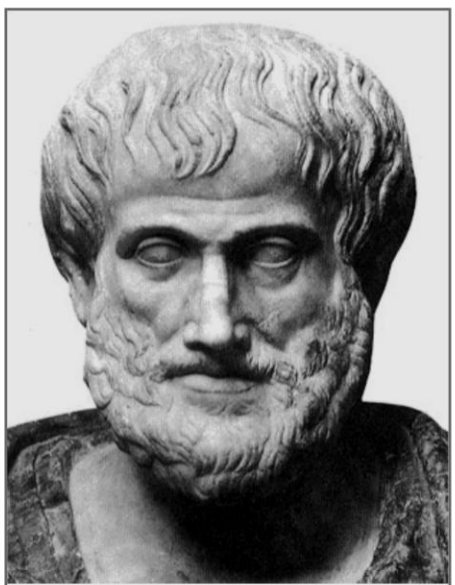
Not all pre-Socratic philosophers believed that mind and matter, or body and soul, had equal properties and were subject to the same natural law. Nor did they all agree on the reliability of the senses as indicators of reality. **Pythagoras** (582–500 BC) and his followers were fascinated by numbers, and explained many abstract concepts by them. The Pythagoreans did not consider the soul and the body as one entity, but postulated that the soul leaves the body after death to undergo a possible succession of reincarnations. This division of body and soul was elaborated by the Christian philosophers, who thus prepared psychology for the dualistic approach of mentalism and mechanism.

Protagoras (480–410 BC), an older contemporary of Plato, recognized the subjective value of the human senses and doubted their objectivity. He pointed out that sensations and perceptions differ between and within individuals, being subject to a constant flux of biological and social influences. Hence, his famous saying, 'Man is the measure of all things' (**Diels** 1934).

Anti-naturalism reached its peak with Plato. He thought the senses were unreliable, because one could perceive, for instance, triangles of all shapes and sizes and still maintain an idea of triangularity. It is, therefore, the idea, the form or the abstract thought, which yields true knowledge. Sense perceptions, Plato believed, yields only probabilities and approximations.

The Greek philosophers established two discrete philosophical approaches to psychology. One approach emphasized reason, logic, thought, theory, innate knowledge and a mind distinct from the body. The other approach emphasized observation, experimentation, environmental learning and unity of body and soul. Much of all future psychology has fallen into one of these two camps.

The views of **Aristotle** (384–322 BC), however, cannot be assigned to either camp. Aristotle was a theorist as well as an observer. **Watson** (1968) considers him to have been the first psychologist because he tried to present a systematic and integrated view of the function of the human mind. The many topics he wrote about are very similar to the titles of chapter headings in modern general psychology texts.



Aristotle

Unlike Plato, Aristotle thought that form could not be separated from matter, that a bronze statue, for instance, must have matter in order to have form and vice versa. This unifying concept is also present in Aristotle's view of the 'psyche', often interpreted as 'soul' or mind. Aristotle's soul includes matter as well as the functioning of the mind. Its development is based on evolutionary principles—on a vegetative soul attributed to plants, a sensory soul attributed to animals and a rational soul belonging to man. Aristotle's 'psyche' did not have any religious or supernatural properties.

Aristotle wrote about the five senses and postulated a sixth one necessary to combine the functions of any two or more senses. He thought that we must rely on the senses to make factual observations, but warned that empirical data, no matter how correct, are useless if interpreted with false logic or wrong

premises. He also warned that correct logic is misleading, if based on faulty observations. He thought knowledge was a combination of sense experience and thinking.

Many of Aristotle's hypotheses on the nature of remembering and forgetting have given rise to many experiments in the area of learning. His doctrine of association stated that the memory is facilitated by either similarity or dissimilarity of a present and past event, or by their close relationship in time and space. Later, these hypotheses were known as the law of similarity, contrast and contiguity.

Aristotle formed theories about desires, appetites, pain and pleasure, reactions and emotions. His doctrine of catharsis suggested, for instance, that fears could be transferred to the hero in a tragedy—an idea that much later formed one of the tenants of psychoanalysis and play therapy.

There was little inquiry into psychology during the early Christian period and during the middle ages. **St. Augustine's** (354–430) teachings were accepted for hundreds of years. He emphasized on the introspective method believing that 'self-knowledge', subjective reflecting upon one's own mind, is more exact than knowledge gained through sense perception. The main force of the mind or the 'self' was the power of the 'will', which in turn, was responsible for habits, actions and faith. Involuntary bodily functions, however, were not considered part of the 'self' and were to be neglected and ignored—an attitude, which has remained in Western culture where autonomic functions such as sex, and gastro-intestinal activities are still preferably conducted in privacy.

St. Thomas Aquinas (1225–74) accepted Augustine's concept of 'faith' and 'will' as well as Aristotle's 'reason'. In this union, Augustine's 'will' became subordinated to Aristotle's 'reason' and Aristotle's 'rational soul' became immortal and reviving. Aquinas also modified Aristotle's hierarchical concept of 'soul' or 'psyche'. He postulated that there was only one soul, but that this soul was composed of a rational faculty, which was non-physical and deathless, and of sensory and vegetative faculties that are physically dependent and perished with the body.

Aquinas's definitions of reason, mind, soul and body were not challenged until **Descartes** (1596–1650) introduced his dualistic concept of man. He held that the mind or soul is located in the brain, though it has no substance. The body, on the other hand, was thought to have substance or 'extended' qualities which like machines, followed mechanical laws. Descartes further believed that mind could influence the body and the body could influence the mind, and he attempted to describe the physiological mechanisms of this interaction. Descartes is often called the first modern psychologist because psychology would have remained speculative without the introduction and the recognition of physiological factors.

After Descartes' introduction of the concept of interaction, philosophers began to debate about the qualities and the quantities of the body's influence on the mind. They were primarily interested to know whether such mental qualities as knowing, thinking and ideation arise within the mind, or come to the mind via the body's senses. **John Locke** (1632–1704) took a radical environmental view. He maintained that the mind is a 'blank tablet' (*tabula rasa*) and that all knowledge must enter the mind through the senses, and that ideas are, in turn, combinations and reflections of sensory impressions. Locke and other British philosophers such as Hume, Hartley, the Mills and Bain, who held similar views, were known as the '*British empiricists'*. They were also called '*associationists'*, because they believed that Aristotle's principles of association play a major role in the selection, storage and composition of all mental content such as knowledge, thought, images and ideas.

Not all philosophers agreed with the empiricists. **Berkeley** (1685–1753) pointed out that the mind, as in case of depth perception, for instance, needs to process information from retinal size differences, clearness of the image, tension from certain eye muscles and so on—information or stimuli not directly related to depth perception. Berkeley argued that the ultimate reality lies in the mind and not in the matter found in the environment.

Psychology's major problem had been of 'body and soul'. The nineteenth century superimposed on it that of '*nativism* vs *empiricism'*, or that of heredity vs environment—a problem that still causes much discussion in the measurement and definitions of such psychological factors as temperament and intelligence.

The physiologists of the nineteenth century gave much to the philosophers who theorized about the content and function of the mind. **Pierre Flourens** (1794–1867) demonstrated that certain parts of the brain are directly responsible for certain behavioral functions. When he extirpated the cortex of a bird, for instance, he found that it could no longer fly 'voluntarily', but only if thrown into the air. **Paul Broca** (1824–1880) attempted to locate the brain area responsible for speech, and in 1870, **Fritsch** and **Hitzig** discovered the areas of the cerebral cortex related to motor functions.

The studies of sensory receptors, nerves and muscles also contributed much to the understanding of human feelings, thoughts and activities. **Helmholtz** showed in 1850 that neural conduction requires a specified time. **Sechenov** (1863) examined reflexes and found that some animals can perform 'purposive' acts by means of spinal reflex actions, which do not require the activity of the brain.

Physiology brought not only physiological data but also the scientific method in general to psychology, and scientists from non-physiological disciplines began to make important contributions. The physicist **Gustav Fechner** (1801–1887), who was also a medical doctor and a philosopher, spent much of his lifetime investigating the relationship between the objective, physical world and the subjective, personal one. He measured the physical energy needed to produce various intensities of sensations. Fechner's method was known as '*Psychophysics'*, and has found much use in apparatus design and human engineering.

The Dutch physician **F.C. Donders** (1862) attempted to measures mental activities through reaction-time experiments. To obtain a time measure for thought, he deducted the reaction time required for simple from that required for tasks that were more complicated.

Hermann Ebbinghaus (1850–1909) pioneered another scientific, but non-physiological method of exploring the mind. He investigated rates of learning and of forgetting, such as, for instance, the relationship between number of repetitions and length of memory. Ebbinghaus created and used the '*nonsense syllable'*. He theorized correctly that the use of meaningful words would interfere with objectivity in learning experiments.

In 1879, **Wilhelm Wundt** (1832–1920) at the University of Leipzig founded the first psychological laboratory. Wundt was trained in medicine, physiology and philosophy. Wundt tried to investigate the mind by studying its conscious content, and more specifically the elements of sensation, such as intensity, duration and locality. Wundt's preferred method was that of '*introspection'*, in which an individual describes his sensations and feelings in discrete, technical terms. Wundt's laboratory became the centre of psychological activities. Wundt's contributions to psychology are unique.

Unity in psychology was short-lived. Other psychological schools were soon to follow which emphasized different methods of studying the mind. **Oswald Kuple** (1862–1915) founded a psychological laboratory in Wurzburg in 1896. He and his students examined complex tasks such as thinking, remembering and judging. They used a molar type of introspection, believing that the Wundtian approach was too atomistic.

The '*gestalt'* psychologists again stressed the principle of 'wholeness'. In 1912, **Max Wertheimer** demonstrated that two stationary lights, lit in a certain succession, would give an observer the sensation of movement. Hence, Wertheimer and the gestalt psychologists maintain that the product, the experience, is not equal to the stimuli. The gestalt school has continued to oppose atomism and elementarism in psychological research, especially in the areas of sensation and learning.

In Russia, **Ivan P. Pavlov** (1849–1936) followed Sechenov's work in 'reflexology'. His work on the conditioned reflex has given many basic rules about the nature of learning, especially those that pertain to time relationship, generalization, discrimination, extension, reward, punishment etc. during the process of association between stimuli and response.

Certain psychological schools and systems that evolved around the turn of the century, differed not only in methodology, but also about the purpose of psychology itself. Influenced by the writings of **William James** (1842–1910), psychology in America became '*functionalistic*'. Its research methods as well as

PSYCHOLOGY NUGGET

A Short History of Psychology

Pre-scientific Psychology

Ancient Egypt First psychological experiment showed that early man was thinking about how the mind works. All thought came from the gods—no free will.
Ancient India Buddha attributes human thought to sensations and perceptions. Major themes have been around since the sixth century BC.
Ancient Greece Greeks developed a rudimentary understanding of human thought and behavior. *The contributions of some famous Greek Philosophers/Psychologists were as follows*:
Alcmaeon Sense organs send information to the brain for interpretation.
Democratis Vision.
Hippocrates Biological basis for personality and mental illness.
Plato Soul divided into three parts.
Aristotle Sensation, memory and imagination help to form perceptions of world.

Psychology in the Middle Ages

St. Augustine Mind/body connection. Three functions of the mind. Nature of memory.
St. Thomas Aquinas Origin of ideas. Emotions. Religion and Psychology.
Psychology in the Age of Reason (seventeenth and eighteenth centuries)
Rene Descartes (1596–1650) Mind/body influences each other. Voluntary and involuntary behavior. Two types of ideas: innate and derived.
John Locke (1632–1704) Knowledge acquired through observation. No innate ideas. Brain is *tabula rasa*.
Nineteenth Century Pre-scientific Psychology Phrenology, Physiogamy, Mesmerism, Mental Healing, Spiritualism.

Founders of Scientific Psychology

William Wundt (1832–1920) Founded first psychological research laboratory. Studied behavior by looking at senses. Used introspection.
Max Wertheimer (1880–1943) Founded gestalt psychology. Consciousness is different from parts of the brain. Research in perception, learning and thinking. Foundation for cognitive psychology.

Early Milestones

G. Stanley Hall Established first US psychology research lab (1883). Started first psychology journal (1887).
Herman Ebbinghaus Classic studies on memory (1885). Proved learning and memory could be studied using experimentation. Developed learning and forgetting curves.
Edward B. Titchener Founded structuralism. Studied experience from the point of view of the experiencing individual. Major questions. Introspection (Demonstration), Reductionism.
William James Founded functionalism. Critic of structuralism. Published 'Principles of Psychology' (1890).
Sigmund Freud Formed ideas about origin and treatment of mental illness. Unconscious mind fuels behavior. Pioneered free association.
American Psychological Association founded in 1892 Centred around scientific research. In the 70s, moved toward support for clinical specialization.
Margaret Floy Washburn First female psychology PhD (1894). Denied entrance to Columbia University. Major work in motor theory and animal behavior.

Mary Whiton Calkins First female president of APA (1905). Established psychology department at Wellesley. Denied PhD at Harvard. Major work on psychology of self.
Ivan Pavlov First to study conditioned reflexes. Founder of Behavioral perspective.
Alfred Skinner Schedules of Reinforcement. Positive/negative reinforcement.
John B. Watson Leader of Behaviorism. Only relevant study in psychology is behavior. Environmental determinism. Pioneered psychology in advertising.
Francis Cecil Sumner: First African American PhD Chair of Psychology Department at Howard University (1928–1954).
American Psychological Society: Founded in 1988. Focuses on scientific experimentation. Competes with APA.

purpose became broader. Data from animals, children and mental patients were admitted for research. Psychologists began to make practical recommendations for childcare, education, industry and living system in general.

John B. Watson (1878–1958), the behaviorist, used the *Pavlovian* method of conditioning to show that certain fears and desires of human infants can be conditioned by direct or indirect associations with physical pain or pleasures. Watson published experimental findings and provided practical advice on childcare.

There were other applied systems of psychology that contributed to great diversification. The historical roots of Freud's psychoanalysis can be found in Greek literature, in hypnosis and psychopathology. Freud's practical task, the care of neurotic and psychotic patients, produced his theories about the content and the function of the 'unconscious' mind.

Mental testing, a psychological area of the most widespread and practical influence, began with the work of **Francis Galton** (1869), who tabulated the accomplishments of famous men and their offspring. **Binet and Simon** (1905) developed the useful IQ test. In spite of revisions and modifications, the IQ tests, as used today, are essentially like the original ones designed by Binet and Simon.

Applied areas such as conditioning, psychoanalysis and mental testing have provided, perhaps as by-products, many psychological theories. In some areas, the theories may overshadow experimental verification. Some psychologists feel that their science has been 'oversold to an over willing public' (**Miller** 1962).

Much of psychology's histories have been written in retrospect. In many instances, the writers of psychological ideas did not show historical continuity. However, at present the history of psychology seems no longer neglected. In the sixties, there has been much renewed interest in its teaching and research. In India, a history course has been included in the basic psychology curriculum.

Advent of Psychology in India

Our history will not be complete without talking about the contribution of Indians in the growth and development of psychology as a separate branch, which once lived under the shadow of philosophy. Psychology not only emerged from Greek philosophical thought but was also a part of Indian philosophy. We find references of human behavior based on psychological principles of today in the various Indian scriptures. The West influenced the advent of psychology as a science, in India however most of the men behind it were Indians. Though, as history records, the first psychological laboratory was established at the University of Calcutta in 1916 yet a fact remains, though of dispute, that in 1914, a British professor Dr Duck established the first experimental laboratory in psychology at St. John's College, Agra, which was then affiliated to the University of Calcutta. This fact has not been recognized and recorded by historians since St. John's was a college and only the university department was taken into consideration for credit of the establishment of the first psychology laboratory in India. The contribution of Dr. Duck should find place in the history of psychology as far as India is concerned, irrespective of claims of being the first.

The establishment of a psychology laboratory did not free psychology from philosophy. In 1939 when Professor M.A. Hakim returned from the USA to St. John's College, Agra, he took the task of liberating psychology from philosophy and his efforts brought fruitful results. Under his able guardianship, an independent department of psychology was established at St. John's College, Agra. This was, with no dispute, the first independent psychology department to be established in northern India.

Indian psychology does not cover modern developments of psychology in India. It refers to the psychologically relevant materials in ancient Indian thought. In the beginning of the century, psychologists in India brought out Indian theories of sensation and perception from ancient texts and created an Indian psychology. This occurred at the beginning of the century and the focus of study was centered to sensation and perception. For example, Indian theories called attention to the notion that in perception the mind goes out through the senses and assumes the shape of the objects. In 1934, **Jadunath Sinha** wrote a book on Indian theories of perception. When the Western psychologists started studying *cognition*, Indian psychologists started looking for Indian theories of cognition. This development led to a new book on Cognition by Jadunath Sinha in 1958. Later on, modern psychology started emphasizing on emotions, and in 1981, Jadunath Sinha wrote a book on emotions and the will.

Humanistic psychology after 1960 emerged and psychologists became interested in paranormal dimensions of growth. Maslow's theory of *self-actualization* and *transcendental self-actualization* established the link to the major part of ancient Indian theories and methods. Almost the whole of ancient Indian writings became psychologically relevant. Ancient Indian scriptures (Hindu, Buddhist and Jain) emphasize on *self-realization*, *samadhi* or *nirvana*. *Psychology of Consciousness*, *Parapsychology, Psychology of Mysticism*, Psychology of Religion and *Transpersonal Psychology* borrow extensively from Indian writings. The terms *Oriental Psychology, Buddhist Psychology, Yoga Psychology, Jain Psychology,* etc. are found in modern psychological literature now. Many books in psychology now include writings on Yoga, Buddhism and Zen.

The basics of the theory of consciousness can be traced back to the Indus Valley civilization (6000 to 1500 BC). Artifacts of a man sitting in *Padmasana* have been obtained in excavations. The *Swasthika symbol* was used in Indus Valley script. Buddhist thought and methods (sixth century BC) are in line with the objective spirit of modern science and the *law of parsimony of science.* The Psychological relevance of the *four noble truths* and *eight-fold path* and *Sunyavada of Buddhism* and *Buddhist techniques of meditation* are of significant relevance in modern Psychology. Similarly, Jain scriptures are also found to be relevant to psychology in more than one way. The Vedas and the *Upanishads* (appendices to the Vedas, which date from 600 B.C.) describe the *Vedanta philosophy* and provide the theoretical foundation of *Jnana Yoga, which* are of more direct relevance to Psychology. *The Bhagavat Gita* gives an embodiment of Indian way of life and philosophy and it describes the four *yogas—Karma, Bhakthi, Raja* and *Jnana*. Numerous books have been written on the psychological importance of the *Gita*. Maslow's theory of *Meta-motivation* is comparable to the concept of *Nishkama karma* outlined in the *Gita*.

Both *Bhagavat Gita* and Patanjali's *Ashtanga Yoga* are supposed to have been written around the turn of B.C. to A.D. *Sankara's* writings (eighth century AD) are on the different yoga's. His *Advaita philosophy* is considered as classics in the area and is of great value to the *Psychology of consciousness*. Modern interest in relaxation can be traced to studies on *Savasana*. Mounting popularity of meditation practice links psychology to Oriental religious practices and philosophy. Indian literature on aspects of consciousness is vast. Mental states have been analysed and differentiated. Similarly, paranormal powers (*siddhis*) have been classified in detail. The processes of personal growth and obstacles to growth have been examined methodically. *Indian theories of linguistics*, social behavior, crime, etc. are all based on the holistic approach and the broad-based insightful understanding of behavior in contradiction to Western theories, which are piecemeal, analytic and situation-specific. The rising importance given to the holistic approach makes it possible to integrate modern Western psychology with ancient Indian thoughts as well as methods.

The psychosomatic relationship was well known in ancient times. The first invocatory stanza of *Ashtangahridaya* (the main text in *Ayurveda*, written in the fourth century AD) describes how emotions like desires lead to both physical and mental diseases.

Many attempts are being made to integrate ancient Indian psychology with modern Western psychology. More than 40 books have appeared in the field of Indian psychology. There is the *Journal of Indian Psychology* published from Andhra University, which has an Institute of Yoga and Consciousness. At least five psychologists have developed personality inventories based on the *Triguna theory* (*Satwa, Rajas* and *Tamas*) of *Kapila* (*Sankhya philosophy*, sixth century BC).

I conclude this section with a personal note by means of a tribute to these great Indian psychologists, most of whom have been my teachers, for having guided and steered the subject of psychology and bringing it on the international platform.

PSYCHOLOGY DEFINED

Psychology is at the center of our efforts to understand the behavior of all living things. Branching of from the mainstream of philosophy, it is interesting to note that literally the word 'psychology' means the 'science of the soul'. It is a combination of two Greek words '*Psyche'* which means soul and '*logas'* which means discourse. Psychology was, therefore, literally, a study of the soul as we saw while discussing its history.

With time, there was a gradual shift in the emphasis of its subject matter. The word 'soul' was replaced by 'mind' and later, by 'consciousness'. In 1890, **William James** defined psychology as the '*science of mental life'*. Thus, by this time psychology became an orderly, truthful and as far as possible a complete account of mental life.

With the advent of behaviorism, the favored definition became '*science of behavior'*. The scientific study of behavior includes for its subject matter behavioral processes that are observable as well as those that can only be inferred as thoughts and dreams. Psychology concerns itself with the study of human as well as animal behavior.

Today, the most acceptable definition of psychology is '*Psychology is the scientific study of all mental processes, as expressed in bodily behavior and as observed in direct experience'*. Thus, psychology is not only the study of an individual's physical reaction, which can be readily observed by another person, but also of his thoughts, feelings, attitudes, values and the like, which may not be always readily observable.

SCOPE OF PSYCHOLOGY

The scope or the field of psychology has an intimate relation with its accepted definition. If we define psychology as the science of conscious mental life, then our field will be limited only to directly known conscious experiences of human beings. If we limit our definition of psychology to the study of behavior, then it will also put restrictions on the scope. Taking psychology as the scientific study of all mental processes, as expressed in bodily behavior and as observed in direct experience, will help us in evaluating its scope.

The problem of the psychologist is to find out the various classes of mental processes; analyse them into the simple or elementary process and try to discover those rules, principles or laws, which can help him in understanding and explaining the origin, growth and development of the various mental experiences.

Further, since several mental processes are known only through the observation of bodily behavior, knowledge of the bodily mechanism will help us to understand the accompanying mental processes. Thus, it is also the duty of present day psychologists to try as far as possible to explain mental facts by reference to bodily changes, especially nervous changes.

As such, we find that the scope of psychology is broad and ever changing. The wide scope of psychology can be understood when we know the various fields that have developed within its fold. Our discussion regarding scope and problems will continue as we go on to examine the various fields of psychology.

Various Fields of Psychology

The various fields of psychology can be broadly classified as theoretical and applied. We will discuss them independently under separate headings (see Fig. 1.1).

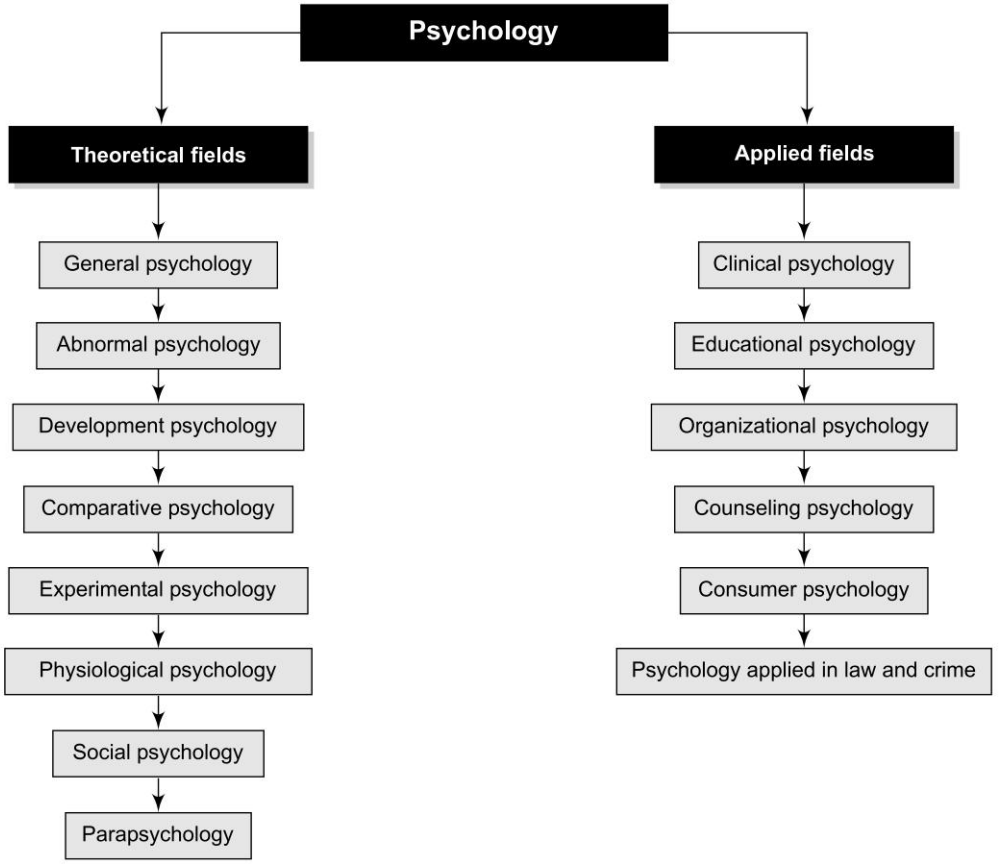


Fig. 1.1 Various Fields of Psychology

Theoretical Fields

We will first deal with general psychology.

General Psychology: In this field of psychology, the emphasis is on general principles as opposed to individual variations, species differences and sociocultural factors. The word '*General'* has been used to refer to principles underlying such **processes** as *learning*, *remembering* and *thinking*, and such **activities** as

attention, *motivation* and *emotion*. **Stern** (1921) comments 'the problems set by general psychology and by the psychology of the individual are quite different'. **Warren** (1958) defines general psychology as 'the branch of psychology which seeks to discover what is true to individuals in general rather than of one individual or class of individuals as distinct from others'. This definition of Warren is in terms of the goals or purposes of the investigator or writer concerned. **Drever** (1952) defines general psychology as concerned with general principles of mental life 'as distinct from peculiarities characteristic of the individuals'. Historically, general psychology has been associated with the method of experiment, in the strict sense of systematic manipulation of experimental variables.

General psychology is concerned with the description of three things: *behavior*, *experience* and *other people* in as far as, they are personal agents. At a less fundamental level, general psychology describes the social condition necessary for the birth of psychology.

Abnormal Psychology: Abnormal psychology is the study of *'abnormal behavior*' or *'abnormal personality*', i.e. '*abnormalities'* of sensory perception or psychomotor function of cognitive, motivational and other psychological function; abnormalities of personality including psychoses, neuroses, psychosomatic disorders, character disorders, mental deficiencies, etc.

As an objective science, abnormal psychology uses biological, physiological, behavioral, psychodynamic, sociocultural and other experimental and observational approaches to statistically unusual or deviant behavior. It is related to diagnostic and therapeutic psychiatry, clinical psychology and other scientific approaches to mental health, in which subjective and artistic methods are included or integrated.

Development Psychology: Developmental psychology is the study of the remarkable changes in behavior which happen as people grow older. These changes have been charted from the first moments in life, and though most of the current information about developmental changes concerns children, it is also about the changes that take place during adulthood, since no doubt exists that in many ways older people think and behave differently from younger ones. Broadly speaking, developmental psychology has two independent aims. The first is to describe what developments there are. The second aim is to discover the causes of development difference.

Comparative Psychology: Scientists studying human behavior in increasing numbers are making use of docile non-human species in order to make credible comparisons with problems of human organization and conduct. They do so in order to increase the comfort of man. The use of animal subjects to further understanding about human beings falls in the domain of comparative psychology. Though the animals are unable to communicate via language, this is compensated for by elaborate investigatory methodologies, which give credence to conclusions derived from these experiments. Comparative psychology has been used in the field of learning, memory, emotions and many other areas of psychology. The results obtained have been generalized and shown considerable resemblance with human behavior under various experimental condition.

Experimental Psychology: Experimental psychology was first concerned mainly with problems of perception and reaction time. Today, the field of experimental psychology is not defined in terms of subject matter alone. The particular way in which to study behavior characterizes experimental psychology. Experimental psychology attempts to apply the rules of scientific method for the study of sensory processes, memory, learning, etc. and to discover the lawful relationships that govern behavior. The behavior may be simple or complex, experimental psychologists search for the determinants of such behavior with respect to the organism and its environment.

Physiological Psychology: In its most general form, this field of psychology is concerned with the theory of relations between physical and mental (psychic) processes, including all attempts to reveal such relationships. It has, as its object, the scientific investigation of the mechanisms by which the nerve cells of

the human brain with their almost incalculably numerous links between one another can produce and control the behavioral variety of a living creature, which is also 'infinitely' great.

The basic problem of physiological psychology is to throw light upon behavior by the analysis of causes, behavior in this case meaning every kind of activity directed to the environment or communication with it for the purpose of exchanging information. Physiological psychology thus requires contributions from all subdivisions of physiology.

Two rapidly developing areas of interdisciplinary research are *psychopharmacology* and *neurosciences*. Psychopharmacology contributes to the question of the inter- and intra-individual variability of psychic processes. Neurosciences include *neurophysiology* or *neuropsychology*. These investigate the correlation between experience and the basic biological processes. The term '*neuro'* stresses the dominant role of the nervous system, though other systems are also taken into account.

Social Psychology: Social psychology has been defined as the study of *behavioral dependence* and *interdependence*. However, this view of social psychology, which regards the study of social behavior essentially as a sub-discipline of psychology, can be interpreted in different ways. Behavioral (inter) dependence implies that behavior is studied as both the cause and effect of the behaviors of others, but the definition leaves open the possibility that others may be actually present, imagined or merely implied by the situation. In the former case, we are concerned with such phenomena as social facilitation, imitation, conformity, social interaction, etc. whereas the latter includes the effect of social structure and culture on human behavior.

Because the boundaries of the study of social behavior are vague, social psychology has concerned itself with a wide variety of problems.

Social psychology is traditionally divided into three or four areas of research. The study of individual social behavior, the study of radical social interaction and communication processes, the study of small groups and the psychological study of social issues. Along with these, there is an increase in the application of social psychology in clinical, organizational and educational problems. Currently, the impact of our synthetic environment and social psychological processes in legal proceedings are studied intensively.

Parapsychology: The word *para* means beyond. Parapsychology, as the name suggests, is literally the study of that which is beyond the ordinary psychology. It refers to the study of *psi phenomena*; various forms of experience and behavior, which imply that human beings can gather veridical information about the world or each other (various kinds of *extra sensory perception*) and/or alter physical events (*psycho kinesis*) in the absence of known physical mechanisms for these phenomena. The basic kind of real-life observation leading to the idea of *psi* is an experience (like a dream or a hunch) that provides veridical information about distant events when it is known that physical energies could not convey the information, and when the event was not predictable from information already known to the percipient. It is difficult to absolutely rule out ordinary explanation of such apparent *psi* events, such as distortion of memory, poor observation, fraud, etc. as well as difficult to assess just what 'coincidence' is in such cases. Laboratory research where all the relevant conditions could be reliably assessed began around the turn of the twentieth century. It reached sophisticated form in the work of J.B. Rhine (1895–1980) and his colleagues at Duke University, which started in the 1930's.

Parapsychologists are concerned with the lack of discrimination in the scientific world between their well-controlled research and popular fads and superstitions, a confusion that is increased by pseudo-critics who deliberately lump these things together as part of an effort to discredit the little research activity that does go on. Parapsychologists see their primary problems as gaining mainstream acceptance so that adequate research effort will be expended to clarify the field, discovering how to make *psi* work more reliably so that it can be demonstrated on demand and finding a theoretical structure to make sense of *psi* phenomena.

Applied Fields

Clinical Psychology: Witmer first used the term clinical psychology in 1896. Clinical psychology is the activity of the psychologist in a clinic or hospital, confined normally to diagnosis and, within certain limits, to advice. Clinical psychology is a special method (exploration and observation) that was first introduced into child psychology by **Jean Piaget**. Clinical psychology is the application of the results and methods of all the basic psychological disciplines and related disciplines.

In brief, we can say that this branch of psychology is concerned with the practical application of research findings and research methodology in the fields of mental and physical health. Clinical psychologists share a strong belief in the ability to understand human behavior. They are specifically skilled in the application of objective methods of observation, normative data and theories of change to human thought, feeling and action. When faced with dysfunctional behavior, they will attempt to explain it in terms of normal processes, and to modify it by applying principles acquired from the study of normal learning adaptation and social interaction.

Educational Psychology: If we denote the term 'education' as a social reality, seen in terms of a network of interrelated political, economic, philosophical, historical, technical and demographic problems, then educational psychology represents all the investigations of institutions, strategies, curricula and teaching methods, and component structures of schools considered an organization, which are carried out from a psychological viewpoint. In this perspective, educational psychology is a psychology of educational systems. If we denote the term 'education' as the product of a process, then educational psychology is a psychology of the educable and educated that is still in the course of development. Yet, the classification of the behavioral variables, which distinguish variously educated individuals, has hardly begun. If we denote the term 'education' as a behavior pattern by means of which an individual or a group influences one or more individuals, then educational psychology can be defined as the investigation of the psychological components of actual educational situations: as the investigation of the psychological processes actuated or produced by various methods and techniques.

One of the important tasks of educational psychology is the investigation and theoretical elucidation of learning processes. Another area of educational psychology might be seen as that definable in terms of concepts such as educational objectives and values and moral education.

In brief, educational psychology should address itself to education occasions since learning and development are major concerns of both education and psychology. However, difficulties arise in establishing the content and the limit of educational psychology, which makes it hard to accord it a distinctive identity within the field of psychology.

Organizational Psychology: This is that branch of psychology that is referred to as Industrial psychology or Organizational Behavior and is concerned with work and ergonomics. Its aim has often been stated as maximizing efficiency in the production and distribution of goods and services through the study and manipulation of 'human factor' which is the approach of ergonomics, but there is an increasing tendency for the satisfaction of workers and consumers to be regarded as an end in itself (**Smith** and **Cranny** 1968). However, the industrial psychologist may orientate his work from the viewpoint of the individual worker, management, the organization or the consumer, it is widely recognized that efficiency is usually best served if the interest of all parties are taken into account. Some of the areas and problems with which industrial/organizational psychology is concerned are: Vocational guidance; Employee selection and placement; Job analysis, Worker analysis; Training, Motivation, Morale and condition of work; Fatigue; Equipment design; Organizational processes; Consumer research and advertising.

Counseling Psychology: Counseling is an interpersonal relationship in which one person (the counsellor) attempts to help another (the counselee) to understand and cope with his problems in the areas of education, vocation, family relationships and so on using psychological methods and techniques.

The counselor works with individuals whose problems are less serious than those who seek help of the clinical psychologist. The difference between the counsellor and the clinical psychologist are not sharp, for the counsellors have to be alert to the person who seems merely upset about a superficial problem but who is deeply disturbed. The counselor refers such a person to clinical services, confining himself to problems not classified as mental illness. Schools employ counsellors who guide students with vocational and academic problems. Minor personal problems are dealt directly by them. They are generally employed in schools, colleges, in industry and in private practice.

Consumer Psychology: This is a branch of industrial psychology, in which, interest is focused on the product or services itself, and its acceptability to the consumer. This is sometimes called '*business psychology'*. Consumer research is concerned with discovering the needs and motives of the public with a view to providing products and services that are appropriate to them. As with many other areas of applied psychology, this field presents some ethical problems concerning which little agreement has been reached, for example, the use of deliberate deception in research and advertising.

Psychology Applied In Law and Crime: Attempts have been made to find the factors that produce criminal behavior. Certain predisposing personality factors have been emphasized. Social factors responsible for crime are also investigated. The emphasis today is on reformation and rehabilitation of the criminal. Our attitude to juvenile delinquents has change immensely with psychology. Juvenile courts, approved schools, probation officers are concepts introduced after the psychologists dealt with problems of crime and delinquency.

Although law school have not included psychologists on their faculties in large numbers, the application of psychology to law has a long past. Experimental studies have shown up the inaccuracy of observations and legal testimony.

Munsterberg (1908) indicated, in his studies, that when witness reports are given as part of a free discussion, there is more accuracy than when they are given under conditions of direct questioning.

Application of Psychology in Other Areas

Psychology In the Community: The first psychological clinic was established in 1896 at the University of Pennsylvania, and it was here that clinical psychology was born. The first child-guidance clinic was inaugurated in Chicago in 1909. There are very few clinics in India where problems addressed range from simple bed-wetting to severe cases of maladjustments. Some clinics are supported by community funds and other by charitable trusts. There are also clinics for alcoholism, drug de-addiction and marital problems. Within such clinical settings, psychologists specialize: some function in psycho diagnostics and others in treatment: some are devoted to research and others to administration. Some psychological clinics serve as training centre for 'stress management', 'personality development', 'assertive training', 'effective married living', and so on. Some clinics form a nucleus in educating the public about mental health. Psychologists join with social workers and others on the problems of unemployment, social rehabilitation and human relations.

Psychologists work in three types of institutional settings in larger communities: institutions for behavioral disorders, institutions for physical disease and correctional institutions. There are residential treatment for the emotionally disturbed and the sensory and physically handicapped, and institutions that specialize in drug addiction. There are Prison psychologists, who work on problems of skill measurement and training, as well as various rehabilitation programmes. They serve on parole boards and aid in community research.

Psychology In Literature: It is not a surprise to find mention of psychology in literature, because the poet, the novelist and other humanists to the psychologist are not mere facts and theories. They direct their psychological analysis based on the imagination and subjectivity of the authors, poets and humanists. After all, psychology as a science is only about a century old, whereas people have been writing about human behaviors and experiences throughout the ages. Through the literatures, the humanistic psychology studies the nature of deep satisfaction as well as that of the continuing frustration of being caught within the borders of our individuality.

Bergenthal (1966) has compiled a wide range of Freud's and other theorists work who have been especially concerned with men's efforts to know themselves and to build relationships based on an authentic sharing of their essential being.

Kaplan (1967) analysed the meaning of 'Madness' in Shakespeare's *King Lear*. The more conventional interpretation of psychology is that while madness disrupts and disorganizes the reason, it does not do so totally, as a result some remnants of reason are left among the ruins of mind. The imagery is that of a crumbling building in which, despite an overall ruin, certain walls foundations or columns remain standing.

Levitas (1963) collected writings by philosophers, novelists, poet, mysteries and theologians on issue central to psychology. **Klinberg** (1938) studied the emotional expression in Chinese literature. **Hollander** (1956) has found popular literature valuable in teaching social psychology. **Stone** and **Stone** (1966) edited the volume 'The abnormal personality through literature'. It covers topics like neurotic depression, compulsive thoughts and 70 other abnormalities through writings ranging from **Emily Dickinson** to **John Steinbeck**.

Psychology In Engineering: This branch is referred to as '*Human-Factor Engineering'* or '*Ergonomics*'. It was developed to study the human behavior problems ranging from the design of equipment compatible with human abilities to perform well in an industry and in space. It studies how people take in information through their senses, how people store this information and how it is used in making decisions. It is also concerned with people's reactions to the stimulus situations or objects.

The engineering psychologists use much of their knowledge in psychophysics, information theory and decision-making, data processing, and human learning and perception. They are interested in design as it relates to people: the safety measures of automobiles, an executive table that will lessen physical fatigue. They also study the principles involved in how man and machine can be made to work in sync. Astronauts receive seemingly incongruous advice as part of the training designed to help space men survive if they have to make a re-entry to earth on one of this world's many deserts. The engineering psychologists help to work on such problems of comfort and survival.

Engineering psychology arose out of the professions of engineering and experimental psychology, designing, constructing and producing structures and machines useful to man is the engineer's job. He applies his knowledge of the mechanical, electrical, chemical or other properties of matter to the task of creating functional devices—safety pins and automobiles, mousetraps and missiles. The ultimate user of these devices is the human being, the human characteristics are considered in their construction. Human muscular frailty provided the necessity for and directed the design of such devices.

Military Psychology: We can trace the references of Military psychology to the Bible itself; there they have differentiated military organization based on behavior. The psychological warfare and propaganda have roots in history. In 1254 BC, Gideon used lamps and pitcher to cause confusion among the enemies and Gideon forces won their enemy by this psychological warfare. The early Greeks put out propaganda leaflets saying: 'Men of Ionia, you do wrong in fighting against your fathers and helping to enslave Greece'. Thus, psychology in the military utilizes the application from many psychological fields to win a fight or to win peace.

During World War I, the application of psychology was brought into the military in the United States. It began with the development of *Army Alpha* for those who could read and write and *Army Beta* for illiterates,

these are the two intelligence tests used in those days. Later during World War II, the application widened because of experimental psychology. It guided the efficient use of human senses and motor skills in combat. Selection and training received expert attention from industrial and educational psychology for the adjustment problems, counselling and clinical psychologists rendered helping hand.

Social psychologists turned their talents to problems of leadership, behavior and propaganda. The latest research programmes instituted various training programmes to facilitate psychological survival in prison camps.

'*Political Psychology'* had appeared as a new branch of military psychology by 1968. **Sperling** (1968) describes political psychology as that body of knowledge, which lies between psychology and sociology. It deals with problems of the control of behavior amongst groups, with the study of organizations of people in conflict and also with morale. Although considered a branch of military psychology, it can operate in peacetime, just as army personnel help during the flood time operations.

Sperling defines this new branch of military psychology with some questions. Is the uniform a morale builder? What is the impact on a man's behavior of being under military law? What are the differences in human behavior when control is brought about by different influences?

Psychology In Government Agencies: Psychologists work with state and local government levels agencies in rehabilitation centres, civil service commissions and mental hospitals. Psychologists in government do much the same things as other psychologists; some conduct research and run training programmes and the like, but in large measure, they administer programmes of research, grants and contracts ranging from small-scale studies to expensive projects. The psychologists working for the government join with other behavioral scientists and work with other local agencies, with unions and industry, on community renewal programmes, unemployment and education. This has both its positive and negative aspects. Most of the psychologists feel frustrated because of the bureaucratic structure, often creating an organizational climate where they feel they are clerks and not scientists with professional knowledge. It is a system where important communications can be buried in vast graveyards of memos 'sent upstairs' (**Shakow** 1968).

Psychometrics: Tests and other devices for measuring human abilities is the province of the psychometricians who develop new tests and improve statistical techniques used in measuring human abilities. Of late, computer application of psychology is used for data analysis. Psychologists work in the area of 'Evaluation research' as they have the expertise in experimental designs. Psychologists are becoming increasingly active in the evaluation of public programmes in the areas as education, health and employment.

Expanding Psychology's Frontiers

With the advancement of science and technology, psychology as a behavioral science is growing constantly and rapidly. Because of this growth, the newer fields that have emerged are evolutionary psychology, behavioral genetics and clinical neuropsychology.

Evolutionary Psychology: Evolutionary psychology is the application of the principles and knowledge of evolutionary biology to psychological theory and research. Its central assumption is that the human brain is comprised of a large number of specialized mechanisms that were shaped by natural selection over vast periods of time to solve the recurrent information-processing problems faced by our ancestors (**Symons** 1995). These problems include such things as choosing which foods to eat, negotiating social hierarchies, dividing investment among offspring and selecting mates. The field of evolutionary psychology focuses on identifying these information-processing problems, developing models of the brain-mind mechanisms that may have evolved to solve them, and testing these models in research (**Buss** 1995; **Tooby** and **Cosmides** 1992).

Behavioral Genetics: Human behavioral genetics seeks to identify and characterize both the genetic and the environmental influences on individual differences in behavior. An individual's genotype (the biochemical code providing the individual's genetic composition) will impact his or her personal characteristics through biological processes and through development. Even though individual phenotypes are influenced by genetic composition; unlike genotypes, phenotypes include environmental influences.

EXPERIMENTAL PERSPECTIVE

Variance in Behavior

Behavioral geneticists attempt to partition the variance in behavior among individuals (phenotypic variance) into genetic and environmental components. For a behavioral trait, for example, a parameter that is of interest concerns what is called the heritability (h2) of the trait—this statistic estimates the proportion of phenotypic variance (between individuals) accounted for by genetic differences (**Bouchard** and **McGue** 2003). Here it must be pointed out that heredity and environment may have such an intertwined influence on within-individual human development such that it might be difficult to completely disentangle their effects (**Olson**, **Vernon**, **Harris** and **Jang** 2001). Currently, behavioral genetic designs can only estimate the extent to which between-individual differences in a particular individual attribute or characteristic reflect environmental or genetic variation within particular ranges of environmental and genetic variation, and not in an absolute sense.

Clinical Neuropsychology: Clinical neuropsychology unites the areas of neuroscience and clinical psychology. The clinical specialty of neuropsychology bridges interest in the biological functioning of neural cells in the brain, spinal cord and body with the study of psychological disorders. The neuropsychologist uses objective, scientific techniques to link behaviors to underlying normal and abnormal biological (i.e., brain) processes. The clinical neuropsychologist studies patterns of abnormal behavior to infer the biological abnormalities that might be producing or contributing to those behaviors.

Traditionally defined, neuropsychology is the study of (and the assessment, understanding and modification of) brain-behavior relationships. Neuropsychology seeks to understand how the brain, through structure and neural networks, produces and controls behavior and mental processes, including emotions, personality, thinking, learning and remembering, problem solving and consciousness. The field is also concerned with how behavior may influence the brain and related physiological processes, as in the emerging field of psychoneuroimmunology (the study that seeks to understand the complex interactions between brain and immune systems, and the implications for physical health).

SCHOOLS OF PSYCHOLOGY

When psychology was established as a science separate from biology and philosophy, the debate over how to describe and explain the human mind and behavior began. At the turn of the century, many advances in science were occurring due to a fundamental concept that philosophers of science refer to as *elementism*. Elementism refers to the conception of complex phenomena in terms of basic parts or elements. This conception of science has led to many important discoveries with important applications in areas such as the biological sciences in the late 1800s. It was at this time that what most psychologists acknowledge as the first 'school of psychology' began. In 1879, **Wilhelm Wundt** began the first psychological laboratory in Leipzig, Germany. Almost immediately, other theories began to emerge and vie for dominance in psychology.

Structuralism

The school of psychology that Wundt began and championed all his life is referred to as '*structuralism'*. For this reason, Wundt is often referred to as the father of structuralism. Structuralism can be defined as the study of the elements of consciousness. The idea is that conscious experience can be broken down into basic conscious elements, much as a physical phenomenon can be viewed as consisting of chemical structures that can in turn be broken down into basic elements. In fact, much of the research conducted in Wundt's laboratory consisted of cataloguing these basic conscious elements. In order to reduce a normal conscious experience into basic elements, structuralism relied on a method called *introspection*. For example, one of Wundt's research assistants might describe an object such as an apple in terms of the basic perceptions it invoked (e.g. 'cold', 'crisp' and 'sweet'). An important principal of introspection is that any given conscious experience should be described in its most basic terms, so that a researcher need not describe some experience or object as itself, such as describing an apple as an apple. Such a mistake is a major introspection faux pas and is referred to as the 'stimulus error'. Through introspection experiments, Wundt began to catalog a large number of basic conscious elements that could be hypothetically combined to describe all human experiences.

In brief, structuralism was the first school of psychology, and focused on breaking down mental processes into the most basic components. The goal of the structuralists was to find the units or elements that make up the mind. The main method used to discover these elementary units of mind was introspection. The prominent psychologists belonging to this school are **Wilhelm Wundt** and **Edward Titchener**. While structuralism is notable for its emphasis on scientific research, its methods were unreliable, limiting and subjective. When Titchener died in 1927, structuralism essentially died with him.

Functionalism

Psychology flourished in American during the mid- to late-1800s. **William James** emerged as one of the major American psychologists during this period and the publication of his classic textbook, *The Principles of Psychology*, established him as the father of American psychology. His book soon became the standard text in psychology and his ideas eventually served as the basis for a new school of thought known as functionalism. Functionalism formed as a reaction to the theories of the structuralist school of thought and was heavily influenced by the work of William James. Major functionalist thinkers included **John Dewey** and **Harvey Carr**.

The focus of functionalism was on how behavior actually works to help people live in their environment. Functionalists utilized methods such as direct observation. While both of these early schools of thought emphasized on human consciousness, their conceptions of it were significantly different. While the structuralists sought to break down mental processes into their smallest parts, the functionalists believed that consciousness existed as a more continuous and changing process. This school proposes that psychology should study 'what mind and behavior do'.

In brief, these early psychologists studied the function of mind and behavior. While functionalism is no longer a separate school of thought, it went on to influence later psychologists and theories of human thought and behavior.

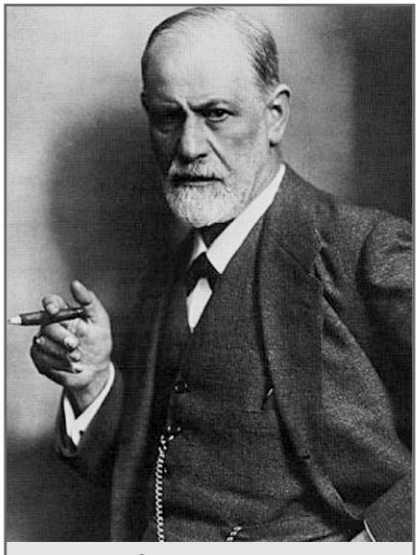
Gestalt School

The gestalt school of psychology founded by **Max Wertheimer** and his younger colleagues, **Kurt Koffka** and **Wolfgang Köhler,** was to some extent a rebellion against the *molecularism* of Wundt's programme for psychology, in sympathy with many others at the time, including William James. The gestalt psychologists believed that mental experience was dependent not on a simple combination of elements but on the organization

and patterning of experience and one's perceptions. Thus, they held that behavior must be studied in all its complexity, rather than separated into discrete components. They also advocated that perception, learning and other cognitive functions should be seen as structured wholes. In fact, the word *gestalt* means a unified or meaningful whole, which was to be the focus of psychological study. Experiments done by Max Wertheimer, Kurt Koffka and Wolfgang Köhler led them to conclude that the mind imposes its own patterns of organization on the stimuli it receives rather than merely recording them, and that the significance of the mental 'wholes' thus formed transcends that of their component parts. These and other experiments led to the wide-ranging gestalt view of *the whole as more than the sum of its parts*.

Psychoanalysis

Strictly speaking, this is not a school of psychology, but it had a great impact on the thinking and theorizing of many psychologists. It was founded in Vienna, Austria, by the psychiatrist **Sigmund Freud** (1856–1938). Freud developed a theory of behavior and mind, which said that much of what we do and think results from urges or drives that seek expression in behavior and thought. Based on this theory, psychoanalysts, in their attempt to understand mental life and behavior, focused on people's unconscious urges and drives. Thus, this school of thought emphasized the influence of the unconscious mind on behavior. The term *unconscious motivation* describes the key idea of psychoanalysis. In his book *The Psychopathology of Everyday Life*, Freud detailed how these unconscious thoughts and impulses are expressed, often through slips of the tongue and dreams.



Sigmund Freud

According to Freud, psychological disorders are the result of these unconscious conflicts becoming extreme or unbalanced.

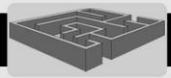
Another theorist associated with psychoanalysis is **Erik Erikson**. Erikson expanded upon Freud's theories and stressed on the importance of growth throughout the lifespan. Erikson's psychosocial stage theory of personality remains influential today in our understanding of human development.

The psychoanalytic theory proposed by Sigmund Freud had a tremendous impact on twentieth-century thought, influencing the mental health field as well as other areas including art, literature and popular culture. However, they have been criticized for overemphasis on the unconscious mind, sex, aggression and childhood experiences. Many of the concepts proposed by psychoanalytic theorists are difficult to measure and quantify.

While several of his ideas are viewed with skepticism today, the influence of Freud and Erikson on psychology is undeniable. While most psychodynamic theories did not rely on experimental research, the methods and theories of psychodynamic thinking contributed to experimental psychology. Many of the theories of personality developed by psychodynamic thinkers are still influential today, including Erikson's theory of *psychosocial stages* and Freud's *psychosexual stage theory*.

Behaviorism

Psychology changed dramatically during the early twentieth century as another school of thought known as 'Behaviorism' rose to dominance. Behaviorism was a major change from previous theoretical perspectives, rejecting the emphasis on both the conscious and unconscious mind. Instead, behaviorism strove to make



PSYCHOLOGY IN EVERYDAY LIFE

Dream as 'Wish Fulfillment'

We all dream in our sleep. Freud encapsulates the phenomenon of dreams in his seminal work *Interpretation of Dreams*. The book introduces Freud's theory of the unconscious with respect to dream interpretation. Dreams, in Freud's view, were all forms of 'wish fulfillment'—attempts by the unconscious to resolve a conflict of some sort, whether something recent or something from the recesses of the past. (Later in *Beyond the Pleasure Principle*, Freud would discuss dreams that did not appear to be wish fulfillment.) However, because the information in the unconscious is in an unruly and often disturbing form, a 'censor' in the preconscious will not allow it to pass unaltered into the conscious. During dreams, the preconscious is more lax in this duty than in waking hours, but is still attentive. As such, the unconscious must distort and warp the meaning of its information to make it through the censorship. As such, images in dreams are often not what they appear to be, according to Freud, and need deeper interpretation if they are to inform on the structures of the unconscious.

psychology a more scientific discipline by focusing purely on observable behavior. It became the dominant school of thought during the 1950s. Based on the work of thinkers such as **John B. Watson**, **Ivan Pavlov** and **B. F. Skinner**, behaviorism holds that all behavior can be explained by environmental causes, rather than by internal forces. Behaviorism is focused on *observable behavior*. They insisted that psychology be restricted to the study of behavior—the observable. Theories of learning including classical conditioning and operant conditioning were the focus of a great deal of research.

Ivan P. Pavlov, through his *classical conditioning* experiments, demonstrated that behavior could be learnt via conditioned associations. In turn, this learning process could be used to make and association between an environmental stimulus and a naturally occurring stimulus.

John B. Watson considered as the strongest advocate of behaviorism defines it as, '*Behaviorism...holds that the subject matter of human psychology is the behavior of the human being. Behaviorism claims that consciousness is neither a definite nor a usable concept. The behaviorist, who has been trained always as an experimentalist, holds, further, that belief in the existence of consciousness goes back to the ancient days of superstition and magic.*' (Psychology as the Behaviorist Views It, 1913)

B.F. Skinner furthered the behaviorist perspective with his concept of *operant conditioning*, which demonstrated the effect of punishment and reinforcement on behavior.

The impact of behaviorism was enormous, and this school of thought continued to dominate for the next 50 years. However, thereafter it lost its hold on psychology, yet the basic principles of behavioral psychology are still widely in use today. Therapeutic techniques such as behavioral modification and token economies are often utilized to help children learn new skills and overcome maladaptive behaviors, while conditioning is used in many situations ranging from parenting to education.

MODERN PERSPECTIVES IN PSYCHOLOGY

The discoveries made by the structural, gestalt and functional school of psychology have become part of general store of psychological knowledge, but the schools, as such, have vanished. Behaviorism and psychoanalysis, on the other hand, are still in modified forms. Table 1.1 lists out the modern perspectives in psychology which are then discussed in detail.

TABLE 1.1 Modern Perspectives in Psychology

Behavioral Perspective	It focuses on the observed behavior of people or animals and not on their mental processes.
Biological Perspective (Neuroscience Perspective)	Psychologists with a biological perspective try to relate people's behavior and mental events to functions of their bodies, especially to the activity of their nervous and glandular systems.
Cognitive Perspective	This area of psychology focuses on mental processes such as memory, thinking, problem-solving, language and decision-making.
Sociocultural Perspective	Psychologists from this perspective are interested in the interactions between and among people, which influence mind and behavior.
Humanistic Perspective	Humanistic psychology focuses on individual free will, personal growth and self-actualization.
Evolutionary Perspective	Evolutionary psychology is the study of how evolution explains physiological processes.
Psychodynamic Perspective	The psychodynamic perspective focuses on the unconscious motives and defense mechanisms, which manifest themselves in mental life and behavior, looking for hidden processes and hidden impulses.

Behavioral Perspective

As was true of the older schools of behaviorism, the current behavioral perspective focuses on the observed behavior of people or animals and not on their mental processes. While behaviorism dominated psychology early in the twentieth century, it began to lose its hold during the 1950s. Today, the behavioral perspective is still concerned with how behaviors are learned and reinforced. Behavioral principles are applied in mental health settings, where therapists and counsellors use these techniques to explain and treat a variety of illnesses.

Biological Perspective (Neuroscience Perspective)

Psychologists with a biological perspective try to relate people's behavior and mental events, to functions of their bodies—especially to the activity of their nervous and glandular systems. Over the years, the study of physiology has played a major role in the development of psychology as a separate science. Hence, today this perspective is known as biological psychology. It is also referred to as *biopsychology* or *physiological psychology.* It emphasizes upon the physical and biological bases of behavior. Over the years, this perspective has grown significantly, especially with advances in our ability to explore and understand the human brain and nervous system. Modern medical gadgets such as magnetic resonance imaging **(**MRI**)** or nuclear magnetic resonance imaging (NMRI) and positron emission tomography **(**PET**)** through scans, allow researchers to look at the brain under a variety of conditions. Scientists can now look at the effects of brain damage, drugs and disease in ways that were simply not possible in the past.

Cognitive Perspective

During the 1960s, a new perspective known as cognitive psychology began to take hold. Known today as the 'cognitive revolution', this area of psychology focuses on mental processes such as memory, thinking,

problem solving, language and decision-making. Influenced by psychologists such as **Jean Piaget** and **Albert Bandura**, this perspective has grown tremendously in recent decades. From this perspective, behavior and mind are understood in terms of the ways in which information, from the environment received through the senses, is processed.

The cognitive perspective examines internal mental processes such as creativity, perception, thinking, problem solving, memory and language. Cognitive psychologists are interested in how a person understands, diagnoses and solves a problem, concerning themselves with the mental processes that mediate between stimulus and response. In recent years, cognitive psychology has become associated with computer information processing and artificial intelligence, studying parallels in the ways that both brain and computer receive, process, store and retrieve information.

The cognitive view of abnormal behavior focuses on the mental process. The cognitive perspective studies how people perceive, remember, reason, decide and solve problems to find the cause of mental illnesses. Modern cognitivism does not cater to introspection like past versions. Today's study of cognition is based on two assumptions: first, what organisms are going to do can only be found by studying their mental process, and second is it possible to objectively study the mental processes by focusing on specific behaviors and interpreting the underlying mental processes. From its beginnings in 1879 to today, many schools of cognitive study have emerged.

Sociocultural Perspective

Psychologists from this perspective are interested in the interactions between and among people which influence mind and behavior. The Sociocultural perspective explores social norms and customs. Group behavior, social relationships and the concept of helping are often studied under this perspective. This perspective looks at how people in different cultures and social situations behave. Psychologists study how difference in cultural values and practices can lead to different ways of seeing the world and different ways of behaving. For example, if you show the same picture of a house on a hill to a person belonging to the Uttranchal hills and to someone from Delhi, the person from Delhi is more likely to be interested in the hillside, while the person from Uttranchal is more likely to be interested in the house.

Humanistic Perspective

Humanistic psychology developed as a response to psychoanalysis and behaviorism. Humanistic psychology focused on individual free will, personal growth and self-actualization. It emphasizes on a person's sense of self and each individual's attempts to achieve personal competence and self-esteem. It focuses on the positive image of what it means to be human. Accordingly, human nature is viewed as good, and humanistic theorists focus on methods that allow fulfilment of potential. Major humanist thinkers included **Abraham Maslow** (1908–1970) and **Carl Rogers** (1902–1987).

Abraham Maslow proposed that a hierarchy of needs motivates an individual**.** Basic needs ought to be satisfied before the higher ones. Arranged in order from lowest to highest (in a hierarchy), the needs are: physiological (satisfaction of hunger and thirst); safety (security); belongingness and love (being loved, avoiding loneliness); esteem (achievement, recognition, self-esteem); and self-actualization (realization of one's full potential). Maslow also believed that the achievement of self-actualization is marked by peak experiences, feelings of incredible peace and happiness in the course of life activities.

Carl Rogers, a clinical psychologist, used the theory of *self-concept* that he defined as an organized pattern of perceived characteristics along with the values attached to those attributes. He also assumed that within each individual there is a biological drive toward growth of self-concept, which can ultimately lead

to *self-actualization*. Rogers believed that while children's self-concept is developing, they might internalize *conditions of worth* and judgments about the kinds of behaviors that will bring approval from others. He felt that to promote growth and development, parents and authority figures should give a child unconditional acceptance and love that allows a child to develop self-acceptance and to achieve self-actualization. To help his clients get back on the road to self-actualization, he developed a therapeutic approach called *client-centred therapy*, in which the therapist offers the client *unconditional positive regard* by supporting the client regardless of what is said. The warm, sympathetic therapeutic environment allows the client to be freed of internalized conditions of worth and to resume the self-actualization process.

Abraham Maslow

Evolutionary Perspective

Evolutionary psychology is the study of how evolution explains the physiological processes. Psychologists and researchers take the basic principles of evolution, including natural selection, and apply them to psychological phenomena. This perspective suggests that these mental processes exist because they serve an evolutionary purpose as they aid in survival and reproduction.

Ghiselin probably coined the term evolutionary psychology in his 1973 article in Science. **Jerome H. Barkow, Leda Cosmides** and **John Tooby** popularized the term in their highly influential 1992 book *The Adapted Mind: Evolutionary Psychology* and *the Generation of Culture.* Evolutionary Psychology (or EP) proposes that human and primate cognition and behavior can be better understood in light of human and primate evolutionary history. Specifically, EP proposes the primate brain comprises many functional mechanisms, called psychological adaptations or evolved psychological mechanisms (EPMs), that evolved by natural selection to benefit the survival and reproduction of the organism. These mechanisms are universal in the species, excepting those specific to sex or age. The main sources of evolutionary psychology are cognitive psychology, genetics, ethology, anthropology, biology and zoology.

Evolutionary psychology is based on the presumption that just like hearts, lungs, livers, kidneys and immune systems, cognition has functional structure that has a genetic basis and, therefore, has evolved by natural selection. Like other organs and tissues, this functional structure should be universally shared amongst humans and should solve important problems of survival and reproduction. Evolutionary psychologists seek to understand cognitive processes by understanding the survival and reproductive functions they might serve.

Psychodynamic Perspective

The current psychodynamic perspective focuses on the unconscious motives and defence mechanisms that manifest themselves in mental life and behavior, looking for hidden processes and hidden impulses. The psychodynamic perspective includes all the theories in psychology that see human functioning based upon the interaction of drives and forces within the person, particularly unconscious between the different structures of the personality. **Freud's** psychoanalysis was the original psychodynamic theory, but the psychodynamic approach as a whole includes all theories that are based on his ideas, e.g. **Jung** (1964), **Adler** (1927) and **Erikson** (1950).

The words '*psychodynamic*' and '*psychoanalytic*' are often confused. It is to be remembered that Freud's theories were psychoanalytic, whereas the term 'psychodynamic' refers to both his theories and those of his followers. Freud's psychoanalysis is both a theory and a therapy. His various theories, coupled, form the basis of the psychodynamic approach to psychology. These theories of his are clinically derived, that is, they are based upon what his patients told him during their therapy.

The psychodynamic approach assumes that one's behavior and feelings are powerfully affected by unconscious motives. They, along with other psychological problems that one suffers from in adulthood, are in turn rooted in one's *childhood experiences*. This approach also assumes that all behavior has a cause which usually is unconscious and thus it is predetermined. According to this perceptive, personality is made up of three parts (*tripartite*). These parts, which are hypothetical, are referred to as the *id*, *ego* and the *superego*. Behavior, according to the psychodynamic perspective, is motivated by two *instinctual drives*: *Eros* (the sex drive & life instinct) and *Thanatos* (the aggressive drive & death instinct). Both these drives come from the 'id'. Parts of the unconscious mind (the id and superego) are in constant *conflict* with the conscious part of the mind (the ego). The personality shaped as the drives are modified by different conflicts at different times in childhood (during *psychosexual development*).

Psychodynamics approach has been criticized for being unempirical in its analysis of human behavior. Many of the concepts central to Freud's theories are subjective and as such impossible to scientifically test. For example, how is it possible to study concepts like the unconscious mind or the tripartite personality? In this respect, the psychodynamic perspective is un-falsifiable as the theories cannot be empirically investigated. Furthermore, most of the evidence for psychodynamic theories is taken from Freud's case studies (e.g. Little Hans). The main problem here is that the case studies are based on studying one person in detail, and with reference to Freud the individuals in question are most often middle aged women from Vienna (i.e. his patients). This makes generalizations to the wider population (e.g. the whole world) difficult.

The humanistic approach has also leveled its share of criticism stating that the psychodynamic perspective is too deterministic, leaving little room for the idea of personal agency (i.e. free will).

RESEARCH METHODS IN PSYCHOLOGY

From the very beginning, man has wondered about the nature of the physical world around him. At the onset, rain, lightning, thunder and fire confused him and he used to be afraid of them. He started worshipping them out of fear. With time, man became well-equipped with the physical appliances and sciences like astronomy, physics chemistry and biology came into being. Man's efforts to gain an understanding of biology led to the development of mental philosophy and finally to the science of psychology.

In their attempts to make a detailed analysis of man's behavior and experience and to unravel the complexities of human behavior, psychologists have been using a variety of methods for investigation and for explaining behavior. Early attempts at this were largely philosophical and they did not experiment upon or systematically observe human behavior as it occurred. They used a method that is now referred to as *armchair theorizing* that depends upon speculation and lays emphasis on observation. The experimenter makes sweeping generalizations and does not bother to verify these experimentally and therefore the conclusions are likely to be partly or wholly false. Statements such as 'Snakes are revengeful', 'Present-day students are not polite', 'Gifted boys are not mentally balanced' and so on are generally made on the basis of casual methods of arriving at conclusions. These are based on unsystematic observations. When psychology developed as a science, armchair theorizing was discarded in favor of well-established scientific methods based on objective observations.

Table 1.2 shows some research methods in psychology.

TABLE 1.2 Methods of Research in Psychology

Laboratory Experiment	It is carried out when a psychologist wishes to investigate the direct relationship between two or more variables under controlled conditions.
Field Experiment	A field experiment is a research study in a realistic situation in which one or more independent variables are manipulated by the experimenter under carefully controlled conditions as the situation permits.
Survey Method	When a researcher collects information from a known setting, he/she is doing a survey research. We can thus say that survey is the collection of information from a known setting.
Observation Method	Observation becomes a scientific tool when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability. Observation can thus be defined as methodically controlled non-random purposive examination of the actions of one or several individuals in order to discover some distinct characteristics of their personality.
Interview Method	Interviewing is one of the major methods of data collection. It may be defined as two-way systematic conversation between an investigator and an informant, initiated for obtaining information relevant to as a specific study.
Questionnaire Method	Apart from psychologist, this method is used by private individuals, behavioral science research workers, private and public organizations and even by government agencies. This method involves the use of a questionnaire. The questionnaire consists of a number of questions printed or typed in a definite order on a form or a set of forms with instructions on the first page. Respondents are requested to answer the questionnaire.
Cross-Cultural Method	This method is designed to discover similarities and differences amongst cultural patterns in a sizeable sample of societies.
Sociometric Method	The objective of this method was to establish the pattern of feelings of acceptance and rejection of likes and dislikes that exist among the members of the group.
Case Study Method (Clinical Point of View)	A case study presents the story of an individual; in as complete and as objective form as possible. It does not interpret the data and it in itself, does not, bring to a focus the information on the present problems faced by the individual.

We will now discuss the research methods in psychology in detail.

Laboratory Experiment

An experiment can be defined as '*observation under controlled conditions*'. This observation of a phenomenon is done under conditions of control to eliminate the intrusion of any extraneous variables that might affect the responses.

When a psychologist wishes to investigate the direct relationship between two or more variables, he prefers to use the experimental method. According to **Kerlinger**, a laboratory experiment is a research study in which the variance of all or nearly all of the possible influential independent variables pertinent to the immediate problem of the investigation is kept at a minimum. A laboratory experiment is the basic research in any discipline. It is carried out in a restricted environment that usually involves a large number of subjects. The experimental research can be carried out through the following three different stages:

(a) The first and foremost aim of the researcher who intends to study a phenomenon in the laboratory is to set up a number of fruitful hypotheses at the beginning of the research. Usually, a *null hypothesis* is formed. A null hypothesis is a statement stating that there is no significant difference existing between the variables under study. This null hypothesis is tested by taking a minimum of two groups of subjects and the group may be of any number in a sophisticated environmental approach. Usually one group is

the *control group*. A control group is one in which the independent *variable* is manipulated with zero intensity, whereas in the *experimental group* the independent variable is manipulated as per requirements of the problem. The idea behind taking these two groups is to see the comparative effects of the manipulation and thereby concluded accordingly.

(b) The next stage is activation of the experimental process by manipulating the experimental variable/s (independent variable/s). The manipulation of the experimental variables is done by testing of subjects in random assignments in various experimental conditions. The reason for random assignment is to eliminate the *carry over effect* if any, under different experimental conditions. Carry over effect occurs when performances under a given condition with a fixed ordinal position in the sequence turns out to depend on what conditions preceded it in the sequence.

(c) The third step involved in carrying out a laboratory experiment is a very important one and the researcher must pay due attention towards it. This step is concerned with minimizing *the errors* that arise from various sources which if not checked properly will effect the experimental task and thereby the results obtained. These errors, termed as *experimental errors*, arise from four main sources.

The **first source** is the subject. The errors arising from the subject may be due to psychological reasons such as motivation, attitude, set, attention, aptitude, learning, perceptions, apperception, etc. that may affect the results if not conducive to the problem under investigation. Errors may also arise due to physiological reasons such as fatigue, lack of sleep, hunger and thirst.

It thus becomes important to select a subject who is psychological as well as physiologically fit for the required experimental task. This will avoid any chance of errors arising from the part of the subject.

The **second source** is the instrument being used for conducting the experiment. If the instrument is faulty and does no give accurate readings, then the measured variables are likely to be effected. It is essential that the instrument used by the researcher is measuring the required phenomenon accurately and in case it is erroneous then the error must be added or subtracted accordingly after each reading to achieve accurate readings. It is advisable that before using any instrument, the researcher must fully equip himself with knowledge about the operations and various other aspects of the instrument he wishes to use.

The **third source** of error in a laboratory experiment is the environment. The environment includes light, temperature, ventilation, noise, etc. These factors can be controlled in the laboratory since control of these environmental conditions is possible.

The **fourth** type of experimental error arises from the experimenter himself. The experimenter can become a source of error if he is not well versed with the experimental task that he has to conduct. At times, the experimenter's attitude towards the entire experimental situation or parts of it may lead to errors in the form of biased results.

The experimental errors mentioned above are to be reduced substantially and this is possible in laboratory experiments if the researcher gives due attention to these aspects.

Strength of Laboratory Experiments

The greatest strength of a laboratory experiment lies in its inherent virtue of relatively complete control. By control, as mentioned before, while defining an experiment, we mean to eliminate the intrusion of any *extraneous variables* which may affect the responses and thereby the results. Control in a laboratory experiment can be complete since the environment in the laboratory is a restricted one and it becomes easy for the researcher to bring about conducive changes for the conduction of the required experiment.

In addition to situational control, laboratory experiments can ordinarily use *random assignment* and can *manipulate one or more independent variables*. By using random assignment, the researcher can eliminate the carry-over effect, if any, under different experimental conditions. Closely allied to this is the *precision* and *replicability* of laboratory experiments. Precise means accurate, definite and unambiguous. Precise

measurements are made with precision instruments. The more precise an experimental procedure, the less is the *error variance*. Variance refers to a measure of variability or dispersion, the square of the standard deviation used to determine the degree of difference from one another of certain value (scores) in a set. Precise laboratory results are achieved mainly by *controlled manipulation*. By specifying exactly the conditions of the experiment, we reduce the risk that subjects may respond equivocally and thus introduce random variance into the experimental situation.

Weaknesses of Laboratory Experiments

As discussed above, the greatest strength of the laboratory experiment is control, which is possible mainly due to the restricted artificial environment. At the same time, this artificiality becomes a weakness as well in terms of independent variable. Since the environment in a laboratory is artificial, the strength of the independent variable is also less. Since the laboratory experiments are often all situations that are created for special purpose, hence the effects of experimental manipulation are usually weak.

Another weakness is a product of the first: the artificiality of the experimental research situation. It is, however, difficult to know if artificiality is a weakness or simply a neutral characteristic of laboratory experimental situations. The criticism of artificiality does not come from experimenters, who know that experimental situations are artificial; it comes from individuals lacking an understanding of the purpose of laboratory experiments.

Another weakness of laboratory experiment is the temptation to interpret the results incorrectly. If the researcher does not possess adequate knowledge relating to the problem and allied problems under investigation, he/she may falter in the interpretation of obtained results.

Laboratory experiments, no doubt have relatively high internal *validity,* i.e. they can measure the phenomenon under study with precision and accuracy. At the same time, they lack external validity. This lack of external validity is because in a laboratory experiment, the conditions are standardized for the purpose of the required experiment but these results cannot be generalized and fully applicable to conditions outside the laboratory and hence the validity is affected.

Purpose of Laboratory Study

The laboratory experiments have three purposes, which are related to each other. **Firstly**, they attempt to discover relations under 'pure' and uncontaminated conditions. These conditions are possible due to complete control in a laboratory. The **second** purpose of the laboratory study is the testing of predictions derived from theory and other research. The **third** purpose of laboratory experiments is to define theories and to formulate *hypothesis* related to other experimentally or non-experimentally tested hypothesis and, perhaps most important, to help build theoretical systems.

As such, laboratory experiments are one of man's greatest achievements. Although weaknesses exist, they are weaknesses only in the sense that is irrelevant. Though they lack external validity, they still have the fundamental prerequisite of any research, i.e. internal validity. The laboratory experiment, though being microscopic in nature, has always been considered as fundamental research in any discipline, which gives insight for wide-scale research in any situation.

Field Experiment

According to **Kerlinger**, a field experiment is a research study in a realistic situation in which one or more independent variables are manipulated by the experimenter under carefully controlled conditions as the situation permits. Comparatively speaking, the difference between a field experiment and a laboratory experiment is not sharp. The difference is mostly a matter of degree. In a laboratory, experiment maximum

control is possible whereas in a field experiment, due to the realistic situation the criteria of complete control can be satisfied only theoretically and this becomes a hindrance to the achievement of precise and accurate results.

While conducting a field experiment, the researcher has to take into consideration the following three steps: **First,** the researcher must be clear about the aims and objectives of the research task he intends to carry on. Thus, formulation of an appropriate research problem is of prime importance before the onset of the actual experimental task. **Second**, the researcher, after having defined the aim and objectives of the research, should accordingly as required by the problem under investigation, select a natural setting for the conduction of the experiment. Along with these, the **third** and important step is to draw out the design of research to be followed in order to facilitate the smooth operation of the entire research process.

In a field experiment along with the hypothesis testing approach, the researcher can also do an exploratory research. In the hypothesis testing research, the researcher tries to find causal relationships involving several conditions within a selected group of subjects. In the experimental research, on the other hand, in addition to causal relationship, the researcher also tries to discover important variables for further studies. It will not be wrong to say that since both the laboratory experiment and the field experiment are akin to each other, the field experiment is an extension of the laboratory experiment for future planning and development. However, the laboratory experiment and field study should not be equated because in a field study, no experimental approach is required and it draws material that is similar to survey research.

Strength of Field Experiment

Field experiments are admirably suited for many of the social and educational problems of interest to social psychology, sociology and education. It will not be wrong to say that most educational experiments are field experiments, since they are done in actual schools and classrooms.

The greatest strength of field experiments is that the independent variables can be manipulated and randomization can be used, the criteria of control can be satisfied at least theoretically. As compared with the laboratory experiment, control of the experimental field situations is not fully possible. This is strength in the sense that control is possible to an extent but at the same time, complete control is not feasible. The researcher though has the freedom and power to manipulate, he is still prone to the possibility that his independent variables are contaminated by the environmental variables that cannot be, due to various reasons, brought under complete control. This point is being stressed upon because of the fact that the extraneous independent variables particularly need controlling in field experiments. Thus, the prime objective of the researcher is to try to equate the field research situation with that of the laboratory as far as possible.

The field experiment has a few more unique virtues. We have seen in the laboratory that the variables were weak in strength due to the artificial situation. Here in a field experiment since the situation is realistic, the variables have a stronger effect. These variables are strong enough and capable of penetrating the distractions in a field experimental situation. The logic behind is that the more realistic the research situation, the stronger the variables. Not only does realism increase the strength of variables but it also contributes to external validity. This gives the field experiment an edge over the laboratory experiment that lacks external validity. The more realistic the situations, the more valid are generalizations to other situations.

Another virtue of field experiment is that it can be used for studying social influences, which are complex in nature. Social processes and changes in life, like settings, can also be studied with the help of field experiments.

Testing of theory and the solution of practical problems can be done with the help of field experiments. Broad hypothesis can as well be tested using this method. Field experiments as compared to laboratory experiments are more flexible as well as the results obtained can be applicable to a wide variety of problems.

Weaknesses of Field Experiments

We have seen that the randomization and manipulation of independent variables is possible only theoretically and at times is not possible or practicable in many field situations. This becomes the major weakness of the field experiment. Nevertheless, difficulties are frequently met. Even if random assignment is possible and permitted, the independent variables may be blurred, because the effects of the treatments cannot be isolated from other effects. If the experimenter lacks the ability to randomize, he must abandon the research or if possible modify it to suit the situation or he can seek a situation where randomization is permissible or feasible. The experimental field characteristic also plays an important role. It is a weakness for some experimenters and strength for others. The experimenter must be a smooth operator knowing well the skills required for successful operation in the environment he is experimenting within. Many researchers' loose patience during the initial preliminaries as they are in a great hurry to finish the task they are carrying out. The attitude of the researcher, which is overlooked, is also an important factor and which may cause obstacles for a good design.

As with the laboratory experiment it was possible to get precise results, this is not possible in a field experiment due to systematic and random noise in a realistic situation. In order to measure the effect of an independent variable on a dependent variable in the field experiment, it is not only necessary to maximize the variance of the manipulated variable and any assigned variables but also to measure the dependent variables as precisely as possible. In other words, the dependent variable measures are often so crude that they cannot pick all the variance that has been engendered by the independent variables.

Survey Method

When a researcher collects information from a known setting, then he is doing a survey research. Thus, we can say that survey is the collection of information from a known setting. Before one intends to start the collection of information, a few queries must be answered relating to five different dimensions. The researcher must have a clear idea of what he intends to survey and what should be the size of his sample. At the same time, keeping the objective in mind, the appropriate time to conduct the survey should be planned. The location to conduct the survey must be thought of in advance. Finally, it is also decided as to what means to proceed with towards the attainment of the desired goal, keeping in view the problem under investigation.

After the researcher has satisfactorily answered the above-mentioned queries, these stages can be conveniently displayed in the form of a flow chart, which will include the objectives, the samples, the instruments, the fieldwork, the statistical analysis and the report writing.

Before the survey is conducted, it is of prime importance that the objectives be made clear emphasizing on each aspect of the research being undertaken. It is also of great importance to know the population and sample characteristics before the survey is carried out. Different types of population and different types of *samplings* are considered in this step. The third step of survey is the selection of tools. Usually a questionnaire is used for survey research. The questionnaire can be of various dimensions, or a scale is used and questionnaire for the scale could be either structured or unstructured.

In a structured questionnaire, the question format is a standardized one whereas this is lacking in an unstructured questionnaire. After the responses have been obtained from the respondents, *content analysis* is done (content analysis is a research technique that seeks to describe objectively, systematically and quantitatively the manifest content). Finally, the report writing and interpretation is done at the end of the survey.

Advantages of Survey Research

The survey research is a useful technique for fact-finding. A large population can be tested or surveyed with less time and expense. Generally, in a survey, a sample of about four hundred is taken to draw firm

conclusions about the population. These are based on 'upper' 27 percent and 'lower' 27 percent of the sample or *discriminate functional analysis* (a statistical method for classifying individual values in several populations or for separating different populations). It is essential that classification or separation should take place based on not one but several criteria. There must be several scores for the individual to be classified and the corresponding scores for other individuals whose classification with respect to the population is known or has also to be ascertained. Knowledge of scores for the members of the basic groups enables a discriminant function to be obtained. Thus, with the help of survey research, we can draw firm conclusions about the general population.

Disadvantages of Survey Research

A survey research gives superficial information and does not penetrate very deeply below the surface. Due to this reason, depth interview of a representative group of individuals are to be supplemented along with surveys. Another disadvantage of the survey research is that it gives the information at that time, in that locality. Seeing this from the psychological viewpoint, opinions and attitudes change so quickly within individuals that the results of a survey at a particular time may not be reliable at different points of time. In this context, the survey research is accepted within a span of time beyond which this type of research may not be any fruitful working hypothesis.

To conclude, we can say that in spite of the limitations, the survey research is the guiding principle for any researcher and in that sense for any nation. For the cross-cultural researcher, the economic, political, social factors of any country differ within and among the countries. These are all checked based on survey reports published by the government of these countries. In psychological research, the survey technique has been widely used for generalization of population characteristics based on sample statistics.

Observation Method

The observation method is commonly used in studies relating to behavioral sciences. Observation is a general phenomenon which every individual indulges in, but this type of observation is not scientific. Observation becomes a scientific tool when it serves a formulated research purpose, is systematically planned and recorded, and is subjected to checks and controls on validity and reliability. Observation can thus be defined as methodically controlled non-random purposive examination of the actions of one or several individuals in order to discover some distinct characteristics of their personality.

While using the observation method, the researcher should keep in mind as to what he intends to observe. He should also be clear and equipped with the recording devices he intends to use for the purpose of observation and how this recording is to be done. Along with this, he should ascertain as to how the accuracy of the observation can be ensured.

The observation method has its a**dvantages**. If observation is done accurately, subjective bias is eliminated. The information obtained using this method relates to what is currently happening. This method is independent of respondent's willingness to respond.

However, like other methods this method has its **disadvantages** as well. It is a very expensive method. The information provided is very limited and sometimes unforeseen factors may interfere with the observational task.

Types of Observation

Different types of observation are structured and unstructured; participant and non-participant observations; and controlled and uncontrolled observations.

Structured Observation: In structured observation, the units to be observed are carefully defined in advance; the style in which the observation is to be recorded is definite. The conditions are standardised and the data that is being recorded pertinent to the structured observation task. This is appropriate for descriptive studies. By descriptive studies, we mean studies that involve the description and understanding of the phenomenon and not just trying to explain the phenomenon casually and mechanically. This type of observation has a greater control on sampling and permits stronger generalizations and checks on reliability and validity. This is more like a survey, where every respondent is asked the same set of questions. However, in this case, questions are not asked. Instead, particular types of behavior are looked for and counted.

Structured observation may look quite scientific but it has its share of disadvantages as well. Language can act as a barrier and so can culture. Though it is possible to observe particular people or families, even if they agree to your presence, the fact that you are observing them can make them behave differently from normal and you are never sure that they would do the same things if they were not being observed.

Unstructured Observation: Observation is said to be unstructured when it takes place without the above-mentioned characteristics thought of in advance. This type of observation is best suited for exploratory studies. It is done during the early phase of the research. It may become specific to when and where to observe, what specific aspects of the setting or behavior to observe and how to make and record observations.

The best way to carry out unstructured observation is to organize yourself. Take a notebook and pen and note down when you see something interesting. Write down theories as you form them but do not jump to conclusions straight away. Look around for more evidence and confirm things you have observed by asking people.

Participant Observation: If the observer observes by making himself/herself a member of the group and he/she is observing so that he/she can experience the happenings around him/her, the observation is called participant observation. In participant type of observation, the natural behavior of the group can be recorded. The truth of statements can be verified as well. This method is easier for gathering information as well as is more reliable.

The strength of participant observation lies in the fact that it allows an insight into contexts, relationships and behavior. It can provide information previously unknown to a researcher that is crucial for project design, data collection and interpretation of other data. Figure 1.2 illustrates the steps in conducting a participant observation study.

However, this type of observation has its share of weaknesses as well. It is very time consuming. The documentation that is done is based on recall from memory that may not be always accurate. Further, the personal discipline and diligence of the researcher, if absent, may affect the observational process negatively. This method, on the part of the researcher, requires conscious efforts at objectivity since it is inherently subjective. The absence of this objectivity can thus become a great weakness for this method.

Non-Participant Observation: When the observer is observing the group by not being a part of it, then this type of observation is termed as non-participant. The observer may, if he wishes, disguise himself for observing so that the group he is observing may not get conscious. This type of non-participant observation is referred to as disguised observation.

Thus, in non-participant observation, the observer remains separate from his study population's activities and attempts to be unobtrusive. There may be a conscious structuring of observation in the sense of developing hypotheses to be tested, or following up unclear relationships. Nevertheless, the observer must be careful not to impose preconceived notions, and must remain flexible, and open to new interpretations. Although the observer attempts to be unobtrusive, it is recommended not to deceive. For both ethical and practical reasons, honesty really is the best policy in fieldwork and the people who are being observed have a right to know the scope and purpose of the study.

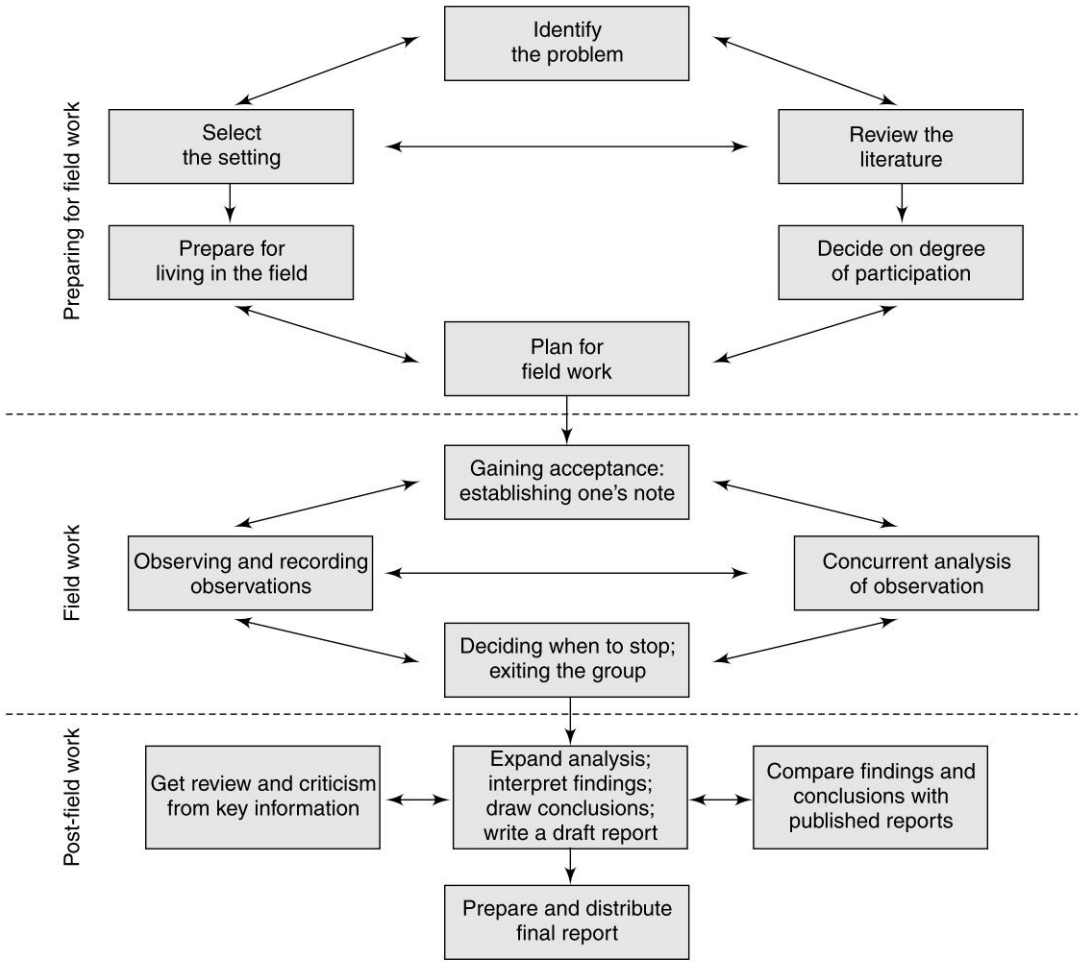


Fig. 1.2 Conducting a Participant Observation Study

Though using this method, there are no ethical problems and there is no influence over or by the group which is being observed, leading to the research data being more objective. The researcher can use more aids for recording as he is not hiding his role. Nevertheless, this type of observation also has its share of disadvantages. The presence of the researcher can affect the group being observed (*Hawthorne effect*) and the group may not act naturally. There is also very limited opportunity to ask further questions which makes it difficult to discover the meaning attached to events. Finally, there is also the risk of researchers imposing their own subjective interpretations on events they witness.

Non-Participant Observation—Steps to Follow

1. **The preliminary tasks**
   - Clearly describe the research problem.
   - State the precise aim of the research.

EXPERIMENTAL PERSPECTIVE

Relay Assembly Experiments

In one of the studies, experimenters chose two women as test subjects and asked them to choose four other workers to join the test group. Together the women worked in a separate room over the course of five years (1927–1932) assembling telephone relays.

The output was measured mechanically by counting how many finished relays each dropped down a chute. This measuring began, in secret, two weeks before moving the women to an experiment room and continued throughout the study. In the experiment room, they had a supervisor who discussed changes with them and at times used their suggestions. Then the researchers spent five years measuring how different variables impacted the group's and individual's productivity. Some of the variables were:

- Giving two 5-minute breaks (after a discussion with them on the best length of time) and then changing to two 10-minute breaks (not their preference). Productivity increased but when they received six 5-minute rests, they disliked it and reduced the output.
- Providing food during the breaks.
- Shortening the day by 30 minutes (the output went up); shortening it more (the output per hour went up, but the overall output decreased); returning to the first condition (where the output peaked).

Changing a variable usually increased productivity, even if the variable was just a change back to the original condition. However, it is said that this is the natural process of the human being to adapt to the environment without knowing the objective of the experiment occurring. Researchers concluded that the workers worked harder because they thought that they were being monitored individually.

Researchers hypothesized that choosing one's own co-workers, working as a group, being treated as special (as evidenced by working in a separate room) and having a sympathetic supervisor were the real reasons for the productivity increase. One interpretation was: 'The six individuals became a team and the team gave itself wholeheartedly and spontaneously to cooperation in the experiment.' (There was a second relay assembly test room study whose results were not as significant as the first experiment.)

- Develop an explanation that either links your research to a theory or says why the observations should be made.
- State the hypotheses (if any) to be tested.
- Identify the appropriate test statistic (if needed).

2. **The observational system**
   - Identify the type(s) of behavior to be observed.
   - Develop clear and objective definitions of each category of behavior.
   - Check that the categories are complete and cover all the target behavior.
   - Check that each category is clearly distinct from others.
   - Check that the differences between each category are easily seen in the observing situation.
3. **The observational process**
   - Identify an appropriate location to make your observations.
   - Decide which data sampling procedure to use.
   - Decide whether to use overt or covert observation.
   - Decide whether to use one or more observers to collect information

4. **And finally . . .**
   - Design the data collection sheet.
   - Review the ethical standards of the investigation.
   - Run a pilot study and make any necessary amendments to the observation system or procedure.
   - If more than one observer has been used, make a preliminary assessment of inter-observer reliability.

Controlled Observation When observation takes place according to definite prearranged plans involving experimental procedures, the same is then termed as controlled observation. This is a type of observational study where the conditions are contrived by the researcher. This type of observation may be carried out in a laboratory type situation and because variables are manipulated, is said to be high in control. The weakness of this method is that it lacks external validity when compared to naturalistic observation because of artificiality of the situation. Moreover, since the participants are aware that they are being studied, they behave differently.

Uncontrolled Observation When the observation takes place in a natural setting, it may be termed as uncontrolled observation. The main drawback of uncontrolled observation is subjective interpretation.

Ensuring Reliability and Validity of Observations

Reliability refers to how consistent a measuring device is. A measurement is said to be reliable or consistent if the measurement can produce similar results if used again in similar circumstances. A common way of assessing the reliability of observations is to use *inter-rater reliability*. This involves comparing the ratings of two or more observers and checking for agreement in their measurements. If the reliability of an observational study is to be improved, then it should be ensured that the categories are clear or that the observers are well-trained in the use of the checklists.

Validity refers to whether a study/test measures or examines what it claims to measure or examine when compared with accepted criterion. Observations could lack validity for a number of reasons. If participants are aware that they are being observed, they might behave in the way they feel they should behave. Validity could also be reduced by observer bias, i.e. the observer may be influenced by expectations and not record what happened objectively. Validity could be improved in a number of ways. Perhaps some of the categories could be coded in a different or clearer way. Observers could be kept unaware of the aims of the observation or more observers could be employed.

Interview Method

Interviewing is one of the major methods of data collection. It may be defined as two-way systematic conversation between an investigator and an informant, initiated for obtaining information relevant to as a specific study.

The interview method of collecting data involves presentation of oral verbal stimuli and reply in terms of oral verbal responses. Interviewing involves not only conversation, but also learning from the respondents' gestures, facial expressions and pauses, and his environment. Interviewing requires face-to-face contact or contact over telephone and calls for interviewing skills. Interviews can be both structured and unstructured.

Interviewing may be used either as a main method or as a supplementary one in studies related with individuals or groups. Interviewing is the only suitable method for gathering information from illiterate or less educated respondents. It is useful for collecting a wide range of data from factual demographic data to highly personal and intimate information relating to a person's opinions, attitudes, values, beliefs, past experience and future intentions. When qualitative information is required or probing is necessary to draw out fully, then interviewing is required. Where the area covered for the survey is compact or when a sufficient number of qualified interviewers are available, personal interview is feasible.

Interview is often superior to other data-gathering methods. People are usually more willing to talk than to write. Once rapport is established, even confidential information may be obtained. It permits probing into the context and reasons for answers to questions.

Interview can add flesh to statistical information. It enables the investigator to grasp the behavioral context of the data furnished by the respondents. It permits the investigator to seek clarifications and brings to the forefront those questions, that, for one reason or another, respondents do not want to answer.

The **advantages** of the interview method are many. More information and that too in greater depth can be obtained. The interviewer by his own skills can overcome the resistance, if any, of the respondents. There is greater flexibility in this method. The observation method can as be applied for recording verbal answers to various questions. Personal information can be obtained easily under this method. Samples can be controlled more effectively. The interviewer can control which person(s) will answer the question. The interviewer may catch the informant off-guard and this may secure the most spontaneous reactions. The language of the interview can be adapted as per requirements. Supplementary information can also be collected.

With the advantages, the interview method also has its share of **disadvantages**. This method is an expensive and time-consuming one. At times, interviewer bias may be there. Respondents may not be easily available. The presence of the interviewer on the spot may over-stimulate the respondent. Interviewing, at times, may also introduce systematic errors. Effective interview presupposes proper rapport with respondents that would facilitate free and frank responses. This is often a very difficult requirement.

Types of Interviewing

We will now delve into various types of interviewing.

Personal Interviewing

Indirect Personal Investigation In this case, the interviewer has to collect the information personally from the sources concerned. This method is particularly suitable for intensive investigations.

Indirect Oral Investigation Under this, the interviewer has to cross-examine other people who are supposed to have knowledge about the problem under investigation and the information thus obtained is recorded. Government committees make use of this method.

Telephone Interviewing Telephone interviewing is a non-personal method of data collection. It is not a very widely used method, but plays an important part in industrial surveys, particularly in developed regions.

This method is more flexible in comparison to mailing methods. It is also faster than other methods. The cost per response is relatively low as compared to the personal interviewing method. Recall is easy; callbacks are simple and economical. There is a higher rate of response. Replies can be recorded without causing embarrassment to respondents. The interviewer can explain requirements more easily; at times access can be gained to respondents who otherwise cannot be contacted for one reason or the other. No field staff is required. The sample can be more representative and wider.

However, telephone interviewing has its demerits as well. Little time is given to respondents for considering answers; interview period is not likely to exceed five minutes in most cases. Surveys are restricted to respondents who have telephone facilities, extensive geographical coverage may get restricted by cost considerations. It is not suitable for intensive surveys where comprehensive answers are required to various questions. Possibility of the bias of the interviewer is relatively more. Questions have to be short and to the point, probes are difficult to handle.

Table 1.3 compares advantages and disadvantages of various types of interviews.

TABLE 1.3 Comparative Summary of Types of Interviews

Type of Interview	Advantages	Disadvantages
Structured Interview	■ Standardization of all questions can give quantifiable data. ■ Replication. ■ Data is more reliable as the issue is being investigated in a consistent way. ■ Allows generalization of results/conclusions to the population from which the sample was drawn.	■ Restrictive questioning leads to restrictive answers. ■ Insensitive to participants' need to express themselves. ■ Validity of questions asked. Are they the right ones?
Semi-structured Interview	■ Standardization of most questions gives quantifiable data. ■ Replication. ■ Data is therefore reasonably reliable. ■ Ability to ask some spontaneous questions is sensitive to participant's need to express themselves.	■ Its use of an occasional spontaneous question makes these answers difficult to quantify and analyse. ■ Spontaneous questions asked of some and not of others can be seen as unfair, especially in personnel selection.
Clinical Interview	■ Flexible, responsive and sensitive to participants. ■ Preparation of core questions should ensure validity. ■ Core questions and responses should be reliable and analyzed easily.	■ Difficult to replicate. ■ As a result, an inability to generalize your findings to a wider population. ■ Possible interviewer bias in their use of leading spontaneous questions.
Unstructured Interview	■ Flexible, responsive and sensitive to participants. ■ Relaxed and natural for those taking part. ■ Highly detailed and ecologically valid qualitative data.	■ Difficult to replicate. ■ As a result, an inability to generalize your findings to a wider population. ■ Possible interviewer bias in 'selective' use of leading and spontaneous questions.

Questionnaire Method

This is quite a popular method of data collection, especially when big enquiries have to be conducted. Apart from psychologist, this method is used by private individuals, behavioral science research workers, private and public organizations and even by government agencies. This method involves the use of a questionnaire, which is usually sent through post or distributed by hand to the respondents taken for that particular study or survey. The respondents are requested to answer the questionnaire and return the same through post or by hand. The questionnaire consists of a number of questions printed or typed in a definite order on a form or a set of forms with instructions on the first page.

The **advantages** of the questionnaire method are many. There are low costs even when the universe is large and is widely spread geographically. It is free from the bias of the interviewer; the respondent is free to answer as per his own wish. The respondents also have adequate time to give well thought out answers. Those respondents who are not easily approachable can be sent a questionnaire and their responses obtained. Large samples can be used and thus the results can be made more dependable and reliable.

However, like other methods this method also has its share of **demerits.** Though, it is easy to send questionnaires through post, but there is no guarantee that they will be filled up and returned. Generally, there is a very low rate of return. The sample using this method gets restricted to only those people who can read, write, and are cooperating to fill up the questionnaire. Apart from this, there is an inbuilt inflexibility because of

difficulty of amending the approach once questionnaires have been dispatched—hence there is no flexibility. There is also the possibility of ambiguous replies or omission of replies altogether to certain questions. This omission makes interpretations difficult. Another demerit is not being sure if the willing respondents are truly representative of the sample. Finally, in a time where speed is important, this is the slowest method of all.'

Before using this method, it is always advisable to conduct a '*pilot study*' or '*pilot survey*' for testing the questionnaire. Such a survey being conducted by experts brings to light the weaknesses, if any, of the questionnaire and of the survey techniques. From the experience gained in this way, improvement can be made.

Cross-Cultural Method

The cross-cultural method is designed to discover similarities and differences amongst cultural patterns in a sizeable sample of societies. In this method, each society is assigned a 'score' on a number of selected cultural dimensions. This score is the modal practice or belief, etc. in the society. The scores of the various societies are then compared.

The potentialities of the cross-cultural method, long in use by anthropologists, have been significantly increased by the creation of the Human Relations Area Files. This is a cooperative enterprise among a number of universities to collect and process ethnographic data on a worldwide sample of societies.

The cross-cultural method has been used to test hypothesis derived from cultural theory and in recent years, to test hypothesis from psychological theory.

The behavior of individuals in interaction can be analysed in terms of three systems: the personality system, the social system and the cultural system. Since personality and culture are intermeshed, we have to analyse the term personality. Analysis in terms of personality considers properties of individuals such as attitudes, needs, traits and feelings, as well as processes like learning and perception.

A number of auxiliary techniques have come to be used to supplement the major anthropological methods, especially by anthropologists interested in the relation between personality and culture. Among these are the projective test techniques and the attitude scale.

Sociometric Method

Before we talk about this method, let us first talk about sociometry. Any group of persons observed over a period of time exhibits regularities in patterns of association. When members can choose who to associate with in a given activity, some persons are chosen more frequently than others. In part, choices are based upon liking or positive effect towards the other person. The patterns of attraction characterizing regular association among group members may be termed the affect structure of the group. Such regularities of association have been conceptualized in terms of sociometric structure. The phrase comes from sociometry, an intellectual movement within the behavioral sciences founded by **J.L. Moreno** (1953).

As originally used, the objective of this method was to establish the pattern of feelings of acceptance and rejection, of likes and dislikes that exist among the members of the group. The method involves asking each member of the group to name privately the other persons in the group with whom he would like, and with whom he would not like, to engage in some particular activity.

The sociometric method has been extended to include other ways of discerning the interpersonal relations among people, beyond what is revealed in their reported feelings about others. Thus, we may record the frequency of contact or the total duration of contact between pairs of individuals. Where such contacts are largely voluntary, it is assumed that their frequency provides a good measure of group structure. The data put together makes it possible to construct a *sociogram* that pictures for the whole group all the patterns of

mutual like, dislikes and indifference, and the pattern of interaction. It is easy for the investigator to see at a glance what the sociometric structure of a group actually is—the cliques, the people who are much liked and disliked, and by whom, the social violates, etc.

Thus, the sociometric method, in its original form, yields a description of the pattern of likes and dislikes among the members of the group. The extension of the method to secure reports of frequency of visiting, eating meals together, etc. makes it possible to portray the pattern of interaction among the members of a group. Sociometric data may be represented graphically in a sociogram. The construction of sociometric indexes is another way of treating the data to describe the individual's sociometric status and various aspects of the group structure.

Sociometry Test

The basic technique in sociometry is the 'sociometric test'. This is a test under which each member of a group is asked to choose from all other members those with whom he prefers to associate in a specific situation. The situation must be a real one to the group under study, e.g., 'group study', 'play', 'class room seating' for students of a public school. A specific number of choices, say two or three, to be allowed is determined with reference to the size of the group and different levels of preferences are designated for each choice. Suppose we desire to find out the likings and disliking of persons in a work group consisting of eight persons. Each person is asked to select three persons in order or preference with whom he will like to work on a group assignment. The levels of choices are designated as: the first choice by the' number 1, the second by 2 and the third by 3.

Case Study Method (Clinical Point of View)

The term 'case study' has been employed in two types of investigation. A study in which real or assumed situations are presented for discussion as a means of arriving at basic principles in a given field or of examining an individual's or a group's understanding of principles has been called case study. A detailed study of an individual conducted for the purpose of bringing about better adjustment of the person, who is the subject of the investigation, is also known as a case study. In a case study, all available data are surveyed, and the significant items are assembled, organized and then studied.

Here, in our discussions of the case-study method, we will concentrate on the case-study method from the clinical point of view since this method is widely used in the area of clinical psychology.

A case study presents the story of an individual; in as complete and as objective form as possible. It does not interpret the data and it in itself does not bring to a focus the information on the present problems faced by the individual.

Since the first task in making the case study is to get the facts about the individual, the initial stages of the case study are almost identical with the case history. The case study however goes beyond the case history. A case history is to a considerable extent a clerical task but keen intelligence and insight are called for in making a case study. The facts available in the case history are marshalled together and interpreted and a diagnosis is made which will serve as a starting point for treatment.

Assembling and Organizing Data in a Case Study (Outlines for Case Study)

There is no set way for making a case study. Outlines vary with the nature of the case and the preferences of the person conducting the case study. A considerable number of outlines have appeared in the case-study literature, one of which is being presented here as an example.

Rivlin's Outline

1. The complaint
2. The Child (details such as parents, status, age, sex, class, etc.)
3. Physical appearance
4. Personality traits (attitudes, play life, hobbies, dislikes, unusual fear, special personal problems)
5. Educational status
6. Results of medical examination
7. The environment (family)
8. The neighborhood

Points To Be Observed In Making a Case Study (Planning a Case Study)

If a case study is being made for the first time, the following points must be kept in mind:

1. Only that case must be selected in which the examiner is interested from the standpoint of the nature of the case and the personality of the individual concerned.
2. Choose a person who needs real help and who would cooperate.
3. Plan only as much as can be accomplished.

Collecting the Data (Precautions to Take)

While collecting data, care should be taken that while interviewing and testing the client he should not take on a defensive stand. He should not be made to feel that he is a culprit or that he is in any way an extreme deviate. The meeting ground of the case investigator and the client should be one of sharing in the solution of the problem. If the case investigator can enlist the interest of the client and can get him to take the initiative from the beginning, the prognosis for the successful solution of the client's problem is excellent.

Writing up the Case

There is no defined pattern as such for writing up the case, but certain general principles should probably be observed.

1. Write objectively, minimally and with directness. The report should not reflect personal bias.
2. In the report of the case, use both general statements and specific illustrations.
3. Eliminate irrelevant items; confine the case report to a few typewritten pages.

Applying and Evaluating Treatment

People who are inexperienced in making case studies often find that the study moves along smoothly until the stage of applying treatment, but that this stage presents problems, which seem frustrating to many. The observation of a few suggestions may help to clarify these problems.

1. A case investigator should not attempt to apply treatment for difficulties that are entirely outside his experience. He should frankly acknowledge his inability to meet the situation and should conclude his report with a recommendation for referral.
2. During the period of treatment, the case investigator should keep a careful journal record of the progress of treatment. A complete record is of great help in making a final report at the end of the period of treatment.
3. If the case is the kind that lends itself to measurement, comparable tests should be administered at the beginning and at the end of the treatment so that a comparative analysis may be made towards the end of the treatment.
4. After a case has been released from treatment, it should be followed up and the individual should be kept under observation for a few months to make sure that a relapse does not take place.

WRITING OF A RESEARCH REPORT

Purpose

The purpose of the report is to tell readers the problem investigated, the methods used to solve the problem, the results of the investigation and conclusions inferred from the results. It is not the function of the investigator to convince the reader of the virtue of the research. Rather, it is to report as clearly as possible what was done, the outcome of the doing and the investigator's conclusion. The report should be well written so that the reader himself can reach his own conclusions as to the adequacy of the research and the validity of the reported results and conclusions. To achieve this purpose is not an easy task. The writer must strive for the right blend of detail, brevity, objectivity and for clarity in presentation.

Structure

The structure of the research report is simple. It is almost the same as the structure of the research itself: the methodology, the results. Here are some general outlines:

1. **Problem**
   - Theory, hypothesis, definition
   - Previous research; the literature
2. **Methodology**, **Data Collection**
   - Sample and sampling methods
   - How hypothesis were tested (methodology)
   - Experimental procedure, instrumentation
   - Measurement of variables
   - Methods of analysis, statistics
   - Pretesting and pilot studies
3. **Results, Interpretation and Conclusions**

Problem

The problem section differs greatly in different reports. In thesis and books, it is usually long and detailed. In published research reports, it is kept to a minimum. The basic idea to keep in mind, though seemingly obvious is not easy to follow: Tell the reader what the research problem is, tell them in question form.

The statement of the general problem is usually not precise and operational. Rather, it sets the general stage for the reader. The sub-problems, however, should be more precise. They should contain implications for testing.

Some report writers, rather than stating the problem, state the general and specific hypothesis. A good practice would seem to be is to state the broader general problem and then to state the hypothesis, both general and specific. Whatever way is used, it should be kept in mind what were the main propositions that were tested. An important part of the statement of the problem is the definition of the variables. At some point in the problem discussion, the variables should be defined. Inform the reader not only of the variables but also about what you mean by them. Define in general and operational terms giving justification for your definitions.

There are two main reasons for discussing the general and research literature related to the research problem. The first of these is more important, it is to explain and clarify the theoretical rationale of the

problem. In this manner, the investigator provides a general picture of the research topic and fits his problem into the general picture.

The second reason for discussing the literature is to tell the reader what research has and has not been done on the problem. Obviously, the investigator must show that his particular investigation has not been done before. The purpose, of course, is to locate the recent research in the existing body of research on the subject and to point out what it contributes to the subject.

Methodology and Data Collection

The function of the methodology and the data collection section of the research report, of course, is to tell the reader what was done to solve the problem. Great care must be exercised in reporting so that the criterion of replicability is satisfied. That is, it should be possible for another investigator to reproduce the research, to reanalyse the data, or to arrive at unambiguous conclusions as to the adequacy of the methods and data collection.

The first part of the methodology is data collection section that should tell what sample or samples were used, how they were selected and why they were so selected. If specific sample is used, the reason for using it should be stated. If the samples were randomly selected, this should be stated. The method of random sampling should be specified.

The method for testing the hypothesis should be reported in detail. If the study has been experimental, the manner in which the independent variable(s) has been manipulated is described. This description includes instruments used—teaching machines, audio-visual aids and so on. It also includes instructions to the subjects, control, precautions and the like. If the study has been *expost-facto*, the procedures used to gather data are outlined.

The report of any empirical study must include an account of the measurement of the variables of the study. This can be accomplished in a few sentences in some studies.

In a *factor analytic* study, for instance, a lengthy description of measurement instruments and how they were used may be required. Such descriptions will of course, include justification of the instruments and how they were used as well as evidence of their reliability and validity.

An account of the data analysis methods used is sometimes put into the methodology section, sometimes in the analysis-interpretation section. It is probably better to include these methods in the methodology section, though space can sometimes be saved the other way. Whichever practice is followed, the analysis method must be outlined and justified. If an unusual method of analysis is used or if a common one is used in an unusual way, the investigator should describe what was done in sufficient detail to enable a competent reader to understand it. If space is at a premium, as it usually is, sometimes a reference to a technical source of the analytic method is sufficient.

In many investigations, pilot studies and pretesting is used (indeed, they should be used in most studies). If so, what was done and the outcome of the same are reported. If the pilot study was solely for trying out the instruments or the variables manipulated on a small scale, little is stated. If, however, the pilot study or the pretesting supplied actual research data, the reader is entitled to know the methodological details.

Results, Interpretation and Conclusions

This part of the report, though logically a unit, is often broken down into two or three sections. The interpretation of results and the conclusions drawn from the results are often reported together in journal research reports. In a thesis or book, however, it may be desirable to separate the data from their interpretations and from the conclusions.

The results or data of a research study are the raw materials for the solution of the research problem. The report writer must be exceptionally careful to report his results as accurately and as completely as possible, informing the reader how the results bear on the hypothesis.

Before writing this part of the report, it is helpful to reduce the data and the results of the data analysis to condensed form, particularly tables. The researcher should thoroughly digest the data before writing. The question, whether the data support the hypothesis must be clearly answered in his mind. After outlining the results section, he should write the report. While writing, the investigator should guard against wandering from the solution of research problem.

Somewhere in the final section of the research report, the limitations and weaknesses of the study should be discussed. Major limitations should be pointed out to enable the reader to judge the validity of the conclusions drawn from the data and the general worth of the study.

Limitations of social, scientific and educational research generally come from sampling and subject assignment inadequacies, methodological weaknesses and statistical deficiencies. The writing of the conclusions is affected by the acknowledged limitations and weaknesses.

Writing

It is not easy to write minimally and visibly. One has to work at it. One should realize that almost no writer could escape the necessity of constant revision by reorganizing pairing, deleting circumlocutions, redundancies and other verbal facts.

Although a research report should be detailed, there is no need to waste words. State the problem, the methodology, and the results as clearly, minimally, and in brief as possible. Unnecessary words and expressions should be revised while doing the final editing.

Writing scholarly papers and research reports requires a certain amount of routine drudgery that only a few persons like. Bibliographies, footnotes, tables, figures and other mechanical details however cannot be omitted. The purpose of statistical, tabular and other condensed presentation should be kept in mind.

A fairly safe generalization to guide one in writing a research report is, first drafts are not adequate. In other words, almost any writing improves upon revision. It is usually possible to simplify the first draft language and to delete unnecessary words, phrases and even sentences and paragraphs. A first rule then is to go over any report with a ruthless pencil towards the end of greater simplicity, clarity and brevity. With experience, this not only becomes possible, it becomes easier.

If an adequate outline has been used, there should be little problem with the organization of a research paper or report. Yet, sometimes it is necessary to reorganize a report.

Anyone's research writing can be improved in two ways: by letting something one has written to sit for a few days, and by having someone else read and criticize one's work. Criticism deserves the serious, careful and objective attention it desires.

KEY TERMS

Psyche
Humanistic psychology
Parapsychology
Gestalt
General psychology
Clinical psychology
Psychodynamics
Social psychology
Counseling psychology

EVALUATE YOURSELF

Multiple Choice Questions

1. Psychology aims at studying
   (a) Behavior and mental processes (b) Behavior
   (c) Mental processes (d) Conscious experiences
2. Psychology primarily aims at
   (a) Predicting behavior (b) Understanding behavior
   (c) Controlling behavior (d) Correcting behavior
3. Which of the following approaches to psychology considers the past experiences of an individual in determining his/her behavior?
   (a) Behavioral approach (b) Psychoanalytic approach
   (c) Cognitive approach (d) All the above approaches
4. Which of the following is stressed upon by the gestalt school of psychology in perception?
   (a) Past experiences (b) Motivational factors
   (c) Configurational characteristics of stimuli (d) Discrete characteristics of various stimuli
5. Animals are not useful in the study of
   (a) Learning (b) Heredity
   (c) Imitation (d) Attention
6. Which of the following is a reason why psychologists prefer experimental method?
   (a) Quantitative results can be obtained.
   (b) Precision instruments can be used for accurate observation.
   (c) It permits the exercise of rigorous controls.
   (d) Permanent records of behavior can be maintained.
7. The distinguishing characteristic of a laboratory is that it is a place where the experimenter can
   (a) Carefully control conditions (b) Observe behavior
   (c) Study animal behavior (d) Do all of the above
8. A stimulus is best defined as
   (a) Any happening in the environment (b) A behavior pattern of organism
   (c) Anything that evokes a response in an organism (d) Anything that disturbs an organism
9. In the study of behavior, greater objectivity and reliability are the criteria that determine the preference for
   (a) Scientific method over introspection
   (b) Statistical method over data obtained from in-depth study
   (c) Normative study over theoretical study
   (d) Observational method over clinical method
10. The most effective method of study in psychology is
   (a) Historical study (b) Case-study method
   (c) Experimental method (d) Survey method

Descriptive Questions

1. Define psychology as a behavioral science.
2. What are the primary goals of psychology?
3. What were the basic ideas of structuralism and functionalism? Highlight the major differences between these two schools.
4. What do you understand by 'gestalt'? Highlight the contribution of the gestalt school.

5. Psychology is a fast-growing behavioral science. Discuss and support your answers with modern perspectives.
6. Define an experiment. Highlight the advantages of the experimental method.
7. Highlight the differences between the laboratory experiment and the field experiment.
8. Comparatively discuss the various types of observations used for data collection.
9. What are the various types of interviewing?
10. Outline the steps involved in writing a research report.

Critical Thinking Questions

1. Is the study of psychology science or arts?
2. How much is the development of the discipline in India influenced by the West? Elaborate.
3. 'Is it behavior that can be observed or should be studied or is it the suspected inner working of the mind?' Discuss in relation with the psychological perspectives which fits with the same.
4. Laboratory research is done in an artificial setting and the effects of the independent variable are weak then how can we say that the results obtained can be applied to real life settings.
5. As a student of psychology do you feel that you will be able to analyze all the people you meet and see right through them and discover their inner thoughts.

PRACTICAL EXERCISES

1. Divide the class into six groups. Ask each group to illuminate one of the six modern perspectives using a relevant topic, such as corruption, glass ceiling, herding and politics.
2. Focusing on one of the major perspectives, can you describe the kinds of research questions and studies that researchers using that perspective might use?

Answers to Multiple Choice Questions

1. (a) **2.** (b) **3.** (d) **4.** (b) **5.** (d) **6.** (c) **7.** (a) **8.** (c) **9.** (a) **10.** (c)

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Chapter 2

Biological Foundation of Behavior

Chapter Objectives

After reading this chapter, you will learn

- Role of evolution and genetics in the shaping of human behavior.
- How environmental factors play a significant role in determination of human behavior.
- Anatomy and physiology of the human nervous system and its role in responding to external stimuli and manifestation in the form of basic sensory processes like hearing and vision and the disorders of the nervous system.
- Anatomy and physiology of the human endocrine system and the role of hormones in the development of biochemical processes, which are seen as manifestations like anxiety and sexual behavior.

DEVELOPMENT OF BEHAVIOR

The course of development of human behavior is determined by the interaction of the genetic potentials with the environmental compulsions. Some behaviors are outcome of evolutionary processes whereby structures and behaviors have been incorporated so that the organism has a better adaptation to his environment.

Role of Evolution In Determining Behavior

The tendency of living creatures to reproduce rapidly is basic to the evolutionary process. This creates competition for scarce resources. Given such competition pressures, the process of genetic variability, adaptation and selection operates to bring about evolutionary changes in behavior and structure.

Species-specific behavior patterns are based on the evolutionary process, but often their final form depends on a contribution during development from environmental factors, which members of a species share in common.

Many species-specific behaviors are triggered by stimuli in the environment called *releasers*; many of these behaviors consist of relatively stereotyped patterns of movement known as *modal action patterns*. A classic example of the modal action pattern type of species-specific behavior is provided by the study of the feeding behavior of young herring gulls. It has been found that instructive behaviors; pecking at a red spot by herring gull chicks, for instance can be modified by environmental factors common to a species into the perfected modal action pattern of behavior that is characteristic of that species. Millions of examples are found in the animal kingdom, but the existence of specific, stereotyped behaviors in human is controversial.

Genetic Factors In Human Development

In addition to the species heritage from evolution, the particular genetic constitutions inherited by individuals play a role in determining behavior. The field of behavior genetics studies the ways in which individual genetic constitutions contribute to behavior.

The genetic material consists of chromosomes and the genes, which are carried on the chromosomes; the genes are considered real genetic units. Some genes are *dominant*, some *recessive* and some sex linked. Most human characteristics are polygenetic, that is, determined by many sets of genes.

Humans have 23 pairs of *chromosomes*. The genes on one pair—the sex chromosomes (23rd pair of chromosomes)—determine the sex of the individual. Other characteristics determined by genes on the sex chromosomes are termed sex-linked characteristics. Genes work in pairs. If the genes of a pair are not identical, one is usually dominant over the other, which in turn is recessive. When the *genotype* or the genetic constitution contains dominant and recessive genes for a trait, the *phenotype* or the set of characteristics actually observed is that controlled by the dominant gene.

Selective breeding, mating animals that are high in a certain trait or low in a certain trait, is a method of studying the genetic basis of behavior. Another method for partialing out the effects of environment and heredity is the twin study in which the characteristics of identical or monozygotic twins (who share the same heredity) are compared with those of *fraternal* or *dizygotic* twins (who are no more alike than ordinary siblings).

Although it is not possible to pinpoint the specific genes responsible for behavioral traits, it is sometimes possible to show a relationship between chromosomes and behavior. In *Down's syndrome*, for instance, instead of a normal pair of number 21 chromosomes, there are three.

Intelligence is amongst the human traits that are most intensively studied from a genetic viewpoint. Correlational studies of people with various degrees of genetic relationship, especially comparisons of identical (MZ) and fraternal (DZ) twins, indicate that both the genetic constitution and environment, or nature or nurture, interact to produce the measured IQ.

Studies on a number of human personality traits show that genetics may contribute to some of them. However, the environment also contributes to the development of these traits as it interacts with the genetic potential. All behavior depends upon the interaction between heredity and environment; the genes set the limits of individual's potentials but what happens to this potential depends upon the environment.

Evidence indicates that the genetic constitution interact with the environment to play a role in causing behavior disorders such as *schizophrenia*. Similarly, diabetes mellitus, which is manifested largely due to the genetic structure can be controlled or prevented by suitable low carbohydrate diet.

Thus, nature or the genetic constitution and nurture or the environment are considered to act jointly to determine the behaviors and traits actually observed—the phenotype. The fact that a particular genetic

constitution, interacting with the environment can result in a number of different outcomes, or phenotypes, is known as the range of reaction.

Environmental and Maturational Factors In Human Development

Environment plays an important role in determining the development of the organism and the manifestation of its behaviors and traits. The contributions of nature and nurture to particular behaviors are studied by attempting to hold one factor constant while varying the other. One way of doing this is to control the genetic factors and study the effects of impoverished or enriched environments.

Conditions of severe deprivation or unusual stimulation can affect the rate of development. Animals deprived of stimulation at an early age are poorer learners as adults than normal animals; an enriched environment produces better learning ability as well as increased brain size. Studies with human infants, however suggest that increased stimulation will not result in accelerated development unless the infant is maturationally ready.

Thus, the course of development in man, and in other organisms, is shaped by both maturation and learning. Maturation can be defined as an innately determined sequence of growth that proceeds at its own rate, relatively independent of the environment, although a minimum of environmental stimulation and support is needed. Some evidence suggests that there may be critical periods in development when the organism is most plastic and ready to acquire some of the behavior essential for optimal development later. During the critical periods, both favorable and unfavorable circumstances have lasting and perhaps irreversible consequences.

An unresolved question is whether development is essentially continuous or consists of a series of definable stages. Piaget's theory describes stages in cognitive or intellectual growth moving from the sensory-motor stage through the preoperational and the concrete operational stage to the formal operational stage. The *psychosexual stages* of Freud and the *psychosocial stages* of Erikson are attempts to place personality development into the context of a stage theory. The concept of stages has been useful, but evidence indicates that development is probably more continuous than stage theories would imply.

An important aspect of development is the development of *interpersonal relations*. Early social attachments form the basis for close interpersonal relations in adulthood. Insensitive mothering or repeated separations may undermine the child's trust and produce anxious attachment. Although consistent relationships between specific child-rearing methods and personality characteristics have not been found, an affectionate relationship with an adult in the early years appears to be crucial to normal personality development.

The process of *identification* is also important in personality development. Some distinctions can be made between sex role identification, in which modeling after the like-sex parent and sex-typing are central and personal (non sex-role) identification in which qualities not strongly sex-typed are learned from parents, siblings and peers. Children are most apt to identify with adults who are warm, nurturant, and powerful and viewed as similar to them in some way.

The age at which adolescents reach puberty or sexual maturity varies greatly, although girls, on the average, mature two years earlier than boys do. Late maturers of either sex (but more specially the late maturing boys) tend to have poorer self-concepts than early ones.

The adolescent in searching for his identity, re-examines his beliefs and challenges many of his parents' values. However, the data suggest that most adolescents end up with values very similar to those of their parents, at least on the important issues. Peer influences tend to have more influence on superficial characteristics.

Development is a continuous process; the individual changes both physically and psychologically and encounters new adjustment problems throughout life.

In brief, course of development of human behavior is governed by the interaction of genetic endowment with the environment. Those genetic features tend to persist which are helpful for the required adjustment with

the environment. Thus, some behavior patterns are the outcome of the evolutionary processes whereby structures and behaviors have been incorporated so that the organism has a better adaptation to the environment. Physiological psychology is that branch of psychology which aims at studying the relationship between physiological mechanisms and behavior. Thus, its goal is to understand and predict behavior as it is controlled and regulated by the physiological systems of the body.

Some behavior patterns are characteristic of a certain species of animals. These species-specific behavior patterns are based on the evolutionary process. Members of a certain species share a common environment and are affected by it in a more or less similar fashion. The final species-specific behavior is based on the interaction between the common genetic heritage and the common environment of the members of the species. Many species-specific behaviors consist of relatively stereotyped patterns or *fixed-action pattern* (FAP). Usually, such patterns are triggered by an environmental stimulus known as a releaser. Millions of examples of the modal-action pattern type of species-specific behaviors can be observed in the animal kingdom.

Human behavior, as we all know, is highly flexible and modifiable under different circumstances. The modal-action pattern type of behavior, characteristic of a certain species is not so prominent in humans. Learning plays an important role in the development of human behavior.

PSYCHOLOGY NUGGET

Scala Naturae and Lamarck's Theories

Until the 19th century, the most common theory among scientists was still the concept of *scala naturae*, proposed by Aristotle. According to this theory, living beings were classified on an ideal pyramid in which the simplest animals were represented by the lower levels and with complexity increasing progressively to the top, which was represented by human beings. There was also a group of 'biologists' who refuted the Aristotelian theory for a more anthropocentric one, according to which all living beings were created by Buddha to serve mankind, and would behave accordingly. A well-radicated opinion in the common sense of the time in the Western world was that animal species were eternal and immutable, created with a specific purpose, as this seemed the only possible explanation for the incredible variety of the living beings and their surprising adaptation to their habitat.

The first biologist elaborating a complex theory of evolution was Jean-Baptiste Lamarck (1744–1829). His theory substantially comprised two statements: first is that animal organs and behavior can change according to the way they are being used and second that those characteristics are capable of being transmitted from one generation to the next (well known is the example of the giraffe whose neck becomes longer while trying to reach the upper leaves of a tree). The second statement is that each and every living organism, human beings included, tends to reach a greater level of perfection. At the time of his journey for the Galapagos Islands, Charles Darwin was well aware of Lamarck's theories and was influenced by them.

Receptors and Effectors

Physical energy excites receptors when they are sensitive to the given form and intensity of energy. The resulting sensations are elaborated by the CNS into perceptions whenever several sensation inputs and CNS traces from past experiences are integrated. Sensations are studied in man when a subject reports on those aspects of perception that depend on sensation. This is the method of introspection. In animals subjects, electrodes are used to detect responses of the receptors, nerves or brain in the method of evoked potentials. The inputs from stimuli are controlled by the experimenter in both methods.

Receptors

Stimuli are physical events to which receptors respond. *Receptors are specialized to respond to specific forms of energy*. Some specialized receptors excite those parts of the brain whose activity results in *conscious sensation*; some receptors cause only *somatic* or *visceral reflexes* or arouse the brain in response to needs.

There are receptors specialized to respond to *mechanical, thermal, chemical, acoustical* or *photic energy.* When a receptor is activated by the form of energy for which it is specialized, it has received an adequate stimulus; if it is excited by another form of energy, it receives an inadequate stimulus. Either stimulus causes a *generator potential that fires sensory neurons.*

The modality of the resulting sensation depends on what part of the brain the nerve impulses reach, according to the law of *specific nerve energies*. Receptors transduce physical energy into nerve impulses. Receptors may be classified by their adequate stimulus. They may be classified by form as unspecialized nerve cells, specialized nerve cells or specialized receptor cells. They may be classified by location in the head only, or in the whole body as special senses or general senses. The general senses are *somesthesis* (pressure, pain, warmth, and cold) and *kinesthesis*. The special senses are *olfaction, vision, gustation, audition* and *vestibular* sensitivity. Receptors can be classified by the functional location of their stimuli as *exteroceptors, interoceptors* or *proprioceptors*. Exteroceptors include *cutaneous senses*; interoceptors include *organic senses*. Proprioceptors respond to body position and movement.

Effectors

The *muscles are called effectors* because they produce effects, changing the individual's relations with the environment. The only other effector possessed by the human organism is *certain glands* such as the salivary gland, which moistens food in the mouth. (Food in the mouth or even in the stomach or intestine is still in the environment, and the digestive juices poured out by the glands change the food before it is actually absorbed into the body.) The light-producing organ of the firefly and the electric shock-producing organ of certain fishes are effectors.

Two basic classes of effectors can be distinguished. *Muscle* cells have specialized in the property of contractility; they respond to stimulation by initiating chemical processes which change the configuration of the cell. In vertebrates three varieties of muscle cells exist. The simplest *smooth* muscle has developed a special substance, the *fibrillae*, which changes in shape and produces the overall deformation of the cell. Smooth muscles are found primarily in the viscera. *Striated* muscles have developed two types of fibrillae, one dark and the other light in appearance. These are arranged in an orderly sequence, giving the muscle a striated appearance. Striated muscles make up all the somatic musculature of the vertebrate organism. The third type of muscle contains the same light and dark fibrillae organized in what appears to be a random network. This muscle is found exclusively in the heart and has therefore been called the *cardiac* muscle.

The second class of effector is the *gland* cell. This cell responds to irritating stimulation of the cell membrane by producing novel chemical substances which are eventually secreted through the cell membrane. Basically, there are two types of gland cells. *Duct* glands discharge their secretions into body cavities such as the stomach or intestine; the *ductless* glands empty directly into the bloodstream. The secretions of duct glands typically have a much localized effect than those of ductless glands.

Adjuster Mechanism (Homeostasis)

Human biological adjustments are basic in the sense that they are life functions and have their equivalents in animals. Needs continually arise and are met. Many physiological adaptations occur automatically. The blood remains slightly alkaline within a very narrow range of change; any larger variation in the direction of acidity or increased alkalinity would result in death. Body temperature is controlled by 'thermostat' in

the brain. This thermostat regulates various processes such as combustion of food, perspiring, and dilatation or constriction of the capillaries. Such adaptations are labeled as *homeostasis*. The *hypothalamus* plays a major role in the maintenance of homeostasis. It helps provide a constant body temperature and monitors the amount of nutrients stored in the cells.

In brief 'homeostasis', in physiology, is an overall term for the tendency of biological systems to maintain a state of equilibrium. This tendency ranges from systems of internal balance in individual organisms to ecological patterns of balance in a community of organisms, as between numbers of predators and prey. The concept was first advanced in the 19th century by the French physiologist Claude Bernard, and was given its name by the American physiologist Walter B. Cannon. Cannon made a distinction between hierarchical, homeostatic levels: *reflex* and *instinctive behavior*, *acquired habits* and *adaptations* and *willed actions*, which serve the self-regulating system intent upon maintaining a 'fluid' equilibrium. Examples of homeostasis include the body's self-regulation of hormone and acid-base levels, the composition of body fluids and cell growth and body temperatures. On a broad scale, the world community of organisms tends to maintain some degree of evolving balance when not seriously disturbed. The so-called *Gaia hypothesis* of the earth as a living organism, which gained great popularity in the 1980s, may in some ways be regarded simply as an extension of homeostasis concepts.

HUMAN NERVOUS SYSTEM

Another way of studying human behavior and experience is by relating it to biological events, especially activity in the nervous system. The nervous system is composed of nerve tissues which in turn are made up of cells called *neurons*. There are billions of neurons in the nervous system connected to each other and thus making complex network. *Synapse* is the point of connection between two neurons. Figure 2.1 shows the human nervous system.

Neurons

Each nerve cell or a neuron is formed of several thousands of nerve fibers enclosed in a connective sheath. A nerve fiber is a long *axon* or *dendrite* of neuron. Each axon is filled with *axoplasm* continuous with the *cytoplasm* of neuron and is bounded by a thin membrane. In some nerve fibers, the axon is enclosed within a fatty myelin sheath. This is surrounded by a thin *nurilemma.* Nurilemma is the membrane of *Schwann cells* that lie in intimate contact with axon. The *myelin sheath* is interrupted at regular intervals by constrictions. These constrictions are called *nodes of Ranvier*. Figure 2.2 shows a typical human neuron.

Afferent and Efferent Nerve Fibers

Based on the direction of propagation of nerve impulse through nerve fibers, the neurons and nerve fibers are classified into *afferent* and *efferent* types.

Afferent nerve fibers conduct sensory impulses from the receptors present in the *peripheral tissue* towards the central nervous systems. The efferent nerve fibers conduct motor impulses from central nervous system to effectors.

Nerve Impulse

Nerve impulses are electrical events that move along the axon. In the resting stage of a neuron, the inside of a nerve cell is slightly more negative than the outside. When the axon of the nerve is stimulated the electrical

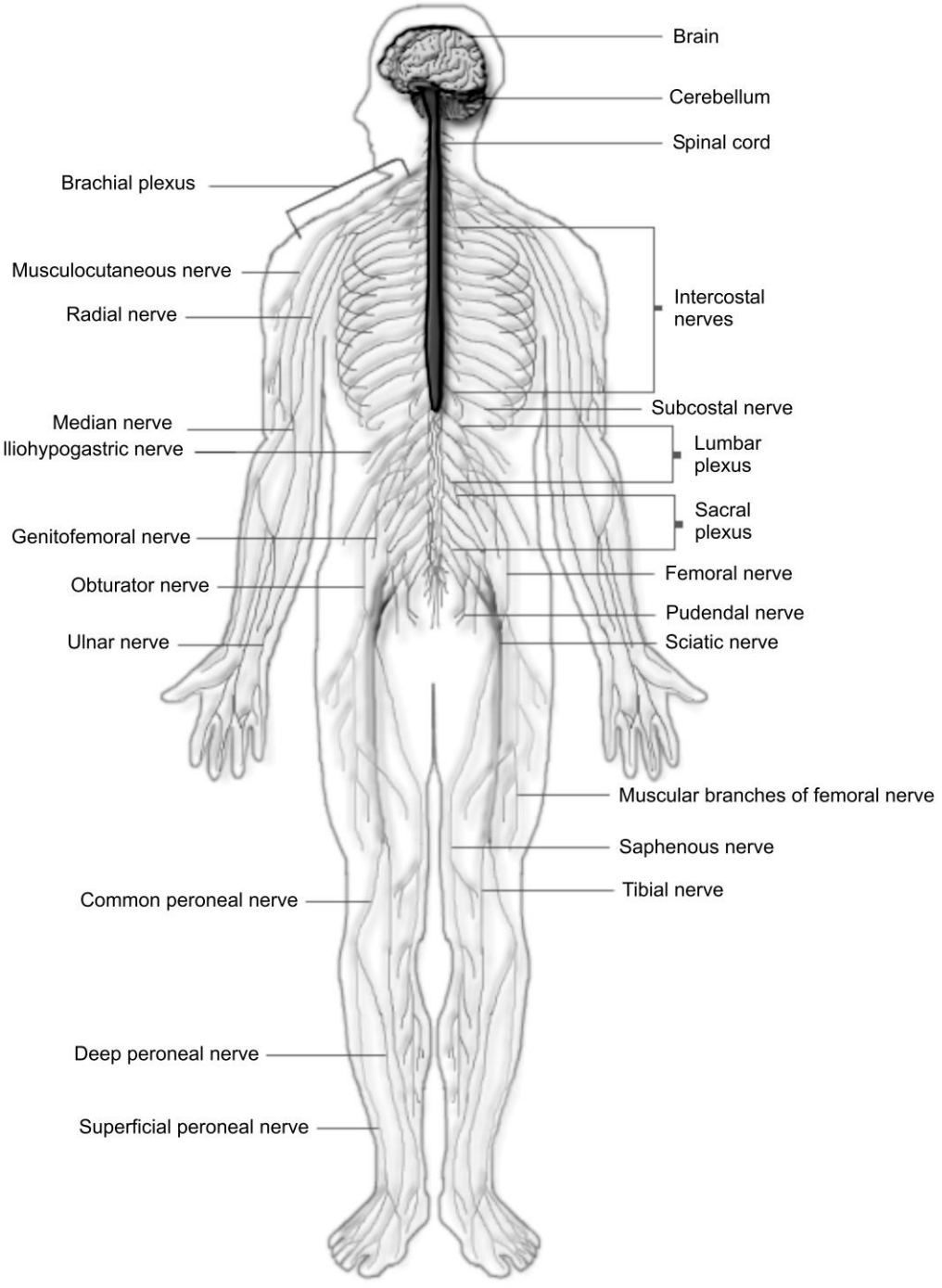


Fig. 2.1 Human Nervous System

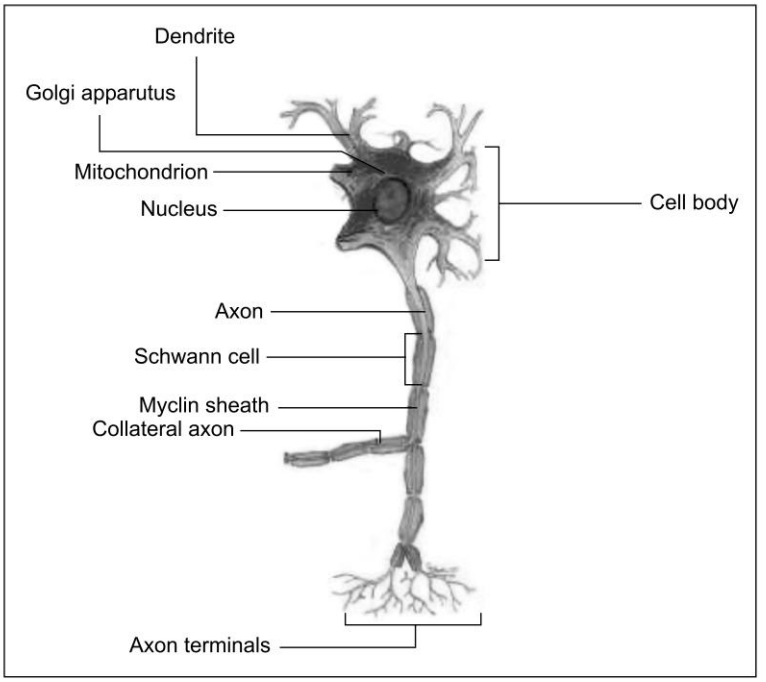


Fig. 2.2 A Typical Neuron

potential across the membrane is reduced and the inside of the neuron becomes positive for a very small fraction of a second. This process is the *nerve impulse*, which travels along an axon.

Neurophysiology

This is the study of how nerve cells or neurons receive and transmit information. Two types of phenomena are involved in processing nerve signals: *electrical* and *chemical*. Electrical events propagate a signal within a neuron and chemical processes transmit the signal from one neuron to another neuron or to a muscle cell.

As discussed above, a neuron is a long cell that has a thick central area containing the *nucleus*; it also has one long process called an *axon* and one or more short bushy processes called *dendrites*. Dendrites receive impulses from other neurons. (The exceptions are sensory neurons, such as those that transmit information about temperature or touch, in which the signal is generated by specialized receptors in the skin.) These impulses are propagated electrically along the cell membrane to the end of the axon. At the tip of the axon the signal is chemically transmitted to an adjacent neuron or muscle cell.

Electrical Transmission

Like all other cells, neurons contain charged *ions*: *potassium* and *sodium* (positively charged) and *chlorine* (negatively charged). Neurons differ from other cells in that they are able to produce a *nerve impulse*. A neuron is polarized—that is, it has an overall negative charge inside the cell membrane because of the high concentration of chlorine ions and low concentration of potassium and sodium ions. The concentration of these same ions is exactly reversed outside the cell. This charge differential represents stored electrical

energy, sometimes referred to as *membrane potential* or *resting potential*. The negative charge inside the cell is maintained by two features. The first is the selective permeability of the cell membrane, which is more permeable to potassium than sodium. The second feature is sodium pumps within the cell membrane that actively pump sodium out of the cell. When depolarization occurs, this charge differential across the membrane is reversed and a nerve impulse is produced.

Depolarization is a rapid change in the permeability of the cell membrane. When sensory input or any other kind of stimulating current is received by the neuron, the membrane permeability is changed, allowing a sudden influx of sodium ions into the cell. The high concentration of sodium, or action potential, changes the overall charge within the cell from negative to positive. The local change in ion concentration triggers similar reactions along the membrane, propagating the nerve impulse. After a brief period called the *refractory period*, during which the ionic concentration returns to resting potential, the neuron can repeat this process.

Nerve impulses travel at different speeds, depending on the cellular composition of a neuron. Where speed of impulse is important, as in the nervous system, axons are insulated with a membranous substance called *myelin*. The insulation provided by myelin maintains the ionic charge over long distances. Nerve impulses are propagated at specific points along the *myelin sheath*; these points are called the *nodes of Ranvier*. Examples of myelinated axons are those in sensory nerve fibers and nerves connected to skeletal muscles. In non-myelinated cells, the nerve impulse is propagated more diffusely.

Chemical Transmission

When the electrical signal reaches the tip of an axon, it stimulates small presynaptic vesicles in the cell. These vesicles contain chemicals called *neurotransmitters*, which are released into the microscopic space between neurons (the synaptic cleft). The neurotransmitters attach to specialized receptors on the surface of the adjacent neuron. This stimulus causes the adjacent cell to depolarize and propagate an action potential of its own. The duration of a stimulus from a neurotransmitter is limited by the breakdown of the chemicals in the synaptic cleft and the reuptake by the neuron that produced them. Formerly, each neuron was thought to make only one transmitter, but recent studies have shown that some cells make two or more.

Mirror Neurons—Cells That Read Mind

Moving to higher levels of the brain, scientists find groups of neurons that detect far more complex features like faces, hands or expressive body language. Still other neurons help the body plan movements and assume complex postures. The human brain has multiple mirror neuron systems that specialize in carrying out and understanding not just the actions of others but their intentions, the social meaning of their behavior and their emotions. These neurons are found in several areas of the brain, including the *premotor cortex*, the *posterior parietal lobe*, the *superior temporal sulcus* and the *insula*, they fire in response to chains of actions linked to intentions.

Mirror neurons, many say, are what make us human. They are the cells in the brain that fire not only when we perform a particular action but also when we watch someone else perform that same action. Neuroscientists believe this 'mirroring' is the mechanism by which we can 'read' the minds of others and empathize with them. It is how we 'feel' someone's pain, how we discern a grimace from a grin, a smirk from a smile. Mirror neurons allow us to grasp the minds of others not through conceptual reasoning but through direct simulation. By feeling, not by thinking.

Everyday experiences are also being viewed in a new light. Mirror neurons reveal how children learn, why people respond to certain types of sports, dance, music and art, why watching media violence may be harmful and why many men like pornography.

ORGANIZATION OF THE NERVOUS SYSTEM

The nervous system consists of the brain, spinal cord and nerves. The major divisions of the nervous system are as follows:

1. Peripheral nervous system
   (i) Somatic nervous system
   (ii) Autonomic nervous system: (a) sympathetic and (b) parasympathetic systems
2. Central nervous system

Peripheral Nervous System

Peripheral nervous system is constituted of nerves or fibers leading from the brain and the spinal cord to the rest of the body. The sensory nerves carry excitation from receptors to the central nervous system. The motor nerves carry excitation from the central nervous system to the glands and muscles. There are 31 pairs of spinal nerves.

Somatic Nervous System

Somatic system receives information from various receptors and controls the *skeletal muscles*. This system is usually considered in two parts—*cranial* and *spinal* nerves. There are 12 sets of cranial nerves and 31 pairs of spinal nerves. The cranial nerves originate in the brain and control the striated muscles. Table 2.1 shows the name, function and origins of the cranial nerves.

TABLE 2.1 Cranial Nerves: Name, Function and Origins

Number	Name	Functions	Origin or End in the Brain
I	Olfactory	(a) Smell	Cerebral hemisphere (ventral part)
II	Optic	(b) Vision	Thalamus
III	Oculomotor	(m) Eye movement	Midbrain
IV	Trochlear	(m) Eye movement	Midbrain
V	Trigeminal	(m) Mast catory movements	Midbrain and pons
VI	Abducens	(m) Eye movement	Medulla
VII	Facial	(m) Facial movement	Medulla
VIII	Auditory vestibular	(s) Hearing (s) Balance	Medulla
IX	Glossopharyngeal	(s) Tongue and pharynx	Medulla
X	Vagus	(s) Heart, blood vessels, viscera	Medulla
XI	Spinal accessory	(m) Neck muscles and viscera	Medulla

The spinal nerves originate in the spinal cord and are more arranged. They are classified into five groups. They enter and leave the cord through space between the spinal vertebrae. Table 2.2 shows their names, number and position of the spinal nerves in man.

TABLE 2.2 Spinal Nerves In Man: Name, Number and Position

Name	Number	Position
Cervical …	8	Neck
Thoracic…	12	Chest
Lumber …	5	Loin
Sacral …	5	End of spinal column
Coccygeal . . .	1	End of spinal column

Autonomic Nervous System (ANS)

Autonomic nervous system consists of nerve fibers from the spinal cord to the smooth muscles and glands. Hence, ANS is a motor system that controls the functioning of the visceral organs of the body. Autonomic system is so named because it controls the self-regulatory functions of the body, e.g. digestion and respiration.

The autonomic nervous system is further divided into the sympathetic and parasympathetic systems. Figure 2.3 shows the autonomic nervous system and its two divisions. The *sympathetic nervous system* originates at the *thoracic* and *lumbar regions* of the *spinal cord* and the *parasympathetic division* takes its origin in the *cranial* and *sacral regions* of the *central nervous system*. These two divisions are largely antagonistic in their effects.

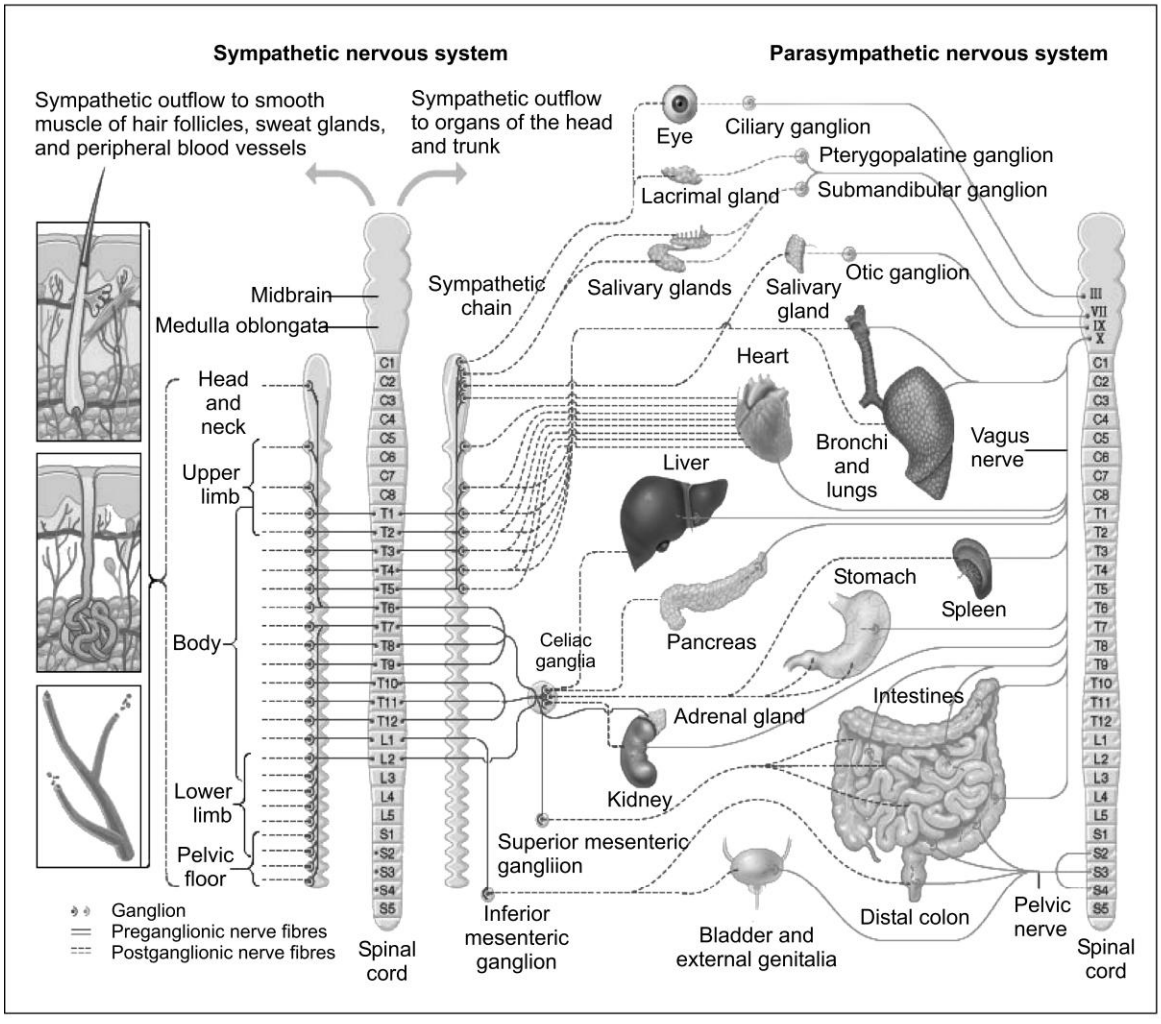


Fig. 2.3 Autonomic Nervous System

The sympathetic nervous systems consist of 22 sympathetic nerves arranged regularly along the spinal cord. The *thoracic-lumbar system*, as it is sometimes referred to, controls all the visceral organs below the heart—the liver, stomach, intestines, bladder, urogenital organs and adrenal glands. The sympathetic reactions tend to be 'mass reactions', widely diffused in their effects and that they are directed towards mobilization of the resources of the body for expenditure of energy in dealing with emergencies or emotional crisis (fight or fight reactions).

The parasympathetic nervous system is also known as the *cranio-sacral system*. This system conserves and stores bodily resources. Functionally, parasympathetic activity is seen when the subject is fully relaxed. In general, the effects of parasympathetic activity are usually discrete and isolated and directed towards conservation and restoration of the resources of energy is the body.

Central Nervous System

The central nervous system includes the nerves in the brain and spinal cord. The spinal cord lies in the *neural canal* of vertebral column. It extends from *medulla* to *lumbar region*. The spinal cord is cylindrical and gradually tapers and finally divides into a bunch of small nerves. Thirty one pairs of spinal nerves connect the central nervous system to various parts of the body. The inside core of the spinal cord consists of cell-bodies and is, therefore, gray, whereas the exterior part consist of the connecting axons and is, therefore, white in color. It appears H-shaped in cross section and contains cell bodies of association neurons. Two deep median grooves, namely *dorsal fissure* and *ventral fissure*, divide the spinal cord into two symmetrical halves. In the cross-section of spinal cord, its gray matter appears penetrating into the white matter and forms horns on either lateral side. These are called *dorsal horns*, *ventral horns* and *lateral horns*. Figure 2.4 shows the spinal cord and Fig. 2.5 shows the cross section of the spinal cord and its members.

The spinal cord performs sensory, motor and reflex functions. Conduction is the most important function of the spinal cord. It also acts as a main centre of reflex actions along with being a link between spinal nerves and brain. Thus, it participates in conscious actions.

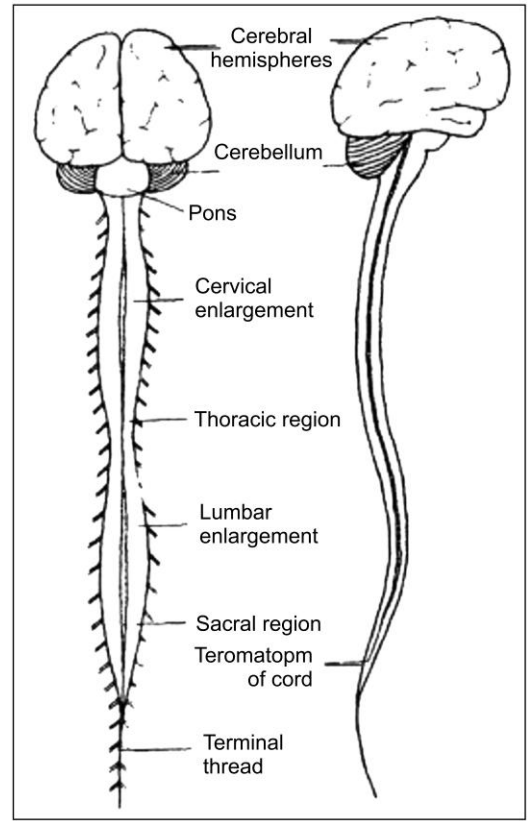


Fig. 2.4 Human Spinal Cord

Human Brain

Human brain is highly developed. In an average adult, it weighs about 1400 grams. It is encased in a bony case, the *cranium*, which protects it from external injuries. The brain is wrapped in three membranes called

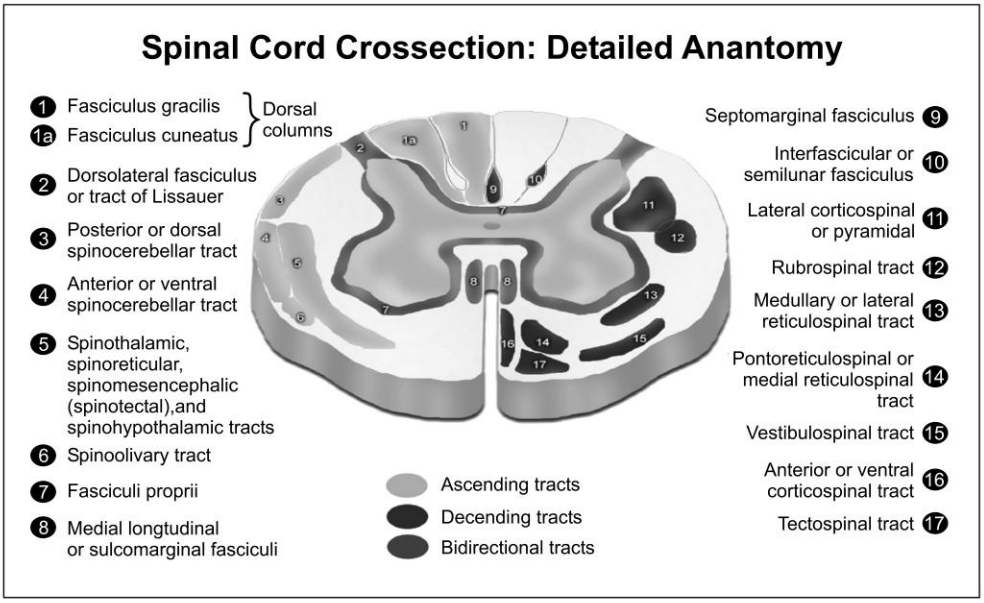


Fig. 2.5 Cross Section of the Spinal Cord and Its Members

the *meninges*. These are:

(i) *Duramater* It is the outer most layer, which is tough and formed of fibrous tissue.
(ii) *Arachnoid* It is the middle membrane.
(iii) *Piamater* It is the innermost layer, which is thin, transparent and vascular.

The spaces between the meninges are filled with *cerebrospinal fluid*, the substance composing the brain is differentiated into *gray matter* and *white matter.* Gray matter forms the outer layer and consists of cell bodies. White matter lies inside and is formed of nerve fibers from the neurons.

Regions of the Brain

The major regions of the brain are listed below (see Fig. 2.6):

1. Forebrain (prosencephalon)
   (a) Telencephalon
      (i) Cerebrum
   (b) Rhinencephalon
      (i) Limbic system
   (c) Diencephalon
      (i) Thalamus
      (ii) Hypothalamus
      (iii) Basal ganglia
2. Midbrain (Mesencephalon)
   (a) Cerebral Peduncles
   (b) Tectum
   (c) Reticular Activating System

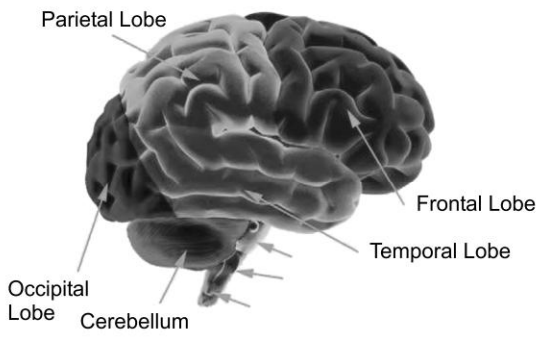


Fig. 2.6 Human Brain

3. Hindbrain (Rhombencephalon)
   (a) Metencephalon
      (i) Cerebellum
      (ii) Pons
   (b) Myelencephalon
      (i) Medulla Oblongata

1. Forebrain

Cerebrum: The cerebrum is the largest and most prominent part of the brain. It lies just beneath the skull roof and fills the greater part of the cranial cavity. The cerebrum is divided into two *cerebral hemispheres* (left and right hemispheres) by a deep longitudinal fissure. In each cerebral hemisphere, the outer layer of gray matter to about 2–4 mm thick. It is called the *cerebral cortex.* Figure 2.7 shows the cerebral cortex left lateral view. The cerebral cortex looks something like a rumpled piece of cloth with many ridges and valleys. A ridge is known as a *gyrus* and a valley is called a *sulcus* or a *fissure*. The cerebral cortex is the seat of complex psychological functions. The cerebral cortex is each hemisphere is divided into four principal areas, or lobes: the *frontal lobe, parietal lobe, temporal lobe* and the *occipital lobe*. Figure 2.8 shows the cerebellum as seen from below.

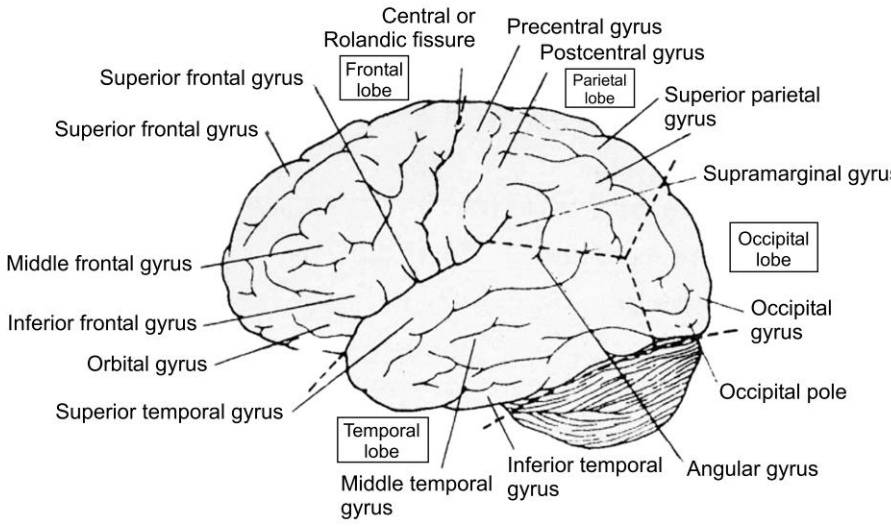
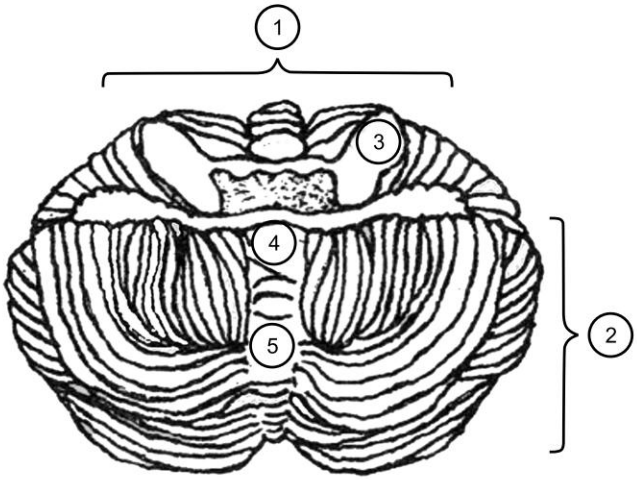


Fig. 2.7 Left Lateral View of Cerebral Cortex

The frontal lobe includes all the cortex anterior to the central sulcus. The parietal lobe extends posteriorly from the central sulcus and laterally to the lateral fissure. Lateral and ventral to the lateral fissure is the temporal lobe.

Some cortical areas are largely sensory in function and others are concerned with bodily movements, while some are involved in psychological functions and are known as association areas.

The frontal lobe is primarily associational in nature. It is important in the programming of the movements necessary for speech. It also plays an important role in learning, memory, language and thinking. The parietal



1. Anterior lobe 2. Posterior lobe 3. Cerebeliar peduncles
4. Flocculus nodule 5. Uvula

Fig. 2.8 Cerebellum As Seen From Below

area is importantly related to touch and kinesthetic functions. Damage to the parietal area may cause tactile agnosia (inability to recognize objects by touch). The temporal lobe is primarily sensory in nature. It is involved in hearing, perception and recognition of sounds. Damage to the temporal lobe might result in auditory agnosia. It is also concerned with speech and written language. The occipital lobe is the primary cortical area for vision and damage to this area might result in visual agnosia.

Limbic Systems: Some of the nuclei of the thalamus, hypothalamus and cerebrum group together to form the limbic system. The other important structures of the limbic system are the *olfactory bulb*, the *hippocampus*, the *amygdala* and the *cingulate gyrus* of the cortex. Limbic system receives inputs from the smell receptors. It is also involved in the expression of fear and rage and also aggressive behavior. Along with the *hypothalamus*, it controls instinctive behaviors.

Thalamus: The major function of the thalamus is to act as a relay station for sensory messages. It lies between the spinal cord and the overhanging cortex and serves as a relay station where the nerve impulses from all the senses (except smell) synapse before being projected into their respective cortical receiving areas. Thalamus regulates manifestation of emotions and recognizes heat, cold and pain. The nuclei in the thalamus can be divided into three main groups:

(i) Subcortical nuclei
(ii) Relay nuclei
(iii) Association nuclei

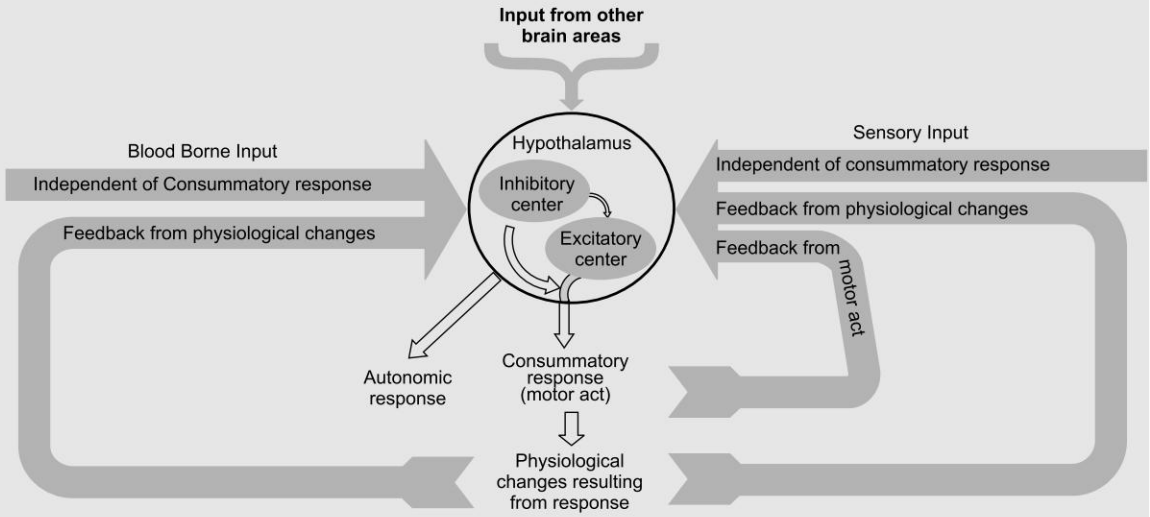
Hypothalamus: Hypothalamus lies beneath the thalamus. It is formed of patches of gray matter in white matter. It links the nervous system to the endocrine system and exercises a regulatory control on the functioning of endocrine glands by secreting hormones. It contains higher centers of autonomic nervous system controlling hunger, thirst, sleep and fatigue. It also plays an important role in sexual behavior, emotions and satisfaction. Hypothalamus is also concerned with the regulation of homeostasis. It also controls carbohydrate and fat

metabolism, body temperature, blood pressure and water balance. It has a very important role in controlling body temperature.

PSYCHOLOGY NUGGGET

Influences on Hypothalamic Function

For each biological drive there is believed to be an inhibitory center and an excitatory center in the hypothalamus. Input is received from other brain centers, from external stimulation, and from blood borne messages. This input includes a running report on the state of the organism and the environment as well as both sensory and chemical feedback from actions already taken or in progress.



When the hypothalamus is not working correctly, when it is not functioning up to par, the wrong neuro-signals are generated and the wrong neuro-messages are received, resulting in an inaccurate integration of all our sensory input. This leads to faulty perceptions which are very subtle but nonetheless powerful, making us feel empty, deprived and emotionally 'unsatisfied'. Dysfunction of the hypothalamus often leads to depression, hyperactivity, abnormal responses to stress, or disturbances in brain and limbic functioning. Some of the physical aspects of hypothalamic dysfunction are disordered sleep, multiple hormonal dysfunctions, immune dysfunction, autonomic dysfunction, and altered body temperatures.

Basal Ganglia: Lying below the cortex is a mass of gray matter known as the basal ganglia. It plays an important role in controlling the voluntary, reflex, and autonomic associated movements of the body. The basal ganglia are also important in maintaining the posture of the organism and in coordination of movement. Diseases of the different nuclear inclusions of the basal ganglia produce disturbances in muscular activities (muscular rigidity, tremor etc.)

2. Midbrain

The midbrain is relatively small and connects the forebrain and the hindbrain.

Cerebral Peduncles: These are in form of thick fibrous tracts and contain reflex centers. These tracts connect cerebellum with cerebrum and transmit motor impulses to limb muscles from cerebrum. Nuclei of some of these centers control muscle tone and modify some motor activities initiated in the cortex.

Tectum: Tectum means roof. It has sensory duties. The tectum has two pairs of sensory centers—the *superior colliculi* (corpora quadrigemina) and the *inferior colliculi*. The superior colliculi are centers of visual and olfactory reflexes and the inferior colliculi are lower centers for hearing.

Reticular Activating System (RAS): The reticular activating system consists of network of fibers and cell bodies. It consists of sensory tracts running upward to the cerebral cortex and is responsible for cortical arousal. The fibers responsible for the arousal of cerebral cortex are known as *ascending reticular activating system* (ARAS). The *descending reticular system* sends impulses to the spinal cord. The ascending reticular activating system regulates various degrees of arousal - from deep sleep to alertness. The reticular activating system controls sleep and waking and plays a role in the ability to focus attention.

3. Hind Brain

Cerebellum: It is the second largest part of the brain and the largest part of the hind brain. It lies behind the *pons* and *medulla oblongata*. Cerebellum is divided into two hemispheres which are joined together by an elongated structure called the *vermis*. It is composed of gray and white matter. Like cerebrum, its upper surface is formed of gray matter and forms *cerebellar cortex*. The cerebellum is further divided into *archicerebellum*, *palaeocerebellum* and *neocerebellum*. Figure 2.9 shows the hind brain.

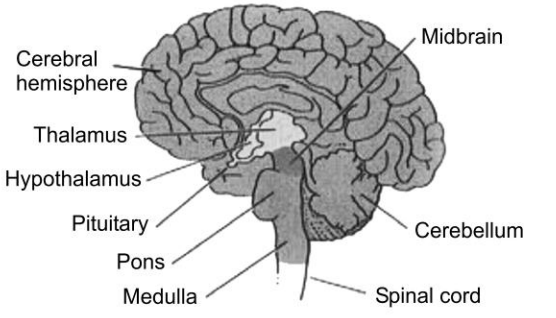


Fig. 2.9 Hind Brain

The archicerebellum helps to synthesis and control antagonistic muscles. Palaeocerebellum acts as a receptive organ for tactile, proprioceptive, auditory and visual impulses. Neocerebellum guides and controls all voluntary movements so that they are coordinated in time, force, direction and extent.

In general, cerebellum regulates and coordinates contraction of skeletal muscles. It modulates and moderates voluntary movements initiated in cerebrum, maintains equilibrium and controls posture. It makes body movements smooth, steady and coordinated.

Pons: It is a thickening located above the medulla and is composed of thick bundles of white fibers with a few nuclei. It consists of the following:

(i) Transverse fibers connecting the two lobes of the cerebellum.
(ii) The pontine nuclei
(iii) Fiber tracts ascending and descending to various levels of the central nervous system

The pons contains fibers connecting the two hemispheres of cerebellum with each other, each hemisphere of the cerebellum with the opposite hemisphere of the cerebrum and these structures with the brain stem. Equilibrium and motor coordination are highly dependent on the pons. Pons coordinates muscle movements on the two sides of the body. The nuclei of the trigeminal nerve are found in pons. This nerve is important in the sensations and movements of mouth and face.

Medulla Oblongata: It is the posterior part of brain and is also called the *brain stem*. It lies below the pons and is continuous with the spinal cord. The side walls of medulla are thick and formed of white matter. These contain nerve tracks connecting the higher parts of the brain with spinal cord. Majority of cranial nerves enter and exit the medulla, thus it contains several nuclei of cell bodies associated with these nerves. The nuclei of medulla serve as several important centers. They are discussed below.

(a) *Cardiac Centre:* The cardiac centre in the medulla is the centre of an area of impressionable matter, which is as extensive as the nervous system itself. Into this centre there pour constant streams of impressions from the vessels, abdominal viscera, skin, muscles, central nervous system (including the seat of mind), lungs and indeed from every organ, including the heart itself; and thence the resulting impulses descend through the vagus and sympathetic to the heart which is thus subject to every influence, however slight, to which the body may he exposed. Further, the cardiac centre is affected by its blood-supply, including both the quality and pressure of the blood within it.

(b) *Respiratory Centre:* This centre of medulla has two bilaterally located parts. One is for inspiration and the other for expiration. Rhythmic respiration depends upon the alternating activity of these two parts of the respiratory centre.

(c) *Gastric Centre:* Medulla also plays an important role in the secretion of gastric juices and hence helps indigestion.

(d) *Reflex Centre:* Medulla is responsible for different visceral efferent and afferent mechanisms. The important responses regulated by medulla are coughing reflex, sneezing reflex, swallowing, salivary reflex, sucking reflex, vomiting reflex and choking reflex.

Thus, the medulla is the vital part of the brain. Medullary disturbances may cause death due to respiratory and cardiac arrest.

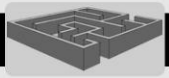
Disorders of The Nervous System

Consideration of disorders of the nervous system is the province of neurology; psychiatry deals with behavioral disturbances of a functional nature. The division between these two medical specialties cannot be sharply defined, because neurological disorders often manifest both organic and mental symptoms.

Diseases of the nervous system include *genetic malformations, poisonings, metabolic defects, vascular disorders, inflammations, degeneration* and *tumors*, and they involve either nerve cells or their supporting elements. Vascular disorders such as *cerebral hemorrhage* or other forms of stroke are among the most common causes of paralysis and other neurologic complications. Some diseases exhibit peculiar geographic and age distribution. In temperate zones, *multiple sclerosis* is a common degenerative disease of the nervous system, but it is rare in the Tropics.

The nervous system is subject to infection by a great variety of bacteria, parasites and viruses. For example, *meningitis* or infection of the meninges investing the brain and spinal cord can be caused by many different agents. On the other hand, one specific virus causes *rabies*. Some viruses causing neurological ills affect only certain parts of the nervous system. For example, the virus causing *poliomyelitis* commonly affects the spinal cord; viruses causing *encephalitis* attack the brain.

Inflammations of the nervous system are named according to the part affected. *Myelitis* is an inflammation of the spinal cord; *neuritis* is an inflammation of a nerve. It may be caused not only by infection but also by poisoning, alcoholism or injury. Tumors originating in the nervous system usually are composed of *meningeal tissue* or *neuroglia* (supporting tissue) cells, depending on the specific part of the nervous system affected, but other types of tumor may metastasize to or invade the nervous system. In certain disorders of the



PSYCHOLOGY IN EVERYDAY LIFE

Medical Methods in Studying the Brain

A few important medical diagnostic tools are used to determine the damage caused in the brain such as in case of accident, malformation, abnormality in behavior and so on. The commonly used techniques are given below.

CT Scan

A CAT Scan is Computerized Axial Tomography (also known as a CT Scan), which is a process of using computers to make a three-dimensional image from a two-dimensional picture (X-ray). During the process, a series of X-ray photographs are taken from different angles and then combined by computer into a composite three-dimensional representation. So, pictures are taken one slice at a time going through the whole object and then the slices are combined to get a great visual of the whole thing. A large donut-shaped X-ray machine takes X-ray pictures at several different angles around the body. These images are processed by a computer to create cross-sectional pictures of the body. In each of these pictures the body is seen as an X-ray 'slice' of the body which is recorded on a film. It is like looking at a loaf of bread that has been sliced up—you can see the whole thing and also remove slices and see the entire slice and everything inside of it.

MRI

Magnetic Resonance Imaging (MRI) is a method used for studying the functions of the brain (or any living tissue) without surgery. Images are obtained by using a strong magnetic field. This technology has improved medical diagnoses and research methods. For example, with an MRI, a psychologist can observe different structures in the brain by having a subject perform certain exercises or tasks.

fMRI

An fMRI (functional magnetic resonance imaging) just builds on the MRI by focusing on the ratio between oxygenated to deoxygenated blood; this is the blood oxygenation level dependent effect (BOLD effect). Basically, an fMRI indirectly measures brain activity by measuring the change in blood levels (specifically haemoglobin as it deoxygenates). An fMRI works because as brains process information blood flows to those areas to help provide the needed oxygen and glucose. The result of this process is a scan of the brain with lighter (or darker) areas where blood is flowing in greater quantity.

PET

Positron Emission Tomography (PET) is a nuclear medicine image technique that produces three-dimensional image of a body part. Usually, an injection of radioactive glucose is used before the PET scan. The image then shows the areas where glucose is present in the amount beyond the normal body needs.

EEG

An electroencephalogram (EEG) is a recording of the electrical waves of activity that occur in the brain and across its surface. Electrodes are placed on different areas of a person's scalp, filled with a conductive gel, and then plugged into a recording device. The brain waves are then attracted by the electrodes, travel to the recording device and then amplified so that they can be more easily seen and examined. The EEG recording can be used to examine a variety of brain functions including sleep (the different stages of sleep) and different psychological disorders.

nervous system, such as *neuralgia*, *migraine* and *epilepsy*, no evidence may exist of organic damage. Another disorder, *cerebral palsy* is associated with birth defects.

SENSORY PROCESSES

An individual's response to stimuli constitutes his behavior. Much of the behavior of an individual is evoked by stimuli, both internal and external. Stimuli normally evoke responses by stimulating or exciting sense organs. An individual's knowledge of the world around him comes from the impingement of stimuli on his sense organs and the resulting activities of receptors, nerve fibers and brain cells. Everything that an individual does is dependent upon the information encoded in messages from the receptors in his sense organs.

The channels through which one comes to know about the world around him are the senses. The major senses that an individual possesses are vision, hearing, smell, taste, cold, warmth, pain, touch, kinesthesis and the vestibular sense. Sensation occurs when any of the sense organs such as the eyes, ears, nose, tongue or skin receives a stimulus from the external or internal environment of the individual. Each of the sense organs is stimulated by a specific and different form of external or internal energy. The eye is stimulated by light energy. Sound energy stimulates the ear. Thermal energy stimulates the skin senses of warmth and cold, while pressure stimulates the skin senses of touch and pain. Chemical agents stimulate the nostrils in the nose and the taste buds on the tongue.

Each receptor requires some minimum level of energy to excite it. The receptor cells in the sense organs translate the physical energy produced by the stimulus into an impulse which is carried by the nervous system to the brain. The process of converting physical energy of the stimulus into impulses that the nervous system can transmit to the brain is called transduction. Transduction takes place at the receptors which receive the physical energy produced by the stimuli and convert it into electrical energy. This becomes nerve impulses which move towards the brain. The minimum level of physical energy necessary to excite it and produce a response in a given individual is called the *absolute threshold*. When the stimulus energy is below this level, the stimuli is not detected. Each sense has different threshold and the thresholds differ from situation to situation.

Vision

Although all the senses contribute in gaining information about the world around an individual perhaps the greatest amount of information reaches him through the sense of vision. The sense organ for vision is the eye. Light is the external stimulus for vision. An individual can see any object which emits light such as the sun or an incandescent light bulb. The objects which do not emit light are seen by reflected light. For example, moon or any other planet is seen at night because its surface reflects light from the sun. Several objects in the environment are seen because they reflect light emerging from a source to the eyes.

Through the eyes an individual senses what is called the visible spectrum of light. Visible white light such as that emitted by the sun is composed of a number of wavelengths. Each of these wavelengths is seen as a distinct color or hue. The entire visual spectrum of light runs from red at one end through orange, yellow, green, blue, indigo to violet at the other end. Infrared and ultraviolet waves fall outside the visible ranges and cannot be seen by the human eye.

The eye is a ball-shaped structure composed of the visible outer portions and an inner chamber which is not visible from outside. The outermost cover is called the *sclera* which maintains the shape of the eye. The middle layer is called the *choroid.* The amount of light that enters the eye is regulated by an opening called the *pupil*. The size of the pupil is controlled by the *iris*. When the light is very bright, the pupil contracts and decreases the amount of light entering the eye. When the light is very dim, the pupil widens and increases the amount of light that enters the eye. The main features of the eye are shown in Fig. 2.10.

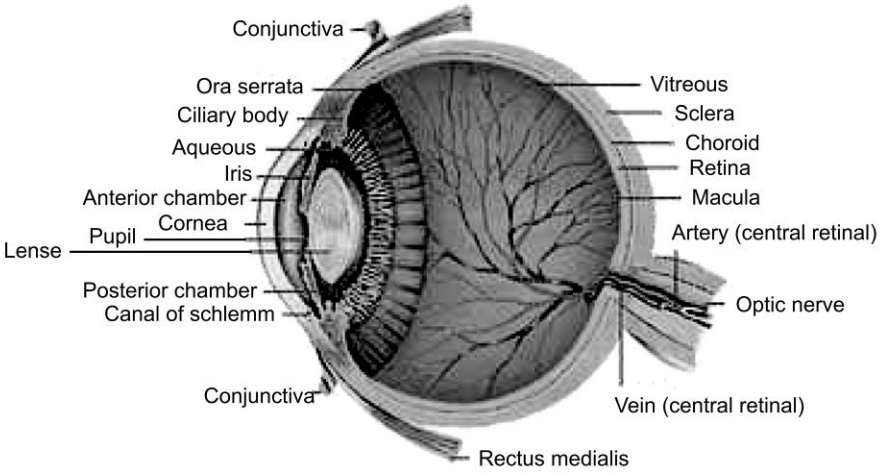


Fig. 2.10 **Cross Section of the Human Eye (As Seen from Above)**

Light enters the eye through the cornea, which is transparent, and passes through the pupil towards the lens. The lens focuses the incoming light rays on the retina which contains the receptor cells and nerve endings required for transforming the light stimulus into electrical impulses and then into nerve impulses. The space between the cornea and the lens is filled with the *aqueous humor* and the inner chamber between the lens and the retina is filled with the *vitreous humor.*

On the retinal surface is the *fovea*, which is the most visually sensitive area of the eye. The *cones* which are sensitive to the different wavelengths and are used in color vision are closely packed in the fovea. The cones are activated under high illumination and are responsible for detailed vision that an individual experiences is day light. The *rods* are used primarily under low illumination. They are not sensitive to color and they translate light energy only into white, black and gray. In addition to the rods and cones, the retina is also composed of the *blind spot*. This is an insensitive area where nerve fibers from the cells in the retina come together to form the bundle making up the optical nerve.

The rods and cones adapt to light and to darkness at different rates. In moving from a dark environment to a light one, the rods take about one or two minutes to become adapted and to function efficiently. When a person goes from a bright environment to a dark one, it takes about 30 to 45 minutes to become adapted and to function efficiently. For example, when we enter a dark cinema hall, we cannot see others in the hall. After a few minutes, the cones adapt to the darkness though we may still not be able to see very well. After about 30 minutes, the rods adapt to the darkness and as a result we are able to see others in the hall clearly. When we come out of the hall after the film show, initially we get blinded by the sunshine. Within a few minutes, the cones and the rods adapt to the bright light.

The human eye can pick out and differentiate many of the details of the objects in the environment. The ability to discriminate details and fine differences in the field of vision is termed *visual acuity.* This enables one to see clearly and distinctly objects that are quite small. It also enables one to rank small objects according to their relative size and to separate them according to their shape or form.

An individual becomes aware of such sensations as light, color and form when the visual centers in the brain are stimulated. Light rays entering the eyes pass through the cornea, the aqueous humor, the pupil and the lens before they are focused on the retina where the rods and cones are stimulated by them. When

light strikes the rods and cones which are specialized receptor cells it results in a series of chemical changes in their light sensitive substances. These changes trigger off certain kinds of electrical impulses and then stimulate the nerve cells. These nerve impulses travel to the brain and stimulate the visual centers in the brain enabling one to become aware of sensation of brightness, color and form.

Functioning of the Eye

In general, the eyes of all animals resemble simple cameras in that the lens of the eye forms an inverted image of objects in front of it on the sensitive retina, which corresponds to the film in a camera.

Focusing the eye, as mentioned above, is accomplished by a flattening or thickening (rounding) of the lens. The process is known as *accommodation*. In the normal eye accommodation is not necessary for seeing distant objects. The lens, when flattened by the *suspensory ligament*, brings such objects to focus on the retina. For nearer objects, the lens is increasingly rounded by ciliary muscle contraction, which relaxes the suspensory ligament. A young child can see clearly at a distance as close as 6.3 cm (2.5 in), but with increasing age the lens gradually hardens, so that the limits of close seeing are approximately 15 cm (about 6 in) at the age of 30 and 40 cm (16 in) at the age of 50. In the later years of life, most people lose the ability to accommodate their eyes to distances within reading or close working range. This condition, known as *presbyopia*, can be corrected by the use of special convex lenses for the near range.

Structural differences in the size of the eye cause the defects of *hyperopia*, or farsightedness, and *myopia*, or nearsightedness.

As mentioned above, the eye sees with greatest clarity only in the region of the fovea; due to the neural structure of the retina. The cone-shaped cells of the retina are individually connected to other nerve fibers, so that stimuli to each individual cell are reproduced and, as a result, fine details can be distinguished. The rod shaped cells, on the other hand, are connected in groups so that they respond to stimuli over a general area. The rods, therefore, respond to small total light stimuli but do not have the ability to separate small details of the visual image. The result of these differences in structure is that the visual field of the eye is composed of a small central area of great sharpness surrounded by an area of lesser sharpness. In the latter area, however, the sensitivity of the eye to light is great. As a result, dim objects can be seen at night on the peripheral part of the retina when they are invisible to the central part.

The mechanism of seeing at night involves the sensitization of the rod cells by means of a pigment, called *visual purple* or *rhodopsin*, which is formed within the cells. Vitamin A is necessary for the production of visual purple; a deficiency of this vitamin leads to *night blindness*. Visual purple is bleached by the action of light and must be reformed by the rod cells under conditions of darkness. Hence a person who steps from sunlight into a darkened room cannot see until the pigment begins to form. When the pigment has formed and the eyes are sensitive to low levels of illumination, the eyes are said to be *dark-adapted.*

A brownish pigment present in the outer layer of the retina serves to protect the cone cells of the retina from overexposure to light. If bright light strikes the retina, granules of this brown pigment migrate to the spaces around the cone cells, sheathing and screening them from the light. This action, called *light adaptation*, has the opposite effect to that of dark adaptation.

Subjectively, a person is not conscious that the visual field consists of a central zone of sharpness surrounded by an area of increasing fuzziness. The reason is that the eyes are constantly moving, bringing first one part of the visual field and then another to the foveal region as the attention is shifted from one object to another. These motions are accomplished by six muscles that move the eyeball upward, downward, to the left, to the right, and obliquely. The motions of the eye muscles are extremely precise; the estimation has been made that the eyes can be moved to focus on no less than 100,000 distinct points in the visual field. The muscles of the two eyes, working together, also serve the important function of converging the eyes on any point being observed, so that the images of the two eyes coincide. When convergence is non-existent or faulty, double

vision results. The movement of the eyes and fusion of the images also play a part in the visual estimation of size and distance.

Protective Structures

Several structures, not parts of the eyeball, contribute to the protection of the eye. The most important of these are the *eyelids*, *two folds of skin* and *tissue*, upper and lower, which can be closed by means of muscles to form a protective covering over the eyeball against excessive light and mechanical injury. The *eyelashes*, a fringe of short hairs growing on the edge of either eyelid, act as a screen to keep dust particles and insects out of the eyes when the eyelids are partly closed. Inside the eyelids is a thin protective membrane, the *conjunctiva*, which doubles over to cover the visible sclera. Each eye also has a *tear gland*, or *lacrimal organ*, situated at the outside corner of the eye. The salty secretion of these glands lubricates the forward part of the eyeball when the eyelids are closed and flushes away any small dust particles or other foreign matter on the surface of the eye. Normally the eyelids of human eyes close by reflex action about every six seconds, but if dust reaches the surface of the eye and is not washed away, the eyelids often blink and more tears are produced. On the edges of the eyelids are a number of small glands, the *Meibomian glands*, which produce a fatty secretion that lubricates the eyelids themselves and the eyelashes. The eyebrows, located above each eye, also have a protective function in soaking up or deflecting perspiration or rain and preventing the moisture from running into the eyes. The hollow socket in the skull in which the eye is set is called the *orbit*. The bony edges of the orbit, the *frontal bone*, and the *cheekbone* protect the eye from mechanical injury by blows or collisions.

Hearing

The ear is the organ of hearing and balance. Only vertebrates (animals with backbones) have ears. Invertebrate animals, such as jellyfish and insects, lack ears but have other structures or organs that serve similar functions. The most complex and highly developed ears are those of mammals.

Structure of the Human Ear

Like the ears of other mammals, the human ear consists of three sections: the *outer*, *middle* and *inner ear*. The outer and middle ears function only for hearing, while the inner ear also serves the functions of balance and orientation. Figure 2.11 shows the structure of the human ear.

The outer ear is made up of the *auricle*, or *pinna*, and the *outer auditory canal*. The auricle is the curved part of the ear attached to the side of the head by small ligaments and muscles. It consists largely of elastic cartilage, and its shape helps collect sound waves from the air. The *earlobe*, or *lobule*, which hangs from the lower part of the auricle, contains mostly fatty tissue.

The outer auditory canal, which measures about 3 cm (about 1.25 in) in length, is a tubular passageway lined with delicate hairs and small glands that produce a wax-like secretion called *cerumen*. The canal leads from the auricle to a thin taut membrane called the eardrum or *tympanic membrane*, which is nearly round in shape and about 10 mm (0.4 in) wide. It is the vibration of the eardrum that sends sound waves deeper into the ear, where they can be processed by complex organs and prepared for transmission to the brain. The cerumen in the outer auditory canal traps and retains dust and dirt that might otherwise end up on the eardrum, impairing its ability to vibrate.

The inner two-thirds of the outer auditory canal is housed by the *temporal bone*, which also surrounds the middle and inner ear. The temporal bone protects these fragile areas of the ear.

The eardrum separates the outer ear from the middle ear. A narrow passageway called the *eustachian tube* connects the middle ear to the throat and the back of the nose. The eustachian tube helps keep the eardrum

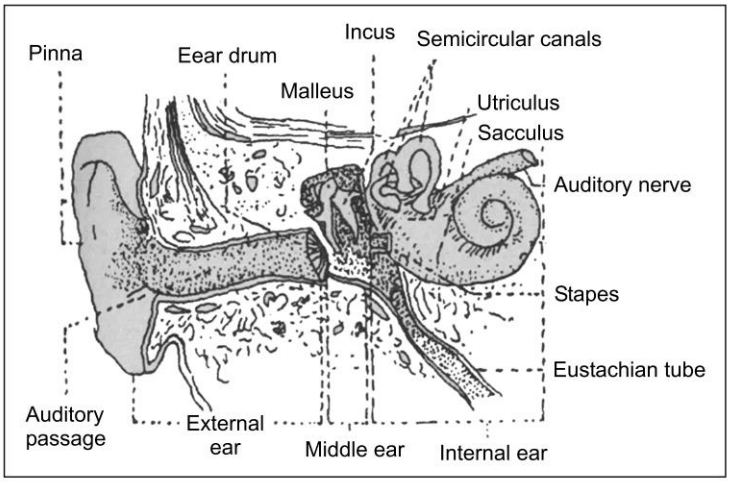


Fig. 2.11 Structure of the Human Ear

intact by equalizing the pressure between the middle and outer ear. For example, if a person travels from sea level to a mountaintop where air pressure is lower, the eardrums may cause pain because the air pressure in the middle ear becomes greater than the air pressure in the outer ear. When the person yawns or swallows, the eustachian tube opens, and some of the air in the middle ear passes into the throat, adjusting the pressure in the middle ear to match the pressure in the outer ear. This equalizing of pressure on both sides of the eardrum prevents it from rupturing.

The middle ear is a narrow, air-filled chamber that extends vertically for about 15 mm (about 0.6 in) and for nearly the same distance horizontally. Inside this chamber is a linked chain of three *ossicles* or very small bones. Both the Latin and common names of these bones are derived from their shapes. They are called the *malleus* or *hammer*; the *incus* or *anvil*; and the *stapes* or *stirrup*, which is the tiniest bone in the body, being smaller than a grain of rice.

The hammer is partly embedded in the eardrum and the stirrup fits into the oval window, a membrane that fronts the inner ear. Vibrations of the eardrum move the hammer. The motion of the hammer moves the anvil which in turn moves the stirrup. As sound vibrations pass from the relatively large area of the eardrum through the chain of bones, which have a smaller area, their force is concentrated. This concentration amplifies, or increases, the sound just before it passes through the oval window and into the inner ear. When loud noises produce violent vibrations, two small muscles, called the *tensor tympani* and the *stapedius*, contract and limit the movement of the ossicles, thus protecting the middle and inner ear from damage.

Inner Ear

The chain of bones in the middle ear leads into the convoluted structures of the inner ear or *labyrinth*, which contains organs of both hearing and balance. The three main structures of the inner ear are the *cochlea*, the *vestibule*, and the three *semicircular canals*.

The cochlea is a coiled tube that bears a close resemblance to the shell of a snail, which is what the word means in Greek. Along its length, the cochlea is divided into three fluid-filled canals: the *vestibular canal*, the *cochlear canal* and the *tympanic canal*. The partition between the cochlear canal and the tympanic canal is called the *basilar membrane*. Embedded in the basilar membrane is the spiral-shaped organ of *Corti*. The

sensory cells in the organ of Corti have thousands of hair like projections that receive sound vibrations from the middle ear and send them on to the brain via the auditory nerve. In the brain they are recognized and interpreted as specific sounds.

The vestibule, the second main structure of the inner ear, helps the body maintain balance and orientation by monitoring the sensations of movement and position. Without a sense of balance, even simple functions like walking would pose impossible challenges. With no sense of orientation, people would not know if they were in a normal position, upside down or lying on their sides. Both balance and orientation depend on nerve impulses to reach the brain when the body is unbalanced or disoriented. The brain, in turn, sends messages to appropriate muscles, causing them to correct the imbalance or reposition the body.

The vestibule is made up of two sacs, the *utriculus* and the *sacculus*. Special sensory areas in the walls of the utriculus send impulses to the brain indicating the position of the head. These sensory areas consist of hair-like projections embedded in *gelatin*. Covering the surface of the gelatin are small mineral particles. Depending on the position of the head, the gelatin and mineral particles exert varying pressures on the sensory cells. The cells, in turn, send particular patterns of stimulation to the brain, where the patterns are interpreted.

For example, when the head is upright, the gelatin and mineral particles press down on all the hair-like cells equally. When the head is tilted straight forward by dropping the chin, the gelatin and mineral particles pull on all the hair-like cells equally. If the head is tilted to one side or the other, the cells receive unequal stimulation, varying with the direction and amount of tilt. If the utriculus of both ears is destroyed by injury or disease, the head will hang down limply unless its position can be judged with the eyes. The utriculus is also used to detect the body's starting or stopping. If a person stops suddenly, the gelatin and mineral particles continue to move, exerting a forward pull on the hair-like cells. The cells then send a specific pattern of nerve impulses to the brain.

The structure of the sacculus is similar to that of the utriculus, but its function is not well understood. The sacculus may aid in determining body orientation, but it may also have a function in hearing.

Arising from the utriculus is the third main structure of the inner ear, the three semicircular canals. These canals direct body balance when the body moves in a straight line or rotates in any direction. Each canal also contains sensory areas with sensory hair cells that project into a cone-shaped cap of gelatin. Two of the semicircular canals are in a vertical position and are used to detect vertical movement, such as jumping or falling. The third canal is horizontal and detects horizontal movement, such as turning or spinning.

The action of the canals depends on the inertia of the fluid inside. When the motion of the body changes, the fluid lags behind, causing the hair cells in the canal to bend. The bending of the hair cells sends nerve impulses to the brain, which in turn informs the body of changes in the direction of movement.

Mechanism of Hearing

Sound is a series of vibrations moving as waves through air or other gases, liquids or solids. A ringing bell, for example, sets off vibrations in the air. Detection of these vibrations or sound waves is called hearing. The detection of vibrations passing through the ground or water is also called hearing. Some animals can detect only vibrations passing through the ground and others can hear only vibrations passing through water. Figure 2.12 shows the mechanism of hearing.

Humans, however, can hear vibrations passing through gases solids and liquids. Sometimes sound waves are transmitted to the inner ear by a method of hearing called *bone conduction*. For example, people hear their own voice partly by bone conduction. The voice causes the bones of the skull to vibrate and these vibrations directly stimulate the sound-sensitive cells of the inner ear. Only a relatively small part of a normal person's hearing depends on bone conduction, but some totally deaf people can be helped if sound vibrations are transferred to the skull bones by a hearing aid.

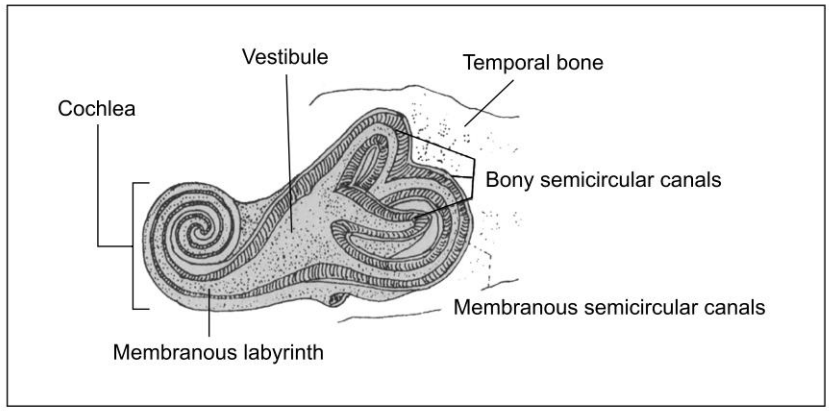


Fig. 2.12 Mechanism of Hearing

Humans hear primarily by detecting airborne sound waves, which are collected by the auricles. The auricles also help locate the direction of sound. Although some people have auricular muscles so well-developed that they can wiggle their ears, human auricles, when compared to those of other mammals, have little importance. Many mammals, especially those with large ears, such as rabbits, can move their auricles in many directions so that sound can be picked up more easily.

After being collected by the auricles, sound waves pass through the outer auditory canal to the eardrum, causing it to vibrate. The vibrations of the eardrum are then transmitted through the ossicles, the chain of bones in the middle ear. As the vibrations pass from the relatively large area of the eardrum through the chain of bones, which have a smaller area, their force is concentrated. This concentration amplifies, or increases, the sound.

When the sound vibrations reach the stirrup, the stirrup pushes in and out of the oval window. This movement sets the fluids in the vestibular and tympanic canals in motion. To relieve the pressure of the moving fluid, the membrane of the oval window bulges out and in. The alternating changes of pressure in the fluid of the canals cause the basilar membrane to move. The organ of Corti, which is part of the basilar membrane also moves, bending its hair like projections. The bent projections stimulate the sensory cells to transmit impulses along the auditory nerve to the brain.

Loudness, Pitch and Tone

Human ears are capable of perceiving an extraordinarily wide range of changes in loudness, the tiniest audible sound being about 1 trillion times less intense than a sound loud enough to cause the ear pain. The loudness or intensity of a noise is measured in a unit called the decibel. The softest audible sound to humans is 0 decibels, while painful sounds are those that rise above 140 decibels.

Besides loudness, the human ear can detect a sound's pitch, which is related to a sound's vibration frequency, or the number of sound waves passing into the ear in a given period. The greater the frequency, the higher is the pitch. The maximum range of human hearing includes sound frequencies from about 15 to about 18,000 waves, or cycles, per second. Because the human ear cannot hear very low frequencies, the sound of one's own heartbeat is inaudible. At the other end of the scale, a highly pitched whistle producing 30,000 cycles per second is not audible to the human ear, but a dog can hear it.

The third characteristic of sound detected by the human ear is tone. The ability to recognize tone enables humans to distinguish a violin from a clarinet when both instruments are playing the same note. The least noticeable change in tone that can be picked up by the ear varies with pitch and loudness.

Another sonic phenomenon, known as masking, occurs because lower-pitched sounds tend to deafen the ear to higher-pitched sounds. To overcome the effects of masking in noisy places, people are forced to raise their voices.

Sense of Taste

There are certain sensory processes in which the stimulation is provided by chemical substances. The sense of taste is one of them. The sense of taste is excited by substances in solution in the mouth. The sense organ for taste is the tongue. On the tongue are many taste buds which are located only in certain areas of the tongue. The chemical stimuli for taste sensations are received by these taste buds. Each taste bud is composed of many elongated taste cells that are sensitive to the taste stimuli. The chemical stimuli which are changed into nerve impulses are carried through the taste cells into the taste neurons which relay these impulses through the sensory nerve fibers to the brain. This in turn leads to the sensation of taste. There are four different qualities of taste. They are sour, salt, sweet and bitter. The tip of the tongue is sensitive to sweet and salt tastes. The sides of the tongue are most sensitive to sour while the back of it is sensitive to bitter taste. The center of the tongue is insensitive to all of these. Figure 2.13 shows the areas of sensitivity to taste in the human tongue.

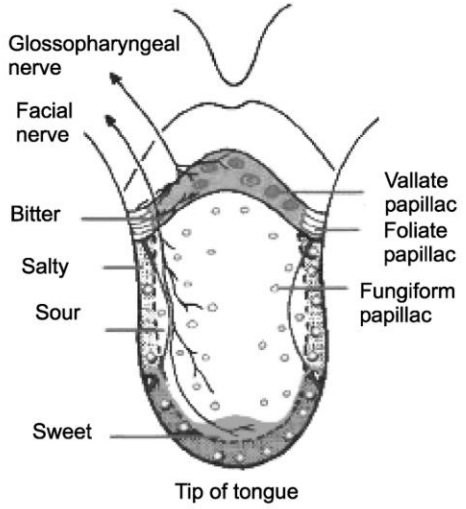


Fig. 2.13 Human Tongue Showing Areas of Sensitivity to Taste

Sense of Smell

Another sensory process in which the stimulation is provided by chemical substances is the sense of smell or olfaction. The gases that enter the nose are the stimuli for the sense of smell. In the upper reaches of the walls of each side of the nasal cavity, lies the *olfactory epithelium*, which is the organ of smell. Only those gases which affect the olfactory epithelium are smelt. If the gas has an odor, certain changes occur in the cells of the epithelium causing nerve impulses to move towards the brain. This results in the sensation of smell. However, it may be noted that very little is known about the processing or transduction of chemical stimuli resulting in olfactory stimulation. There also exists disagreements regarding the basic qualities of smell. Figure 2.14 shows the human olfactory system.

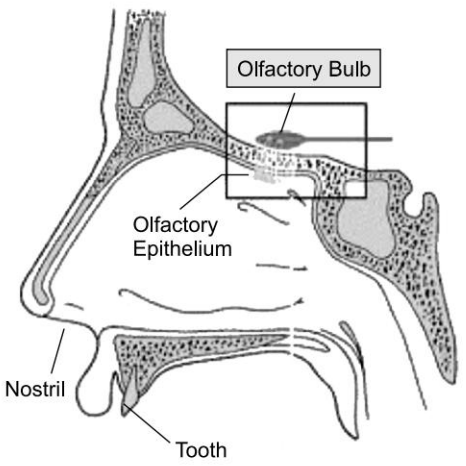


Fig. 2.14 Olfactory System

Skin Senses

Vision, hearing and the chemical sense of taste and smell are the sensory channels that bring in most of the information that individual needs in order to adjust to an ever-changing environment. Another channel which provides important messages about the happenings in or around the human body are the skin or *cutaneous senses*. There are four cutaneous senses: pressure or touch, pain, warmth and cold. The stimuli for pressure are all those objects and forces that depress or deform and bend the skin in some form. These stimuli can be solids, liquids or gases such as air in the form of strong wind. The objects and forces that injure or tend to injure the skin, such as a needle prick, a cut or a hard blow on the skin, are the stimuli for pain. The stimuli for warmth are those objects which are warmer than the skin. The objects colder than the skin act as stimuli for the sense of cold.

The sense organs for the cutaneous sense are the simple nerve endings in the skin or sometimes more specialized structures. There are two types of nerve endings in the hairy region of the skin: the *free nerve*

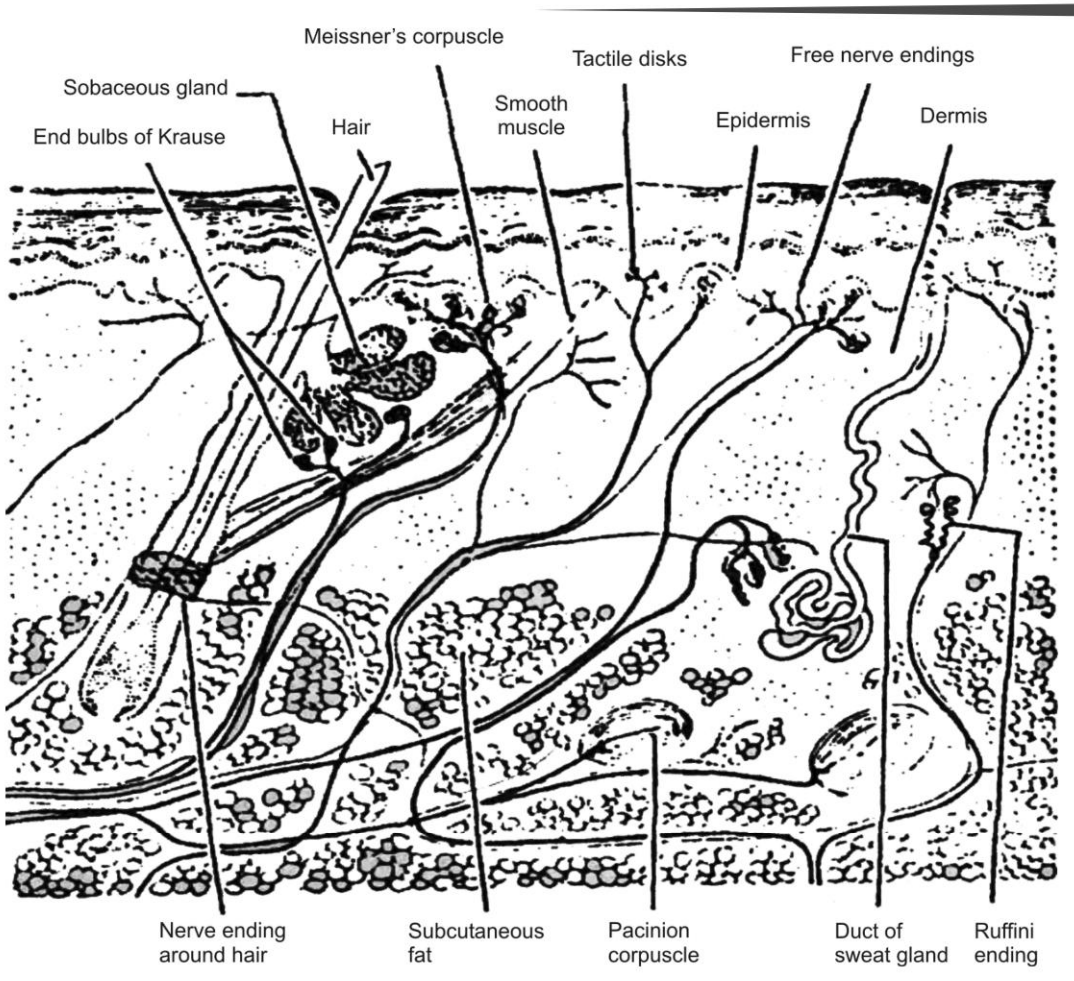


Fig. 2.15 Cross Section of the Human Skin

endings and the basket nerve ending or the *follicles*. The free nerve endings are loose structures below the surface of the skin. The follicles are enmeshed at the base of each hair. The follicles are the main receptors for pressure or touch. Movement of the hair stimulates these nerves triggering off impulses which are then sent to the spinal cord and the brain. The free nerve endings are responsible for sensations of pain, warmth and cold. The non-hairy parts of the body such as the palm of the hand and the sole of the feet contain free nerve endings responsive to touch. The hairless regions also contains pressure sensitive receptors called *Meissner corpuscles* which are also responsible for detection of pressure senses in the non-hairy parts of the body such as the palms of the hands, the soles of the feet, the lips and the eyelids. When the free nerve endings and the specialized structures are stimulated, nerve impulses are triggered off and travel to the brain through the spinal cord resulting in the detection of the cutaneous senses. Not much is known about the exact method by which the free nerve endings are stimulated. It is, however, believed that each stimulus forms a different pattern of impulses in the receptors and these patterns are subsequently transmitted to the brain, which interpret the impulse. Figure 2.15 shows a cross section of the human skin.

Kinesthesis And The Vestibular Senses

Kinesthetic sensitivity comes from activation of the receptors in the muscles, tendons and joints throughout the body. These receptors respond to the movement of the muscle or joints and provide information about the position and movement of the bodily parts. Often one may not be conscious of the working of kinesthetic sense. For example, when a muscle stretches or contracts or when a limb moves, the corresponding receptors transmit nerve impulses to the central nervous system though the individual is seldom aware of it. The kinesthetic sense provides an automatic system for coordinating the muscles in walking, climbing and in all other types of skilled movements.

The vestibular sense enables one to tell the position of his body. It is also important in balance and movement (see Fig. 2.16). The organs of this sense are located in the vestibular area of the inner ear. Near the

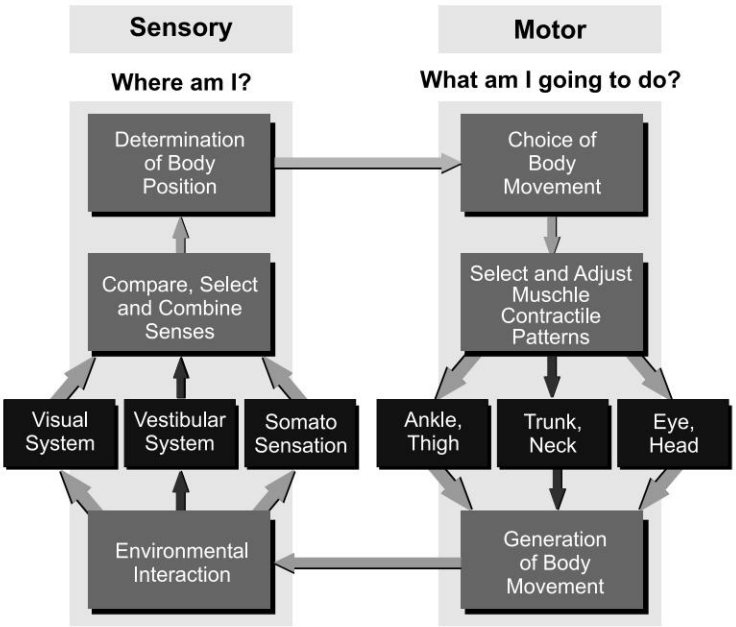


Fig. 2.16 Balance Control

cochlea in the inner ear are located three canals called the *semicircular canals*. These canals are encompassed by a fluid which moves whenever pressure is exerted on it. The base of each canal has a bulging structure called the *ampulla* which contains some hair cells. The ampulla is stimulated by the pressure from the fluid in the semicircular canals.

The small hair cells in the ampulla respond with a nerve impulse when the fluid exerts pressure on them. When these impulses reach the central nervous system they participate in maintaining equilibrium. In addition to the semicircular canals the sense organs for balance include two other cavities the *saccule* and the *utricle*, in the bone near the cochlea. The receptor cells are located on the walls of these cavities. These receptors respond to the tilt or position of the head. The semicircular canals and the saccule and the utricle together contribute to a sense of balance. Impulses from these organs after reaching the brain help a person to correct himself and maintain equilibrium when he has been thrown off balance. Figure 2.17 shows the vestibular system.

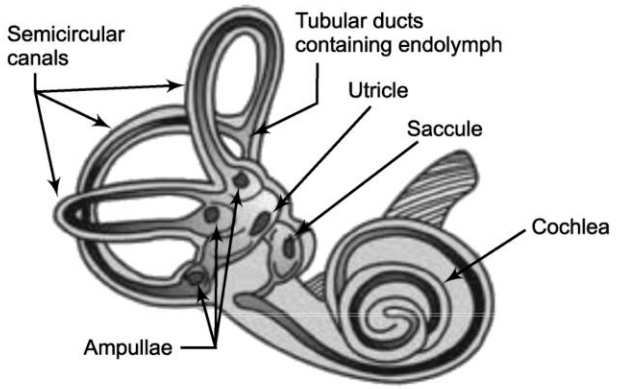


Fig. 2.17 Vestibular System

STRUCTURE AND FUNCTION OF THE ENDOCRINE SYSTEM

Many of the bodily reactions that result from activity of the autonomic nervous system are produced by the action of that system on the endocrine glands. The endocrine glands secrete hormones, which are carried throughout the body by the blood stream. These chemicals are as essential as the nervous system for the integration of the organism's activities and for the maintenance of homeostasis. The endocrine glands play an important role in growth, sexual and maternal behavior, level of energy and mood of the individual as well as reaction to stress. In precise words the endocrine glands secrete hormones into the blood stream which are important for emotional and motivational behavior. They are an essential partner to the nervous system in integrating behavior, and their action is closely tied to the activity of the autonomic nervous system. Figure 2.18 shows major endocrine glands.

Table 2.3 lists out the functions of various endocrine glands. We will briefly discuss those which are important from the behavioral point of view and these are the gonads, adrenals, thyroid and pituitary glands.

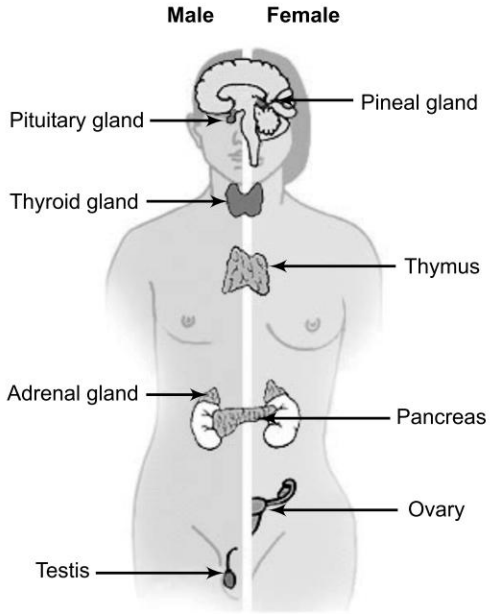


Fig. 2.18 Major Endocrine Glands

TABLE 2.3 Functions of Endocrine Glands

Gland	Hormone	Effect
Thyroid	Thyroxin	Increases metabolism
Parathyroid	Parathormone (Vitamin D)	Increases blood calcium Lowers blood phosphate Prevents loss of Ca and P
Adrenal cortex	Corticoids	Sodium retention Potassium loss Liver glycogen formation Increases carbohydrate metabolism Male sex hormones
Adrenal medulla	Norepinephrine	Mimics sympathetic nervous system Raises blood pressure Stimulates ACTH release
Pancreas	Glucagon	Increases blood glucose level
Alpha cells **Beta cells**	Insulin	Lowers blood glucose level
Posterior pituitary	Vasopressin Oxytocin	Smaller arteries constrict, Kidney water re-absorption Uterus contracts Milk production increases

(Contd.)

TABLE 2.3 (Contd.)

Anterior pituitary	STH	Stimulates growth
	TTH	Stimulate thyroid secretion
	ACTH	Stimulates adrenal cortex secretion
	Gonadotrophic	Stimulates gonads
	FSH	Develops germ cells
	LH	Stimulates sex hormones
	Lactogenic (prolactin)	Develops corpus luteum and increases milk production
Gonads	Androgen Estrogen	Fertility and secondary sex characteristics
Pineal gland	Melatonin	Suppresses sexual behavior

Gonads

Gonads or sex glands (male testes, female ovaries) are prime movers of sexual behavior and also affect many sex-related body features and behaviors. In addition, these glands produce the *gametes* or reproductory cells (spermatozoa and eggs).

The main male hormone, *testosterone*, and the main female hormone, *estrogen*, are produced in accordance with the production of stimulatory hormones from the anterior part of the pituitary gland. This fact suggests the very complex manner in which the endocrine glands constitute a highly coordinated, self-regulatory system. Characteristic male and female sexual responses, although subject to enormous variation from cultural and other learning factors, are correlated with the presence in the blood-stream of one or the other of these sex hormones. Figure 2.19 shows the male and female gonads.

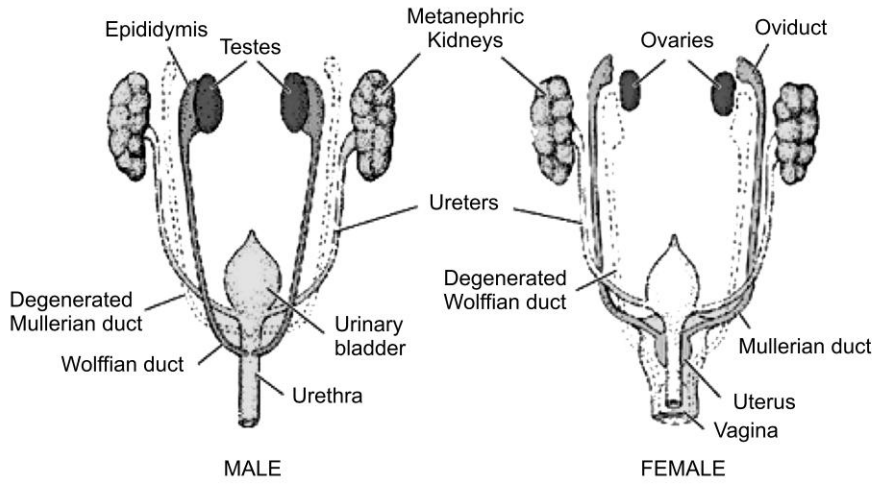


Fig. 2.19 Male and Female Gonads

Thyroid Glands

These glands consist of two lobes located respectively on the two sides of the windpipe. Metabolism is the general function of thyroid glands. It apparently does this in diverse ways affecting other glands, the enzyme system activity is involved in metabolism and virtually all aspects of energy expenditure in the body. Thyroid

glands do not have any specific target organs, but it affects the way cells function in carbohydrate utilization and protein synthesis. Figure 2.20 shows the thyroid glands.

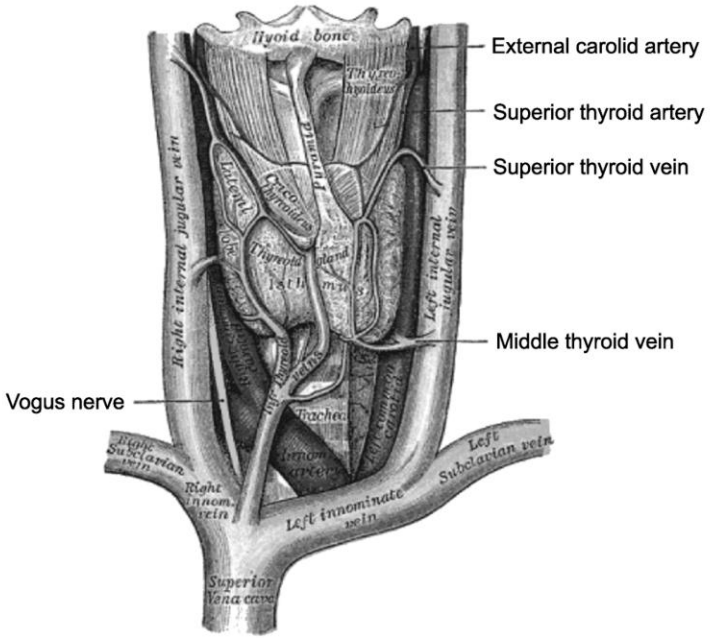


Fig. 2.20 Thyroid Glands

Growth and normal functioning of an organism depends on metabolism, if there is deficiency in the thyroid secretion in the young or growing organism it stunts growth. Early deficiency in life among the human beings is called a '*Cretin*' and if it occurs in adulthood it is called '*Myxedema*'. The person suffering from Myxedema has a lowered metabolism, and this results in below-normal heart rate, circulation, body temperature and general activity level.

'*Thyroxin*' is the principle hormone of the thyroid gland. In fact, thyroxin may be artificially made in the laboratory by mixing iodine with any tyrosine—containing protein, e.g., '*Casein*'. In the body, the tyrosine is stored in a more complex form in the gland and at the same time the gland traps iodine entering the blood along with food stuffs and water. The thyroxin is then made by the gland, as needed, at the time it is secreted into the blood.

The thyroid production is under the control of the *thryrotrophic hormone* of the anterior pituitary gland. The two glands form a feedback loop. When thyroxin concentration in the blood rises, the output of thyrotrophic hormone decreases and vice versa. The equilibrium is maintained in this manner.

Persons with overactive thyroid glands (hyperthyroid) tend to be excessively active and excitable. The thyroid gland may thus have an important input into personality structure and needs to be considered whenever unusual deviation from normal activity level is found.

Pituitary Gland

One of the major endocrine glands, the pituitary gland, is partly an outgrowth of the brain and is joined to it just below the hypothalamus. The pituitary gland has been called the 'Master Gland', because it produces the largest number of different hormones and controls the secretion of several other endocrine glands. The pituitary has two independent functioning parts—the posterior pituitary and the anterior pituitary.

Posterior pituitary

This is a direct extension of the nervous system. Two hormones produced in the hypothalamus are transported along nerve axons for release by the posterior pituitary. One hormone influences the contraction of the uterus during childbirth and the reflexive ejection of milk from the mammary gland. The other regulates the amount of water in the body cells and indirectly controls blood pressure. Figure 2.21 shows the pituitary gland.

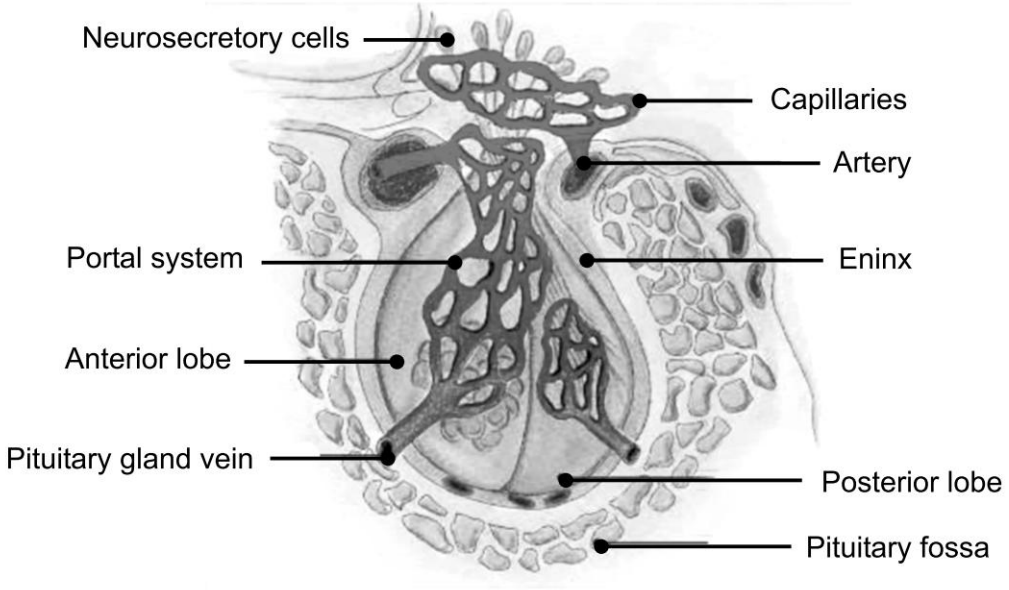


Fig. 2.21 Pituitary Gland

Anterior pituitary

This is also controlled by the hypothalamus, but in a different way. Certain hormones released by the hypothalamus are carried to the anterior pituitary by a system of tiny blood vessels. They stimulate the anterior pituitary to release its own hormones.

One of the anterior pituitary hormones has the crucial role of controlling the timing and amount of blood growth. Too little of this hormone can create a dwarf while over secretion can produce a giant. A number of other hormones released by the anterior pituitary trigger the action of the other endocrine glands – the thyroid, the sex glands or gonads and one part of the adrenal glands. Courtship, mating and reproductive behavior in many animals involve a complex interaction between the activity of the nervous system and the influence of the anterior pituitary on the sex glands.

Adrenal Gland

This gland, located on the kidney, has two parts, each secreting its own family hormone. These two parts are the adrenal 'cortex' or outer part and the adrenal 'medulla' or inner core of the gland.

Adrenal cortex

This is the outer part of the adrenal gland and very essential for life. If this part is removed, the animal becomes weak, loses its appetite and gradually dies. There are changes resulting from adrenal deficiency which are revealed by specific psychological measurements. The chief changes are (a) a disturbance of sodium-potassium balance in which excessive sodium is excreted by the kidney, while more potassium is retained than normal, and (b) carbohydrate metabolism is altered, and in particular the deposition of glycogen in the liver is reduced.

In the last few decades, biochemical research has produced more than 30 different extractable materials from the adrenal cortex. These are known as '*steroids*'. Among these, however, only half a dozen are biologically active and three of them most active. There three are (i) '*Cortisol*', which is a close relative of, but more potent than, *Cortisone*, (ii) '*Corticosterone*', and (iii) '*Aldosterone*'. These three have overlapping functioning, but aldosterone is by far the most potent in promoting sodium retention and electrolyte balance, while cortisol is the most active in carbohydrate metabolism. Corticosterones lie in between in its potency in both functions.

Adrenal Medulla

This part secretes two closely related hormones—'*epinephrine*' and '*norepinephrine*'. They are also called *adrenalin* and *nonadrenaline*, respectively. The norepinephrine lacks a methyl group (CH_3) found in epinephrine, which makes the difference between the two. Taken together, these hormones are called '*catechol amines*' or '*catechol hormones*'. These hormones are connected with chemical transmission of nerve impulses. Norepinephrine is secreted by the *adrenergic nerve* endings of the sympathetic nerve fibers.

The effects of *catechol amines hormones* are often similar, though not always exactly the same. Both raise blood pressure, but epinephrine does it by increasing cardiac output, whereas norepinephrine does it by general vasoconstriction. Blood-sugar levels are raised by both hormones, since they have a direct effect on the release of glycogen from the liver, but epinephrine is much more effective in this respect than norepinephrine.

Figure 2.22 shows the adrenal gland.

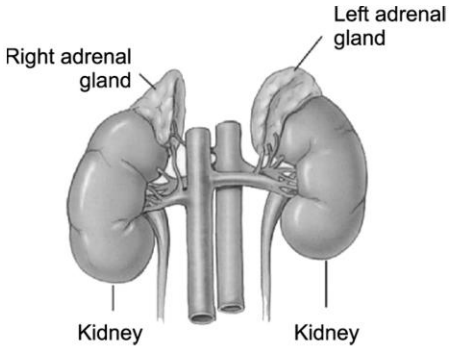


Fig. 2.22 Adrenal Gland

KEY TERMS

Species-specific behaviors	Genotype	Phenotype
Somesthesis	Kinesthesis	Homeostasis
Cerebrum	Medulla oblongata	Blind spot
Eustachian tube	Cutaneous senses	Endocrine system

EVALUATE YOURSELF

Multiple Choice Questions

1. The course of development of human behavior is governed by
(a) The interaction of family and society
(b) The interaction of biological father and mother
(c) The interaction of genetic endowment with the environment
(d) None of the above

2. Many species-specific behaviors consist of relatively stereotype patterns technically labeled as
(a) Fixed-action pattern (FAP)
(b) Fixed-behavior pattern (FBP)
(c) Fixed-reaction pattern (FRP)
(d) Fixed-species pattern

3. Behavior genetics is the study of
(a) How people are born
(b) Ways in which genetic constitution determines behavior
(c) Human misbehavior
(d) The way psychology helps human development

4. Which of the following plays a major role in the maintenance of homeostasis?
(a) Lumber plexus
(b) Receptors
(c) Thermostat
(d) Hypothalamus

5. A nerve fiber is
(a) An axon or dendrite of neuron
(b) A vessel connecting the cells
(c) A protective fabric
(d) None of the above

6. Neurophysiology is the study of
(a) The physiological system
(b) How nerve cells, or neurons, receive and transmit information
(c) How electric potential across the membrane is reduced
(d) The nervous system

7. The peripheral nervous system consists of the
(a) Nerves in the periphery of the body
(b) Nerves or fibers leading from the brain and the spinal cord to the rest of the body
(c) Nerves originating from the spinal cord
(d) Nerve fibers from the spinal cord to the smooth muscles and glands

8. The sacral nerves are located in the
(a) Neck
(b) Chests
(c) Loin
(d) End of the spinal column

9. The parasympathetic nervous system is also known as
(a) The cranio-sacral system
(b) The thoracic-lumber system
(c) The empathetic nervous system
(d) The reticular activating system

10. Metabolism is the general function of
(a) The gonads
(b) The pituitary gland
(c) The adrenal gland
(d) The thyroid gland

Descriptive Questions

1. What do you understand by the term 'behavior genetics'. Discuss the genetic factors in the evolution of human behavior.
2. 'Stimuli are physical events to which receptors respond.' Discuss this statement.
3. Why is the state of equilibrium essential for healthy functioning of an organism? Discuss and highlight the associated mechanisms.
4. How do all the parts of the nervous system interrelate with each other?
5. What do you understand by the term 'neurophysiology'? Discuss with relevance to the functioning of neurons.
6. Which disorders are related with the malfunctioning of the nervous system? Discuss with relevant examples.
7. 'An individual's response to stimuli constitutes his behavior.' Explain this statement in the light of sensory processes.
8. Which are the major endocrine glands in the human body and where are they located?
9. Outline the functions of the major endocrine glands with reference to the hormones they secrete and their effect.

Critical Thinking Questions

1. How can psychologists use drugs that mimic the effects of neurotransmitters to treat psychological disorders?
2. Do you think that cloning will benefit mankind? Argue in favor of or against.
3. 'Schools in India should drastically reduce their syllabus and teach only what is actually required.' Argue in favor of or against this statement.

PRACTICAL EXERCISES

1. Illustrate through a flowchart how a response takes place when you accidentally prick your finger with a pin.
2. Create three groups in your classroom. Ask each group to write five points in favor of one of the three bases in the study of psychology—genetic, biological and environmental.

Answers to Multiple Choice Questions

1. (c) **2.** (a) **3.** (b) **4.** (d) **5.** (a) **6.** (b) **7.** (b) **8.** (d) **9.** (a) **10.** (d)

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Chapter 3

Processes of Consciousness—Attention

Chapter Objectives

After reading this chapter, you will learn

- That attention is a cognitive process.
- The various determinants of attention, including the neural basis.
- The processes and reasons that explain shifts and fluctuation of attention.
- How division of attention happens during our day-to-day activities.
- The various theoretical perspectives and research on span of attention.
- The process of selective attention and theories explaining it.

INTRODUCTION

In the early days of modern psychology, attention was seen as a central property of mental life. Its effect was to clarify the contents of consciousness and to convert the raw material of sensation into perception. William James, Pillsbury, Wundt and Titchner all wrote at length on the nature of attention, and Titchner in particular carried out an impressive experimental program. He conducted experiments involving participants and presented them with an object or stimulus and asked them not to name the object but instead to describe it. For example, if they were shown an apple and identified or described it as an apple, this would be called naming the stimulus error. It was found that when the participants were asked to avoid the stimulus error, there was a shift in consciousness from a representational type of consciousness to a more presentational form. This presentational form is what may be called the 'focus of attention'. We will discuss the more 'solid' manifestation of sensation, **attention,** in this chapter.

PSYCHOLOGY NUGGET

Structuralism in Psychology

Edward Bradford Titchener (1867–1927) was an Englishman and a British scholar. He was a student of Wilhelm Wundt in Leipzig, Germany, before becoming a professor of psychology and founding the first psychology laboratory in the United States at Cornell University. It was Edward Titchener who coined the terms 'structural psychology' and 'functional psychology', in 1898, the early trends in scientific psychology. Structural psychologists analyzed human experiences through introspection, breaking mental activity down into 'basic elements' or 'building blocks'. Although his theoretical models were not adopted by others, his championing of psychology as a science, using the scientific method of laboratory experiments to collect data, made a clear separation between experimental psychology and other trends such as psychoanalysis. Ultimately, however, our understanding of human nature cannot be achieved solely through science, although the distinctions drawn by Titchener were valuable in its early development. As a structural psychologist, Titchener, in his attempt to adhere strictly to a natural science model, readily sacrificed psychological processes and activities that did not fit into his methodological framework. In addition, the over-reliance on the questionable, strict methodology of introspection led Titchener and other structural psychologists into a sterile dead end. In a sense, structuralism was caught between the 'empiricism of the British tradition' and 'nativism of the German tradition'. Titchener and other structuralists articulated a view of the mind as determined by the elements of sensation; at the same time they recognized mental activity and attempted to deal with activity through such constructs as 'apperception'. Coupled with the inadequacies of introspection, structuralism failed to accommodate conflicting philosophical assumptions about the nature of the mind.

There are several concepts of attention. Knowledge concerning attention is developing rapidly, especially in cognitive perceptual psychology, physiological psychology, psychophysics and behavior theory. However, these developments proceed independently to a great extent; different meanings of the term are found in the different fields. However, it is possible to make out some stability with historical meanings of attention in most cases.

Attention is the term given to the perceptual processes that select certain inputs for inclusion in our conscious experience or awareness at any given time. Attention is a pre-perceptive process that depends upon one's interest and motivation at large, as well as the nature of the stimuli, which impinge upon him.

Characteristics of Attention

Attention is a pre-perceptive process. It is captured and maintained by the features of the environment as well as by the motives and other physical and psychological conditions of the observer. One pays attention to one stimulus or pattern of stimuli at a given instant while ignoring others. The process of attention divides our field of experience into a *focus* and a *margin*. Events that we perceive clearly are at the focus of experience. Other items are perceived dimly; we may be aware of their presence but only vaguely so. These items are in the margin of attention. Another characteristic of attention is that it is *constantly shifting*. What is at the focus one moment may be in the margin the next; and what is in the margin may become the focus. Figure 3.1 shows the spotlight model of attention. The term 'spotlight' was first used by **David LaBerge** (1983) and was inspired by the work of William James who described attention as having a focus, a margin and a fringe (**Eriksen** and **Hoffman** 1972).

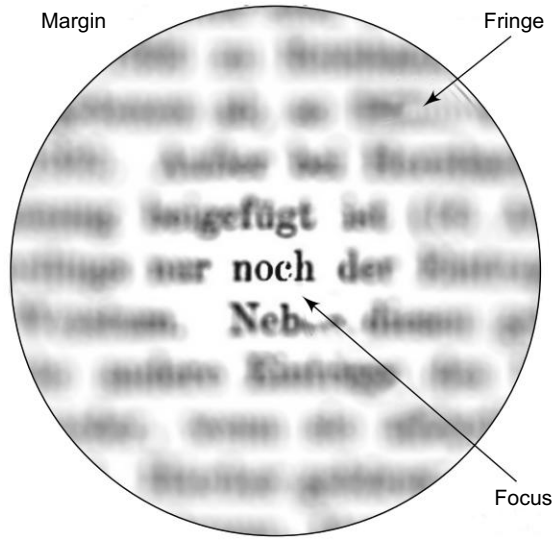


Fig. 3.1 Spotlight Model of Attention (Visual)

Thus, we selectively attend to certain aspects of our environment while regulating others to the background (**Johnston** and **Dark** 1986**).** This selective process in attention is advantageous in the sense that it enables us to maximize information gained from the object of our focus, while reducing sensory interference from other irrelevant sources (**Matlin** and **Foley** 1997). Studies done by **Rensink**, **O'Regan** and **Clark** (1997) have shown that one can focus so intently on one task that he fails to take notice of other events occurring simultaneously.

PSYCHOLOGY NUGGET

How Do We Focus Our Attention?

A shadowing experiment investigated subjects' ability to focus their attention in the presence of two irrelevant messages. The subjects shadowed a binaurally presented message while attempting to ignore two monaurally heard distractors, one on each ear. In one condition, the distractors were normally spoken messages. In a second condition, the distractors were reversed speech (normal speech played backwards). In a third condition, subjects shadowed a binaural message while attempting to ignore a single binaurally presented reversed-speech distractor. The subjects combined both locational cues and the forward/reversed cue to help them to select the appropriate message. This result implies that the discriminability of the relevant message from the background is an important factor in selection. It exerts an effect in addition to any influence of the number of groups into which attended and background messages are segregated (**Robin A. Barr** 1981).

DETERMINANTS OF ATTENTION

The stimuli that comprise the environment at any given instant are constant and insistent. These stimuli rarely reach the sense organs one by one. Most of these stimuli compete with other stimuli for attention or come linked with other stimuli that a person perceives in patterns. **Yantis** (1993) comments on the basis of studies done by him that a variety of stimulus events will capture attention. On the other hand, as mentioned before, attention is constantly shifting. The question that arises keeping the mentioned facts in mind is what factors make us notice one object rather than another when both are present at the same time? An examination of spontaneous looking activity has frequently been used with some success as a vehicle for isolating the determinants of attention. It has been found that attention is dependent upon the characteristics of the stimulus, the internal need, expectancies and experience among others. We will discuss the factors in detail classifying them into external and internal determinants.

External Determinants or Stimulus Variables

Nature: By nature is meant, for example, whether the stimulus is visual or auditory and whether it involves words or pictures, people or animals.

Location: Location plays an important role in the process of attention. If the stimulus is located well within the threshold range, it will have a positive effect. The figure and ground effect is also of importance in the location of the stimulus, thereby affecting the attention process.

Size: The larger the object, the more is the chances of it being attended to.

Intensity: The more intense the stimulus, the greater is the probability of it being attended to.

Color: Brighter colors are more likely to attract attention than dull ones.

Motion: Moving objects are easy to be attended to than stationary ones. Here, relative motion plays its role.

Contrast: If the figure and ground effect is so matched as to highlight the figure, then attention will be paid to it more readily.

Novelty: Any unusual or irregular event is liable to gain more attention.

Internal Determinants or Organismic Variables

Motivation: This is one important factor in determining which stimulus elicits attention. Physical or social deprivations related to basic human needs have a strong effect on the direction and intensity of attention. The fact that in identical circumstances people show great differences in the degree to which they attend to a particular stimulus is partly due to their motivational state at a given instance.

Interest: Events or objects in which a person has already developed an interest are more likely to attract attention than objects and events in which there has been no interest initially.

Attitudes and Prejudice: These also affect the extent to which an individual is inclined to pay attention to events or ideas. A positive attitude towards situations, circumstances or things is more likely to draw one's attention. Prejudices, on the other hand, also negatively influence one's attention. Negativity associated with any situation, circumstances or event is not likely to capture one's attention.

Fatigue: Physical and mental fatigue has a detrimental effect on attentiveness. As a person becomes physically fatigued, there occurs a reduction in his vigilance in any sense modality thus leading to diminished attentiveness.

Preparatory Set: One of the major factors that make a person attend to one stimulus instead of another is his preparatory set. The preparatory set refers to the predisposition to act in certain ways and the readiness

of an individual to respond to one kind of stimuli and not to others. Individuals vary in their responses to the same stimuli because of their habitual or momentary interest that prepares them for certain kinds of stimuli. Preparatory set or expectancy determines what a person will attend. His attention is directed towards those objects or events which he is set to receive.

NEURAL BASIS OF ATTENTION

Typically, our environment contains many different objects but the capacity of our nervous system to fully analyze them is limited. At any given time, only a small amount of the total sensory input is actively taken up for further processing. Several lines of evidence indicate that multiple object representations compete for processing resources in a mutually suppressive fashion. These competitive interactions take place in multiple brain systems, sensory and motor, and can be biased in favor of relevant information as a result of selective attention. Selective mechanisms appear to operate as top-down signals that modulate sensory processing in several ways: enhancement of neural response to an attended stimulus, suppression of ignored-object representations and shift of baseline activity in the absence of sensory stimulation. Depending on the current task, spatial and non-spatial features can be used to give a competitive advantage and processing resources to objects of relevance. A main source of top-down biasing influence may derive from frontal and parietal structures involved in working memory and motor preparation (**G. di Pellegrino** 2004).

SHIFTS AND FLUCTUATIONS IN ATTENTION

Given a field of stimuli, the balance of external and internal determiners of attention governs the first response. Now, let the stimuli remain unchanged, we might expect attention to remain fixed and no change of response to occur. What happens in most cases is quite different. Attention shifts, the response quickly changes. Since the external determiners remain constant, we infer that some internal factor or factors must change. There are several varieties of shifting and fluctuation, the basic method to study this is to hold the stimulus field constant for a time and record the changes of the response.

Ordinary Shifts of Attention

The shifting we shall consider first is 'ordinary' in comparison with the peculiar oscillations. Suppose one is looking at a very complex picture. One will look at various parts of the picture one after the other, perhaps coming back now and then to some especially interesting object. What is the rate of this shift? When the eye movements are photographed, the fixation was found to vary in duration between a minimum of about 100 ms and a maximum of a second or two usually. In silent reading, the eye fixation runs a little shorter than in viewing a picture.

If we ask, not how quickly attention can move but how long it can remain fixed, we can obtain an estimate from experiments of **Billings** (1914). He concluded that the average duration of attention was in the neighborhood of two seconds. When subjects became more acquainted with the experiments, their attention period got shorter while complex stimuli tend to lengthen the attention period. A distracting stimulus did not interfere with the attention; rather helped it and the disturbing elements forgotten were always the last ones.

Present day's psychologists' understanding of attention switching has progressed considerably. Researchers now emphasize on the distinction between voluntary, internally (*endogenous*) driven shifts of attention and involuntary, environmentally (*exogenous*) driven shifts of attention such as when a flash 'captures' one's attention (**Briand** and **Klein** 1987; **H.J. Muller** and **Rabbitt** 1989; **Posner**, **Snyder** and **Davidson** 1980;

Theeuwes 1991; **Weichselgartner** and **Sperling** 1987). Although it may seem odd that attention can be drawn to an irrelevant stimulus against one's will, it is only in the laboratory that such stimulus is truly irrelevant. As an example, if one is hunting for a rabbit in one bush, a rabbit in the next bush will also be of interest.

It has also been found that internally and externally driven shifts could have different time courses (**H.J. Muller** and **Rabbitt** 1989; **Wolfe**, **Alvarez** and **Horowitz** 2000). Estimates of the time required to shift attention endogenously vary from about 150 ms (**Remington** and **Pierce** 1984) to about 500 ms (**M. M. Muller**, **Teder-Sa¨leja¨rvi**, and **Hillyard** 1998). However, exogenous shifts occur on an even shorter time scale, down to about 50 ms (**Tsal** 1983).

Oscillation in the appearance of Ambiguous Figures

An ambiguous drawing can be seen as representing either of two different objects. Under continued scrutiny, the ambiguous figure seems to change its shape or position repeatedly. The oscillation can be controlled to some extent if one fixes his eyes steadily on a corner that he wishes to have protruded towards him. He can then shift his fixation to another corner when he wishes the appearance to change but this control is far from complete, for sometimes one holds his eyes steady and still sees the figure change and at times one moves his eyes without getting any reversal of appearance. The rate of oscillation is variable, usually slow at first and more, and more rapid during continued observation.

Eye Movements and Binocular Rivalry

The phenomenon of binocular rivalry has been mentioned as one of the most spectacular demonstration of fluctuations in attention (**Helmholtz** 1867, **James** 1890, **Lack** 1974, **Woodsworth** and **Schlosberg** 1954; **Blake et al.** 1980; **Lee** and **Blake** 1999).

If radically different stimuli such as colors on figures are simultaneously presented to the corresponding areas of the two eyes, one of the stimuli tends to be seen and the other suppressed. As the double exposure continues, alternations in perception of the stimuli are experienced, so that what was previously invisible comes into view and what was visible disappears. Thus, cycles of dominance and suppression are established.

Several factors have been identified which control the rate of alternation and determine which of the competing stimuli will be more dominant. An advantage occurs to a moving stimulus as well as to the stimulus, which is more intense or more 'interesting' (**Woodsworth** and **Schlosberg** 1954). Predominance can also be affected by the relative amount and clarity of contour in the stimuli (**Crovitz** and **Lockhead** 1967, **Levelt** 1968). In addition, predominance of one of the views can be established to some extent by voluntary effort (**Lack** 1969, **Meredith** and **Meredith** 1962). The resolution of stimulus conflict during binocular rivalry is influenced by a host of sensory, cognitive and affective factors, implying the involvement of multiple, interconnected brain areas in the control of binocular rivalry (**Tong et al**. 2006).

Basis of Rivalry

If binocular rivalry is to be attributed to some forms of attentional oscillation, it is necessary to rule out the possibility that this phenomenon is controlled primarily by peripheral factors associated with the visual receptors. One possible candidate as a peripheral basis of rivalry is retinal adaptation on fatigue. However, since the contending stimuli are always physically present during both dominance and suppression, it is unlikely that these local retinal changes can explain the phenomenal changes characteristic of rivalry.

A somewhat less obvious peripheral factor that has been offered as the mediating mechanism for binocular rivalry involves differential changes in the thickness of the lens of each eye (**Fry** 1936). According to this

EXPERIMENTAL PERSPECTIVE

Neural Bases of Binocular Rivalry

During binocular rivalry, conflicting monocular images compete for access to consciousness in a stochastic, dynamical fashion. Recent human neuroimaging and psychophysical studies suggest that rivalry entails competitive interactions at multiple neural sites, including the sites that retain eye-selective information. Rivalry greatly suppresses activity in the ventral pathway and attenuates visual adaptation to form and motion; nonetheless, some information about the suppressed stimulus reaches higher brain areas. Although rivalry depends on low-level inhibitory interactions, high-level excitatory influences promoting perceptual grouping and selective attention can extend the local dominance of a stimulus over space and time. Inhibitory and excitatory circuits considered within a hybrid model might account for the paradoxical properties of binocular rivalry and provide insights into the neural bases of visual awareness itself (**Frank Tong, Ming Meng** and **Randolph Blake** 2006).

argument, rivalry is the result of differential accommodation and the consequent blurring of retinal images. **Lack** (1971) has provided a test of the accommodations hypothesis.

Still another peripheral factor, which might influence rivalry, is eye movement. Our visual receptors are capable of exercising several different kinds of movements. Some of these are relatively extensive and are under conscious control.

In general, results of experiments designed to investigate potential peripheral contribution to binocular rivalry support the conclusion that rivalry is controlled not by peripheral factors but by some central mechanism such as fluctuations of attention.

Suppression and Selectivity

An interesting question regarding the perceptual fluctuations that occur in rivalry is: To what extent the suppression is selective? That is, does the suppression process selectively attenuate only certain classes of stimulus inputs, or is the suppression process non-selective in relation to the physical properties of the suppressed stimuli? The dominant views concerning binocular rivalry suggest that suppression is related to selections of a particular stimulus (**Dorrenhaus** 1975; **Logothetis et al**. 1996) or to information from a specific eye (**Blake et al**. 1980; **Polonsky et al**. 2000; **Tong** and **Engel** 2001).

Conclusion

The conclusion drawn was that rivalry suppression represents an inhibitory state that attenuates all classes of inputs falling within the boundaries of the suppressed target. Thus, though the source of this kind of fluctuation in attention is central, it is also non-selective.

Recent Advances and Research in Attentional Shifts and Fluctuations

What has recent research got to say about the attentional shifts and fluctuations? An answer to this is the research done by **Gazzaniga, Ivry** and **Mangun** (2002) in which they found out that these shifts occur because the human brain is limited in its ability to process information and simultaneous processing cannot

EXPERIMENTAL PERSPECTIVE

Attentional Boost Effect

Recent work on event perception suggests that perceptual processing increases when events change. An important question is: How do such changes influence the way other information is processed, particularly during dual-task performance. In this study, participants monitored a long series of distractor items for an occasional target as they simultaneously encoded unrelated background scenes. The appearance of an occasional target could have two opposite effects on the secondary task: It could draw attention away from the second task, or, as a change in the ongoing event, it could improve secondary task performance. Results were consistent with the second possibility. Memory for scenes presented simultaneously with the targets was better than memory for scenes that preceded or followed the targets. This effect was observed when the primary detection task involved visual feature oddball detection, auditory oddball detection, and visual color-shape conjunction detection. It was eliminated when the detection task was omitted, and when it required an arbitrary response mapping. The appearance of occasional, task-relevant events appears to trigger a temporal orienting response that facilitates processing of concurrently attended informatio-Attentional Boost Effect (**Khena M. Swallow** and **Yuhong V. Jiang** 2010).

occur without a substantial cost. In effect, this shifting of attention becomes necessary because it allows us to redirect attention to aspects of the environment we want to focus on and subsequently process. **Posner** (1980) and **Gazzaniga, Ivry** and **Mangun** (2002) in separate studies have found out that when an object or area is attended, processing operates more efficiently. Furthermore, the size of our visual field limits us. With multiple objects in a scene, only some may show up in our field of vision at one time. Therefore, the eyes, along with one's attention, must constantly be moved and, in a sense, refocused in order to process multiple stimuli. It is this practice of refocusing one's attention, which involves an attentional shift.

The *moving spotlight theory* that attempts to explain how visual attention shifts states that people can attend to only one region of space at a time (**Eriksen** and **St James** 1986; **Posner et al**. 1980). The theory assumes that the attentional spotlight cannot be divided across multiple locations. If more than one object must be attended to at a given time (say multiple football opponents coming in for the tackle), then attention must serially shift from one location to another. However, **McMains** and **Somers** (2004) challenged this long-standing notion by using fMRI to test whether attending to two separate locations leads to separate regions of neural enhancement in early retinotopic visual areas. The results provide neural evidence that subjects can attend to two separate regions of space and selectively modulate early visual activity in a top-down fashion. Perhaps, however, subjects were achieving this apparent split of attention by rapidly shifting a single spotlight from one location to the other. Overall, the study provides compelling fMRI and psychophysical evidence demonstrating that the spotlight of visual attention can indeed be divided and people are capable of dividing their attention for certain displays and tasks.

DIVISION OF ATTENTION

A question that has stimulated the thinking of many researchers in the past is whether attention has a unitary or divisible character. When one simultaneously focuses on two separate objects, it involves division of attention. However, if one activity out of the two is automatic in nature, no division of attention is required, for example, driving and talking. An individual often performs several activities simultaneously where

attention is to be paid to most of them. However, in general, simultaneous performance of two attentive tasks involving cognition does not ordinarily occur. Usually, there is a rapid succession or alternation between the two tasks being performed. Also most of the time, the activities being performed could be combined into an integrated performance so that strictly speaking there would not be any division of attention.

Because of constitutional limitations in individuals, attentive behavior or performance is constrained. This is because of bottlenecks in his system. If we go by a capacity theory explanation, then we can assume that there is a general limit on man's capacity to execute performance. However, this limited capacity can be allocated with considerable freedom among activities being performed at the same time (**Kahneman** 1973).

Sanders (1967) has suggested that the organism has a limited capacity which is to be shared among various operations that he is trying to perform simultaneously, as a result a marked decrease in sensitivity would be produced by divided attention. This fact has found support from the works of **Glucksberg** (1963), and **Eysenck** and **Thompson** (1966). They all indicate that when tasks are being done simultaneously, the efficiency decreases.

In a study done by **Kahneman** (1973), it was found that different task performance impose dissimilar demands on the limited capacity of the organism. An easy task is less demanding than a difficult and complicated task. Performance deteriorates if the attention available is not sufficient to meet the demands.

Lindsley (1960) has pointed out that highest level of arousal may be associated with divided attention. **Berlyne** (1960) also observed that the more arousing stimuli tend to dominate behavior of the organism in situations where the organism has to decide which stimuli he has to respond to and in which preference. **Baker** (1961) has pointed out the importance of motivation or arousal in relation to combating the effect of division of attention.

Recent studies on division of attention point out that although most people can perform several simple activities such as eating and watching television concurrently (**Sharon** 1997), making simultaneous decisions is difficult (**Pashler** and **Johnston** 1998). For the majority, task overload causes errors in performance (**Girard** 2007), a decline in the quality of treatment (**Ruthruff et al**. 2001) and longer reaction time (**Levy et al**. 2006). The few who cope efficiently under such circumstances employ different cognitive strategies.

SPAN OF ATTENTION

An interesting question regarding attention is: What number of uniform objects can one grasp at a single glance? For example, if one has a handful of grams and threw them on a tray, how many of them can he grasp in a single glance. The range would vary from six to eleven grams. Experimental evidence, using sophisticated gadgets, has lent support to the range of uniform objects one can grasp at a single glance. However, span of attention varies with relation to organization. It could be more in case of letters, the reason being that the letters can form a word if not chosen at random.

Averbach and **Sperling** (1961), using the sampling technique or partial report method (*discussed in detail in Chapter 7 on Memory and Forgetting*) came to the conclusion that subjects take in a considerable amount of information, i.e. about two to three times more than their span, which is apparently indicated by the usual whole report method. One finding which stimulated investigations in this context was that information decays very rapidly, visual intake is fast and relatively a large number of items can be stored for a brief period but then they decay and disappear even before reporting could be done (*for details refer to Sperling's research in Chapter 7.*)

In another research study done by **Sperling** (1960) and **Averbach** and **Sperling** (1961), it was found that when subjects were presented with an array of letters exposed for a very short time, approximately 50 milliseconds, they reported only a few and not all of them when the whole report method was employed (*refer to iconic memory in Chapter 7 for details*).

EXPERIMENTAL PERSPECTIVE

Attention Span: Facts and Myths

Attention span is the amount of time a person can concentrate on a single activity. The ability to focus one's mental or other efforts on an object is generally considered to be of prime importance to the achievement of goals. People usually have a longer attention span when they are doing something that they enjoy.

In a recent study of 2,600 children ages 1 to 3, a team of researchers from University of Washington found that early exposure to television may have a negative impact on attention span. It has also been suggested that internet browsing can have a similar effect. Attention span while working on a computer is in the range of one second or less. If it takes any longer than a fraction of a second for the computer to respond to an instruction, (such as performing a search or hitting the back-arrow key), the human brain starts to wander off task.

The average attention span of a person is 2–5 minutes times their age. So, a 5-year-old would have an average attention span of 10–25 minutes. Elementary education often helps to extend or develop attention span in children. A common myth quoted by many teachers is that a person's attention span is 10 + person's age minutes and that anything taught after that is not taken in, but by taking a 5–10 minute break after this time will help the class recover and replenish their attention span. But there is no evidence that this is actually successful· in children, it is said that their attention span is about a minute for every year of their lives.

In these and many other experiments, the results obtained suggest that a person receives a lot of information but at the time of recalling, not all the received information is available, particularly when the delay is one second or more. The span of attention depends on the factors like the background, the nature of the stimulus and the distance between the stimuli—the more the distance, more difficult it is to recognize. Illumination and exposure time also affect the span of attention. More intense and more the exposure time, more is the increase in the attention span. Factors such as interest, past experience and familiarity also affect the attention span.

SELECTIVE ATTENTION

Assume that your best friend invites you to a birthday party. You are now standing in a room full of people. If I were to ask you 'what do you see in the room', you would probably answer, 'I see a lot of people in the room'. If now I were to ask you 'who are the people present in the room', you would probably give me the names of the people who are already known to you. Though there were many other people present in the room, you attended to only a few of them. In other words, you have been very selective in perceiving the people around in the room.

In real life, hundreds of stimuli impinge on our senses but we attend to only a few. Thus, there is a purpose in our attention and it is selective and purposive in nature.

The selective aspect of attention has been recognized by almost all, in spite of diversified application of its concept. In fact, selective attention is the common core of all the views concerning attention. By selective attention, we mean attention to stimuli in one but not another modality, or even attention to one but not another dimension of stimuli within the same modality. At a given moment, an overwhelming number of events of information are available to an organism. However, not all of these information's are actually perceived by an individual until they are not brought to his attention. The organism only relatively attends to some of the information in preference to others. The choice of stimuli to be allowed to control behavior is affected by the organism. Some of the available information is relevant to the organism, while the rest is not.

EXPERIMENTAL PERSPECTIVE

Is Attention Shared Between The Ears?

A study done by **Richard M. Sniffrin, David B. Pisoni, Kicab and Castaneda-Mendez** (1974) tested the locus of attention during selective listening for speech-like stimuli. They tried to find out if processing can be differentially allocated to the two ears? Two conditions were used. The simultaneous condition involved one of four randomly chosen stop-consonants being presented to one of the ears chosen at random. The sequential condition involved two intervals; in the first S listened to the right ear; in the second S listened to the left ear. One of the four consonants was presented to an attended ear during one of these intervals. Experiment I used no distracting stimuli. Experiment II utilized a distracting consonant not confusable with any of the four target consonants. This distractor was always presented to any ear not containing a target. In both experiments, simultaneous and sequential performance was essentially identical, despite the need for attention sharing between the two ears during the simultaneous condition. They conclude that selective attention does not occur during perceptual processing of speech sounds presented to the two ears and suggest that attentive effects arise in short-term memory following processing.

Selective attention enables an individual to tune in relevant information, while rejecting the rest. Thus, selective attention has a reference to the ability of an organism to process only part of the information registered in the sensory system and to filter the rest. In order to avoid inefficiency, the limits in human capacity for attending to several simultaneously competing stimuli need to be determined. It is also essential to understand the process by which the brain accepts or rejects the sensory information, analyses and stores it, and finally executes an overt behavior.

The concept of selective attention is innately related with limited capacity (**Shiffrin** 1976). In a general way, selective attention has also a reference to the control of information processing (**Schneider** and **Shiffrin** 1977) so that the limited capacity channel is not overloaded and the organism's efficiency for the derived stimulus is safe guarded. Selective attention has been investigated in a wide variety of task performance.

The problem of selective attention is best understood with the analogy of a cocktail party problem put forward by **Cherry** (1953). To analyze the problem of selective attention, Cherry developed a new experimental technique called *shadowing* in which a listener is asked to repeat one of the two continuous messages presented to him over the two earphones as he receives them and to ignore the other. *Dichotic listening* and shadowing effects were studied by **Cherry** (1953). In the shadowing technique, Cherry presented two messages through the headphones, one to each ear, and the subject was to repeat one of the two passages continuously along with hearing the same.

The results of the above experiment were that a listener did not find any difficulty in listening to one speech and rejecting the other as instructed to him. If he was asked to repeat one message without any error concurrently with listening, the words reported were found to be slightly delayed behind those on the record to which he was listening and his voice was speaking in monotony. There was no emotional content or stressing of the words, though the subject was not aware of this and he had no idea about the content of the message he was repeating, particularly when the subject matter was difficult, though he recognized every word.

Shadowing of message in this and similar experiments of **Cherry** (1953) where the subject's 'words were slightly delayed behind those on the record to which he is listening' has been termed *Phrase Shadowing* (**Norman** 1969). In *Phonemic Shadowing,* it can be made more difficult by instructing the subject to repeat each sound as he hears it without even waiting for the completion of a word.

In connection with auditory attention, some latter studies (**Moray** and **O'Brien** 1967, **Underwood** and **Moray** 1971) have used tasks other than shadowing such as monitoring. **Kahneman** (1973) has outlined the main difference between shadowing and monitoring; shadowing requires continuous overt responses, while monitoring requires occasional responses only to the target items. Kahneman admits, 'Selective attention was less effective in our recognition experiments than in studies of shadowing'. He also observed that shadowing is more demanding for the organism than monitoring.

THEORIES OF SELECTIVE ATTENTION

The question which needs to be discussed next is the manner in which psychologists have accounted for the fact that perception has a focus and that which shifts from time to time. Some have used the concept of *filtering* to explain this phenomenon. It is an experienced fact that we cannot process all the information at one time that is available to and through our sensory channels. What we do is we filter or partially block out some inputs while letting others through (**Treisman** 1969; **Lindsay** and **Norman** 1977). Models of selective attention based on filtering differ based upon where the filtering process occurs in the sensory channels. **Broadbent** (1958), on the basis of experimental studies, had proposed that the filter or information bottleneck is at the sense organs or at least in the very early stages of the input processing (*refer ahead for detailed theory*). On the other hand, **Schneider** and **Shiffrin** (1977) put forth the view that the filtering is done at the later stages of the information flow, e.g. at the stage where the input is interpreted as meaningful. Yet other theories lay stress upon the *processing capacity* (**Kahneman** 1973). According to these theories, we have a limited mental capacity for processing incoming information and therefore we cannot deal with all the sensory inputs at once. To efficiently deal with the information, we allocate our limited resource—our processing capacity—to one of the many simultaneous sensory inputs. According to these theorists, those inputs which take up the larger part of our processing capacity are at the focus of our attention. The shifting of attention according to these theorists occurs when environmental changes take place and the new input requires maximum resources of the processing capacity.

We will now discuss and critically evaluate the important theories of selective attention.

Broadbent's Filter Theory

Information Overload

Some of the most exciting work on attention has been the attempts to develop theoretical models that describe the nature of selection process. Perhaps the best known of these is the filter theory, introduced by **Broadbent** in his influential book *Perception and Communication* (1958).

Theories of selective attention must address two basic problems. **Deutsch** and **Deutsch** (1963) have phrased them as follows: 'The first is how different streams of information are kept distinct by the nervous system, and how a resultant babel (a confusion of sounds or voices) is thereby avoided. The second is why only one of the messages (once it has been kept distinct and separate) is dealt with at any one time.'

Broadbent (1958) took the position that messages are kept distinct in part because they proceed along separate neurological pathways or channels. He assumed that the nervous system has a finite capacity for handling the deluge of information that arrives over different channels. To answer the question of how only one message comes to be handled at a time, Broadbent proposed that the brain contains a selective filter that chooses messages based on physical characteristics towards which it is 'tuned' and rejects others. The filter spares the limited capacity system from being overloaded; complex forms of input are rejected based on simple qualities and a higher-level analysis of them need not occur.

According to the model, information enters the nervous system through a wide number of parallel channels. Since the total amount of information arriving within a given point in time usually exceeds the capacity of higher-level centers responsible for perceptual analysis (*p systems*), a serious bottleneck in the flow of information would be expected. The bottleneck is reduced by the operation of a filter mechanism that has the ability of select information from one of the input lines and allows it direct access to the higher level powering centers. Broadbent also proposed that there is a *short-term memory* store at the end of the sensory input lines. If two messages arrive simultaneously, one of them is immediately transmitted through the filter, while the other is held briefly in storage. During its time in storage, the representation of the message fades so that it is ultimately lost or at least seriously degraded when eventually gated through the filter. As is evident from Fig. 3.2, the theory makes allowance for buttressing material in short-term storage through a feedback loop between the higher level centers and the short-term store.

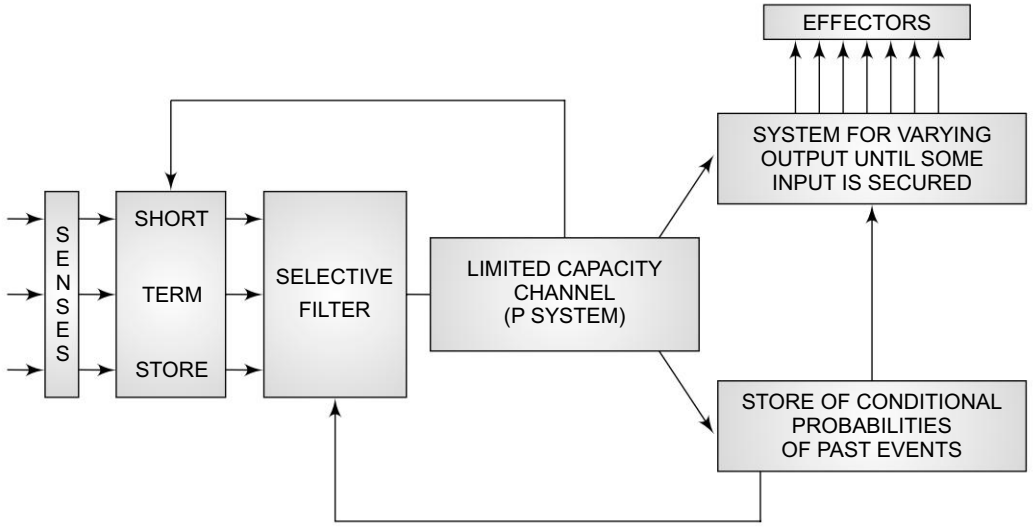


Fig. 3.2 Information Flow Diagram for Broadbent's Theory (1958)

In essence, the filter model views the selective nature of attention as resulting from restriction in the capacity of the nervous system to present information. In addition, as **Moray** (1969a) has noted, the system is kept from being overloaded by an information handling strategy in which parallel inputs are coded in a serial manner.

An important feature of the filter theory is that selection does not take place at random. Instead, Broadbent maintained that the filter biases its selections towards certain physical feature of the stimuli.

This unique and imaginative approach is supported by a broad array of empirical findings, both neurophysiological and behavioral. At the neurophysiological level, the notion of a filter that screens out certain classes of inputs fits nicely with the results of a pioneering series of experiments by **Hernandez-Peon** (1966) and his co-workers that describe the blockage of incoming (afferent) impulses in sensory neurons when attention is distracted.

Critical Review

Broadbent's (1958a) model has been taken as a theoretical structure with strong implications, some of which have been tested and proved wrong. The model has been found to be inadequate to explain many experimental findings. It was assumed that attention could not be divided as the *p-system* (limited capacity channel) is conceived to be incapable of performing parallel processing of independent stimuli. The apparent divisions of attention in two simultaneous activities require alternation between two channels. The rate at which such alternation can take place is also very slow. Moreover, if the processing of the first message, which is already in the *p-system*, is delayed because of its complex nature, the process of the waiting message will be susceptible to decay from the *S-system* before it can be subjected to further analysis in the *p-system*.

However, the idea that parallel processing of simultaneously presented stimuli is not possible and does not seem to be very convincing. Strong evidence was also lacking for the suggestion that the rate of alternation of the switch of the filter is very slow and that it allows only one channel at a time to enter into the *p-system*.

The concept of *attenuation* as proposed by **Treisman** (1960) implied occurrence of some parallel processing of simultaneous messages even when only a particular channel has been attended to. Furthermore, it showed that attention can jump back and forth from one channel to another to follow the content of a message. **Gray** and **Wedderburn** (1960) carried out an experiment that demonstrated that attention followed meaningful sequences, rather than the physical characteristics of the input.

They questioned the idea that attention was based on the physical characteristics of sensory channels and suggested that psychological attributes played an important role in selection.

In short, the gist of the study by Gray and Wedderburn was that attention mechanism must be able to extract the meaning of information from the two ears in order to be sure which ones are to be chosen. However, Broadbent's system requires attention to be switched at an early stage in the processing of sensory information, much before any of the meaning could have been extracted.

Though Broadbent's theory recognizes the important role of the broader cognitive system in its ability to compensate for the limited ability to process items in parallel that have been ignored by many of his detractors, yet they have indulged in criticizing his theory as being extreme and wrong and almost certainly wrong (**Ashcraft** 1998). Support for Broadbent's theory comes nearly after forty five years from the works of **Joel Lachter, Kenneth I. Forster** and **Eric Ruthruff** (2004) who have done extensive research and developed a modern version of selective filter theory (*see box - forty-five years after Broadbent*).

EXPERIMENTAL PERSPECTIVE

Forty-Five Years After Broadbent (1958): Still No Identification Without Attention

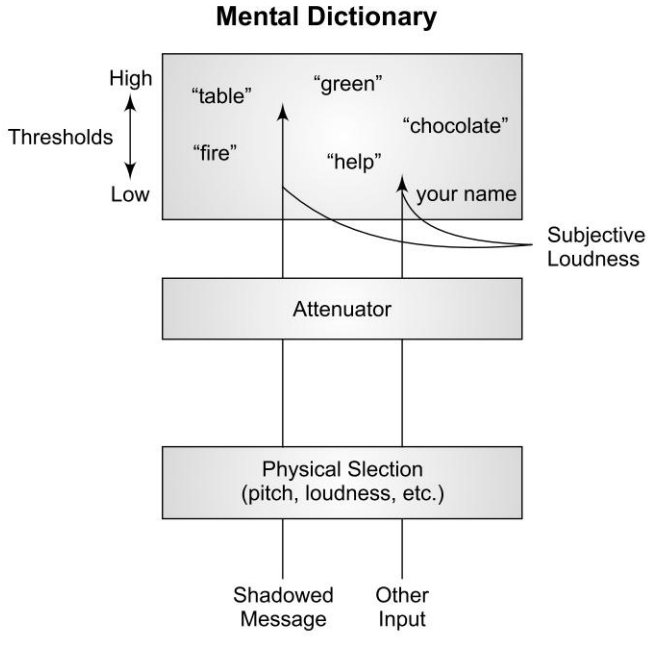
According to **D.E. Broadbent's** (1958) selective filter theory, people do not process unattended stimuli beyond the analysis of basic physical properties. This theory was later rejected on the basis of numerous findings that people identify irrelevant (and supposedly unattended) stimuli. A careful review of this evidence, however, reveals strong reasons to doubt that these irrelevant stimuli were in fact unattended. A review done by **Joel Lachter, Kenneth I. Forster** and **Eric Ruthruff** (2004) exposed a clear need for new experiments with tight control over the locus of attention. They present five such experiments using a priming paradigm. When steps were taken to ensure that irrelevant stimuli were not attended, these stimuli produced no priming effects. Hence, they found no evidence that unattended stimuli can be identified. The results support a modern version of Broadbent's selective theory.

Conclusion

Broadbent's filter theory has gone through a critical analysis by many psychologists. **Treisman** (1960, 1964a) attempted to rectify the problems associated with the filter theory and she proposed a modification of the theory that was subsequently acceded by Broadbent as well. The modified theory suggests that the rejection message is only attenuated, and not completely blocked so that the weakened signals can still be identified by specially altered cognitive systems. Treisman's modifications have enabled filter theory to handle successfully much of the material on selective attention and **Broadbent** (1971) has accepted these revisions. We now will discuss the Broadbent–Treisman filter attention model.

Filter Attenuation Theory

Based on the findings, Treisman rejected the concept of a filter that screens out material solely in terms of physical properties. Instead, she proposed a modification of the filter theory that would render the notion of filtering in selective attention compatible with facts pointing to a more complete analysis of rejected information. The essence of this modification is that filtering is not an all-or-none affair. She suggested that the filter does not cut off rejected messages entirely, but instead attenuates their strength. Thus, under some conditions, the weakened signals can still contact higher-level elements of the perceptual systems (see Fig. 3.3).



1. Early selection.
2. Selection (attenuation) is based on physical properties of the stimulus (e.g., pitch and loudness).
3. Attention is directed toward information that reaches a threshold of recognition.
4. Several inputs can be processed at a time.

Fig. 3.3 Process of Selective Attention: Treisman's View

According to Treisman, selection is accomplished based on a series of tests that are performed on incoming information in a hierarchical order. Incoming messages are first examined for crude physical properties such as pitch, loudness, intensity, spatial location and tissue of arrival. The next stage of processing brings the filter into play. Based on its 'tuning' characteristics, the filter weakens the strength of signals coming from input lines that are to be rejected. In general, stimuli which do not possess the physical characteristics for which the filter is set are attenuated in strength.

After passing through the filter, both non-attenuated and attenuated messages go on to deeper levels of the nervous system where they activate high-level perceptual analyzers on 'dictionary units'. These units extract meaning from incoming stimuli and complete selections made on the bans of the responses of the perceptual analyzers. As conceived by Treisman, each analyzer unit has a threshold, which must be exceeded by the input stimulus to which it is responsive in order for full awareness of the stimulus to occur. Unwanted signals that have been weakened by the filter will generally be unable to activate the higher order perceptual units responsive to them and ordinarily will go unrecognized. On the other hand, wanted signals that are not modified by the filter will trigger their appropriate dictionary units and thus will be recognized.

In order to account for 'leaks' of unwanted material into awareness, Treisman posited additional features of the perceptual analyzing units. She suggested that the thresholds of units that are responsive to highly significant stimuli are lower than those of other units. Thus, such stimuli will be fully perceived even if their strength is attenuated. Furthermore, Treisman asserted that transient modifications in threshold may be brought about by instructional or contractual factors and in this way highly probable events, appearing in an unattended input line may be recognized even though attenuated by the filter. Treisman's modifications have enabled filter theory to handle successfully much of the material on selective attention and these revisions.

Evaluation of Treisman's Attenuation Model

Treisman's model overcomes some of the problems associated with Broadbent's filter model, e.g. the attenuation model can account for the 'cocktail party syndrome'. However, it does not explain how exactly semantic analysis works. The nature of the attenuation process has never been precisely specified. A problem with all dichotic listening experiments is that you can never be sure that the participants have not actually switched attention to the so-called unattended channel.

Treisman and Gelade (1980) later on developed the theory of Feature Integration that states that all stimuli are first processed in parallel and then serially in a conjunction search in which certain features are looked for in combination. This theory has led to other theories such as *guided search theory*, but it ignores the effects of the similarities between distracters and the target. The theory also incorrectly assumes that processing occurs in two phases: parallel and then serially.

In further developments, **Treisman** (1988) and others (**Lavie**, 1995) have proposed a model that combines aspects of both the early and late selection models, depending on the nature and amount of information being processed. Simply put, if there is relatively little information to process, selection will occur later, whereas conditions of information overload are likely to require an early selection on the perceptual processes (**Lavie** 1995). Hybrid models of this sort are possible because both early and late stage models share the same metaphorical structure, namely, an Information-Processing model in which a filter (located at some stage) acts to select information (**Yantis** 1990).

Comparison of Broadbent's and Treisman's Theories

Comparing Broadbent's and Treisman's theories is a relatively straightforward affair since Treisman's model is a direct amendment of Broadbent's. These theories have far more ideas in common, than they do

differences, yet it is the differences which are the key aspects. The two major differences are outlined in the following two paragraphs.

1. *Broadbent's filter is all-or-nothing (it does not allow through unattended messages), whereas Treisman's filter allows unattended messages through, but in an attenuated form*. Treisman proposed this amendment to account for a number of empirical findings that were not explained by Broadbent. For instance, **Moray** (1959) had found that 'subjectively important messages such as a person's own name can penetrate the block (the all-or-nothing filter): thus a person will hear instructions if they are presented with his own name as part of the rejected message'. A similar finding by **Oswald *et al.*** (1960) found that a person's own name and critical names presented to a sleeping subject elicited a clench response, which had been previously conditioned. **Treisman** (1960), using a dichotic listening with shadowing procedure, found that if different sentences in the two ears are suddenly switched, then the subject shadows one or two words of the unattended message before reverting to shadow the attended ear. Clearly, certain unattended messages can be processed semantically, hence the need to modify the physical characteristics filter.
2. *Broadbent's is a simple single filter model, whereas Treisman's can be thought of as a two-stage filtering process: firstly, filtering based on incoming channel characteristics, and secondly, filtering by the threshold settings of the dictionary units*. Treisman's explanation as to the way these threshold settings perform a filtering operation explains the findings of Moray, Oswald and Treisman described above, and many other similar findings. The dictionary units have the two-important properties of having thresholds that differ, and which are variable. Some units, those that respond to biologically (or emotionally) important signals, have permanently lowered thresholds. Hence, even very attenuated signals (because they are not being attended to) can trigger a unit which is 'tuned' to that signal. This explains the reason why one's own name can attract one's attention in a previously unattended message. On a biological level, this explains the sensitivity that mothers have for the noises their babies make, even when virtually out of earshot. In addition to these semi-permanent threshold differentials, there is the transient variation in thresholds due to the expectations of the subject, i.e. the context. The occurrence of a particular signal will, if it triggers a dictionary unit, lower the threshold for other signals, which in the past have been associated with it. Hence, highly probably words (e.g. those halfway through a sentence in Treisman's 1960 experiment) are made more likely to fire even if their signal is attenuated.

EXPERIMENTAL PERSPECTIVE

Dual-Stage Two-Phase Model of Selective Attention

The dual-stage two-phase (DSTP) model is introduced as a formal and general model of selective attention that includes both an early and a late stage of stimulus selection. Whereas at the early stage, information is selected by perceptual filters whose selectivity is relatively limited, at the late stage, stimuli are selected more efficiently on a categorical basis. Consequently, selectivity is first low but then abruptly increases during the course of stimulus processing. Although intended as a general model of selective attention, the DSTP model was applied by **Ronald Hübner, Marco Steinhauser** and **Carola Lehle** (2010) to account for the distributional data of three flanker task experiments. The fit of the model to the data was not only rather good but also superior to those of alternative single-stage models with a continuously increasing selectivity. All together, the model provides a comprehensive account of how early and late stages of attention interact in the control of performance.

Table 3.1 shows a comparison of Broadbent's and Treisman's models.

TABLE 3.1 Comparison of Broadbent's and Treisman's Models

	Broadbent's Model	Treisman's Model
1.	Incoming stimuli, briefly held in a sensory register, undergo pre-attentive analysis by a selective filter based on their physical characteristics.	Incoming stimuli, briefly held in a sensory register, undergo pre-attentive analysis by an attenuation filter based on crude physical characteristics. (The information resulting from this analysis is available to conscious perception and for reporting by the subject, regardless of what happens to the message beyond this point.)
2.	Those stimuli selected pass along a (very) limited capacity channel to a detection device where semantic analysis takes place.	Those stimuli selected (attended to) pass along a limited capacity channel to a detection device (a pattern recognizer, comprising a number of 'dictionary' units) where semantic analysis takes place.
3.	Those stimuli not selected ('filtered' out) are not analyzed for meaning and do not reach consciousness.	Unattended stimuli are attenuated (the signal strength is lowered) before passing along the limited capacity channel to the detection device, where they are semantically processed if they meet certain criteria.
4.	This is, therefore, an early selection theory and an 'all or nothing' view of perception.	This is, therefore, an early selection theory and an attenuation model of attention.

KEY TERMS

Attention
Binocular rivalry
Filter attenuation theory
Stimulus variables
Selective attention
Treisman's attenuation model
Eye movements
Broadbent's filter theory

EVALUATE YOURSELF

Multiple Choice Questions

1. Attention is a
(a) Post-perceptive process (b) Pre-perceptive process
(c) All-or-null process (d) A marginal process

2. The process of attention divides our field of experience into
(a) Past and present (b) Conscious and unconscious
(c) Focus and margin (d) Shifts and fluctuations

3. Which of the following is not an external determiner of attention?
(a) Nature of stimuli (b) Size (c) Novelty (d) Preparatory set

4. The phenomenon of binocular rivalry is a demonstration of
(a) Selective filtering in attention (b) Early filtering in attention
(c) Fluctuation in attention (d) All of the above

5. The moving spotlight theory attempts to explain how
(a) Visual attention shifts (b) Attention is captured (c) Attention is divided (d) The eyes focus

6. Sperling's work on attention is related with
(a) Shifts and fluctuations (b) Selective attention
(c) Suppression and selectivity (d) Span of attention

7. Attention span is the amount of time
(a) Taken for attention to be captured (b) A person can concentrate on a single activity
(c) Taken for perception to evolve (d) Between shifts and fluctuations

8. Selective attention enables an individual to
   (a) Tune in relevant information, while rejecting the rest
   (b) Reject all incoming information
   (c) Alternate attention between various stimuli
   (d) Enjoy freely during a cocktail party
9. 'The brain contains a selective filter, which chooses messages based on physical characteristics towards which it is tuned and rejects others.' It is a concept related with
   (a) Broadbent's filter theory
   (b) Treisman's filter-attenuation theory
   (c) Guided search theory
   (d) All of the above
10. Treisman's theory holds that
   (a) A serious bottleneck occurs in the flow of incoming information.
   (b) Filter biases its selections towards certain physical features of the stimuli.
   (c) The filter does not cut off rejected messages entirely, but attenuates their strength.
   (d) People do not process unattended stimuli beyond the analysis of basic physical properties.

Descriptive Questions

1. 'One pays attention to one stimulus or pattern at a given instance.' Explain this with the help of the spotlight model of attention.
2. 'A variety of stimulus events capture attention.' Briefly outline these events.
3. What do you mean by binocular rivalry and what is its basis?
4. Discuss the recent advances in attentional shifts and fluctuations quoting relevant studies.
5. Can attention be divided? Discuss with scientific evidence.
6. Critically evaluate Broadbent's filter theory.
7. How did Treisman modify the filter theory? Give a comparative analysis of Treisman's and Broadbent's theory.
8. What is the dual-stage two-phase model of attention?
9. Can attention be shared between the ears? Discuss in the light of the studies done.
10. How is attention related with perception, learning and memory? Discuss.

Critical Thinking Questions

1. 'Attention results from buttressing of consciousness.' Analyze and elaborate.
2. Can one's attention be boosted?
3. Why do people usually have a longer attention span when they are doing something that they enjoy?
4. Is attention shared between the ears?
5. How is a 'cocktail party' related with attention?

PRACTICAL EXERCISES

1. Go to any website that has information on psychology. Ask each member of the class to glean information from the web page and jot down the central idea. Do you see a normal distribution in attention span (the length of time each student took)? Do you observe commonality in the central theme? If you do not have access to a web page, you may select a page from a book or an artwork.

Answers to Multiple Choice Questions

1. (b) **2.** (c) **3.** (d) **4.** (c) **5.** (a) **6.** (d) **7.** (b) **8.** (a) **9.** (a) **10.** (c)

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Chapter 4

SENSATION AND PERCEPTION

CHAPTER OBJECTIVES

After reading this chapter you will learn

- That sensation is manifested in the cognitive process of perception.
- Various approaches to the study of perception, including the famous Gestalt psychology.
- The process of perception, stage by stage.
- How perception is organized and the various laws governing it.
- The various dimensions of perception—in space (depth, color, distance, etc.) and time.
- What is subliminal perception and when does it occur.
- How and why illusion occurs as a perceptive cognitive process.

In the last chapter, we have dealt with one aspect of consciousness—attention. We have discussed how attention can be described as a manifestation of sensation in a very presentational form. In this chapter, we will deal with another aspect of consciousness that is perception.

NATURE OF PERCEPTION

Perception refers to the relation between output and input, both potentially observable. The output, in psychological language, is referred to as 'behavior' of the organism; it is related to some aspect of the input or stimulation impinging on the organism.

The human organism is considered as one, which possesses two aspects of energy. The first is the physical aspect of energy, which can permanently or for a significant length of time change the physical structure of an organism and influence its behavior indirectly. The second is the informational aspect, an impingement of energy, within 'limits', which may also influence behavior but not necessarily through a lasting change in structure. Its influence may be effective only during the course of its own duration and the energy, in this sense, is a carrier of signals or messages.

Perception is not based only on two aspects of energy. It is also based on feedback, which an organism gets from the internal and external environment. Hence, feedback has the rudiments of a perceptual system.

Though defining perception is a difficult task, since it concerns not one but nearly all aspects of human behavior, an effort will still be made. Perception, as a term in psychology, refers to the apparently direct and immediate knowledge of the world and of our own bodies by neural signals from the eyes, ears, nose and tongue. The various other sense organs include the skin, senses of touch (hot, cold and pain), organs of balance in the inner ear, the unconscious monitoring of forces of the muscles and the joints to signal the positions of the limbs. Thus, we can broadly say that perception is a psychological function, which by means of the sense organs enables us to receive and process information on the state of and alteration in the environment. In more common and simple words, perception may be defined as *the process by which the sensory input or information is organized and interpreted into a meaningful experience*.

APPROACHES TO THE STUDY OF PERCEPTION (GESTALT AND PHYSIOLOGICAL APPROACHES)

Gestalt Approach

Gestalt is a German word meaning '*pattern*', '*form*' or '*configuration*'. The term was introduced into physiological psychology by the German psychologist C. von Ehrenfels and was disseminated by K. Koffka and W. Kohler. Gestalt psychologists held that in perception we and other animals are aware directly of a

PSYCHOLOGY NUGGET

GESTALT PSYCHOLOGY

The Gestalt school of psychology, founded by, **Max Wertheimer** and his younger colleagues, **Kurt Koffka** and **Wolfgang Köhler**, was to some extent a rebellion against the *molecularism* of Wundt's program for psychology, in sympathy with many others at the time including William James. The Gestalt psychologists believed that mental experience was dependent not on a simple combination of elements but on the organization and patterning of experience and of one's perceptions. Thus, they held that behavior must be studied in all its complexity rather than separated into discrete components. They also advocated that perception, learning, and other cognitive functions should be seen as structured wholes. In fact, the word Gestalt means a unified or meaningful whole, which was to be the focus of psychological study. Experiments done by Max Wertheimer, Kurt Koffka and Wolfgang Köhler led them to conclude that the mind imposes its own patterns of organization on the stimuli it receives rather than merely recording them, and that the significance of the mental 'wholes' thus formed transcends that of their component parts. These and other experiments led to the wide-ranging Gestalt view of *the whole as more than the sum of its parts*. Although the Gestalt School has been criticized for being merely descriptive, it has formed the basis of much further research into the perception of patterns and objects (Carlson et al. 2000) and of research into behavior, thinking, problem-solving and psychopathology.

configuration or structure that is grasped as a whole and not merely as an assemblage of its parts. The fullest account of the theory in English is provided in Wolfgang Kohler's *Gestalt Psychology* (1930).

Thus, *the Gestaltists elected to study perception in terms of inherent organization and configurational properties*. They built up a formidable array of evidence to suggest that psychological events, in general, and perceptual events, in particular, must be understood in terms of their holistic nature, as breaking them down into elements destroys their essential meaning. *According to them, the whole is greater than the sum of its parts*. Like the *structuralists*, Gestalt psychologists made use of the subjective report, but in the form of *phenomenological observation*, which focuses on how things appear rather than on how they are composed.

In our daily life, our perception of several figures may share a common ground and it may seem that figures tend to cluster together in groups. Why do some elements of the perceptual field form the figure while others become ground and why do figural elements group together the way they do? The German psychologists led by Max Wertheimer and his chief collaborators, Kurt Koffka and Wolfgang Kohler, took to the task of investigating this question. Their approach is known as *Gestalt psychology*. We will briefly examine this approach and summarize the concepts.

Thus, the Gestalt psychologists argued that organization is intrinsic to the perceptual system, and they offered the *law of Pragnanz* as the basic principle, which governs the segregation of the field of view into separate forms. This principle states that '*psychological organization will always be as 'good' as the prevailing conditions allow*' (**Koffka** 1935). The term '*good'*, in general, refers to the simplest, most stable figure possible. A '*good'* figure embodies such properties as regularity, symmetry and simplicity. Perhaps the best example is a circle. In a very general way, those figures which 'belong' together are grouped together, thus leading to the simplest and 'best' organization possible.

In essence, the *law of Pragnanz* holds that perception is organized through some sort of *minimum principle*, by which the perceptual response that will occur in a given situation is the most economical response possible (**Hochberg** 1971a). The Gestaltists generated a series of grouping principles supported by many compelling illustrations of the operation of the *law of Pragnanz*. These principles include *proximity, similarity, symmetry, good continuation, common fate and closure*. (These are discussed under the heading, *Laws of Organization*.)

Thus, the Gestalt concept is the further refinement of the notion of wholeness. It proved useful initially in the perception theory and was then applied more generally. It tends to come increasingly to the fore in connection with the problem of the order obtaining within the whole.

Physiological Approach

So far in our discussion, we have seen that senses are crucial to perception. Humans have at least ten sensory channels: vision, taste, smell, touch, cold, warmth, pain, kinesthesis (muscles, tendon, and joint sense) and the vestibular sense (equilibratory sense). All our sense experiences have their *thresholds,* both *absolute* and *differential*. Threshold refers to the value of a quantitative variable such as sound intensity etc. at which a stimulus is just detectable (*absolute threshold*) or the minimum difference between two stimuli on a quantitative or qualitative variable (e.g. hue) that is detectable (*differential threshold*). *Subliminal perception* refers to perception resulting from stimuli below the threshold of conscious perception. These, nevertheless, are supposed to influence behavior. We will now discuss the main features of the visual and auditory senses in relation to their physiological base and related characteristics since an understanding of these is essential for the understanding of perception. Figure 4.1 shows some of the main features of the visual sense.

The eye receives light waves through the *cornea*, *pupil lens* and *retina*. The actual receptors are the *rods* and *cones* of the retina. The cones, concentrated in the *fovea* but scattered throughout the retina, mediate experiences of both black and white and hue (chromatic colors). The rods, in the periphery of the eye,

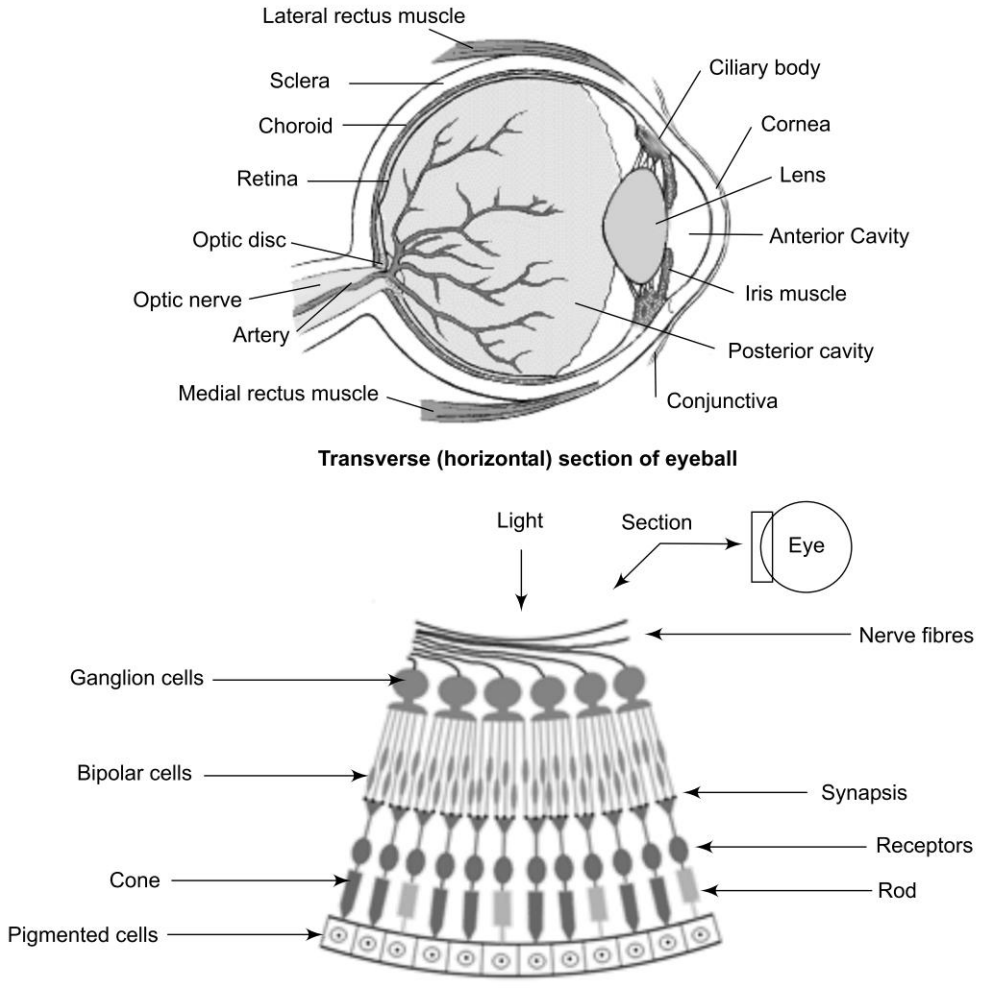


Fig. 4.1 Main Features of Visual Sense

mediate experiences only of black and white (the achromatic colors). In night vision, only the rods function. The distinctive roles of the rods and cones can be inferred from *dark adaptation*, in which the cones reach their maximum sensitivity in about five minutes, while the rods continue to become increasingly sensitive for about half an hour.

The chromatic colors can be arranged around a color circle (following the order of wavelengths) with space allowed for the non-spectral purples and reds. When properly spaced, the colors opposite each other are complementary. When complementary colors are mixed as lights (additive mixture), they cancel each other and result in a neutral gray. Although four psychological primaries can be identified (red, yellow, green, and blue), three color primaries (red, green, and blue) are enough to produce the range of hues by additive

mixture. The chief dimensions of color are hue, brightness and saturation, and they can be represented on the color solid.

Afterimage and contrast effects emphasize the pairing of colors for the withdrawal of stimulation of one hue. The contrast effect is highest between complementaries.

Color theories take these mentioned facts as starting points and attempt to explain them. The *Young-Helmholtz theory* begins with color mixture; the *Herring theory* starts with afterimages and contrast. Recent research indicates that both theories are partially correct. Color vision may be a two-stage process involving three kinds of color responses from receptors in the retina that are encoded into two color, on-off signals by cells, further along in the optic system.

Some Facts and Principles Arising From the Study of the Auditory Senses

The chief dimensions of auditory experience are pitch (correlated with the frequency of vibration of the sound waves that constitute the stimulus) and loudness (correlated with the amplitude of these waves). The absolute threshold for hearing depends on the frequency of the tone. Very low or very high-pitched tones must be more intense to be heard than tones in the middle range of frequencies.

Most tones are not pure, that is, composed of only a single frequency. Musical instruments may be differentiated by the timbre of their tones, a quality that depends on the overtones and other impurities differing from one instrument to another. Complex sounds composed of many frequencies and not in harmonious relation to one another are called *noise*.

The auditory apparatus consists of the *external ear*, leading by way to the *auditory canal* to the *eardrum*, giving access to the *middle ear*. The bones of the middle ear transmit the sound waves to the *oval window*, leading to the *inner ear*. The *cochlea* houses the *receptors* of the inner ear, *sensitive hair cells* buried in the *basilar membrane*. Wave motion in the fluid of the inner ear agitates these hair cells, which in turn, activate the *auditory nerve*.

Theories attempting to give a physiological explanation of pitch are the *place theory*, which emphasizes on the place on the basilar membrane where a particular frequency produces its maximum effect, and the *frequency theory*, which assumes that pitch is determined by the frequency of impulses traveling up the auditory nerve. Evidence indicates that the place theory applies to high frequencies while synchronous discharge is important for the lower frequencies.

It is known that the judgments made by people depend both on sensory and non-sensory or bias factors. *Signal detection theory* provides a way of separating sensitivity from *receiver-operating characteristics* (ROC) curves.

HOW PERCEPTION OCCURS: SEQUENCE OF EVENTS

Perception is the process of understanding sensation or giving meaning to them. This cognitive process is the third stage in the process of gaining knowledge, the first and second stages being sensation and attention, respectively. Sensation is an important pre-requisite of perception. Human beings must have some sense organs with proper functioning. All the stimuli that come from the outside world can be received only by our sense organs. When visual sensation is the cause of perception, it becomes *visual perception*. Similarly, based on the sense organ, which is stimulated by the environment, different types of perception (such as *auditory perception*, *olfactory perception*, and *gustatory perception*) occur. Attention is the term given to the perceptual processes that select certain inputs for inclusion in our conscious experience at any given time.

Attention is a pre-perceptive process, which depends upon one's interest and motivation, above all, as well as the nature of the stimuli, which impinge upon him. Thus, *perception is a selective process which leads one to pay attention to one stimulus or pattern of stimuli at a given instant while ignoring others*. Figure 4.2 shows how perception takes place.

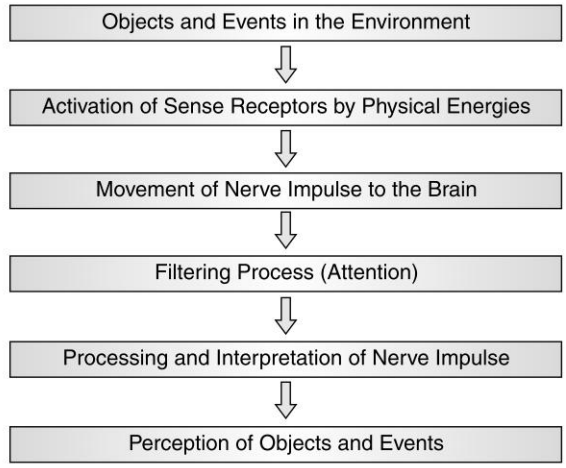


Fig. 4.2 Flow Chart Showing How Perception Takes Place

PERCEPTUAL STYLES

Cognitive style is defined as an individual's characteristic and consistent manner of processing and organizing what he sees and thinks about (**Messick** 1976; **Witkin** et al. 1971). According to **Messick** (1976), cognitive styles 'represent consistencies in the manner or form of cognition …' and the influence of cognitive styles 'extends to almost all human activities that implicate cognition, including social and interpersonal functioning'.

Nineteen major cognitive styles have been identified (**Messick** 1976), which can be classified into three types. First, there are cognitive styles that are related to abilities to perform specific task and are assessed in terms of the accuracy or correctness of performance (**Messick** 1976). An example of this cognitive style is *field-independence* versus *field-dependence*, which refers to the tendency to approach situations and tasks in an analytical way, as opposed to a global way. The ability to discriminate figure from its ground is assessed in tasks. Field dependence and independence refers to the degree 'to which the organization of the prevailing field dominates perception of any of its parts' (**Witkin et al**. 1971). It is an expression of an individual's cognitive psychological structure to separate contextual information (**Witkin** and **Goodenough** 1981). It also describes 'the degree to which a learner's perception or comprehension of information is affected by the surrounding perceptual or contextual field' (**Jonassen** and **Grabowski** 1993). In a field-independent cognitive style, there is a tendency to rely primarily on internal referents in a self-consistent way. On the other hand, in a field-dependent cognitive style there is a tendency to give greater credit to external referents (**Witkin** 1978). The degree of field-dependence or field-independence could also be described as a continuum, with field independent at one end and field dependent at the other end. In the middle of the continuum is the group termed 'field mixed' or 'field neutral', who do not have a clear orientation (**Liu** and **Reed** 1994).

Second, there are cognitive styles, which differ in the value, which can be attributed to them. An instance, of this type of cognitive style is *cognitive complexity* verses *cognitive simplicity* (**Harvey**, **Hunt** and **Schroder** 1961), which refers to the extent to which people organize events, and especially social behavior, in a complex, multi-dimensional and discriminating manner. Cognitive complexity has been defined as an aspect of a person's cognitive functioning which at one end is defined by the use of many constructs with many relationships to one another (complexity) and at the other end by the use of few constructs with limited relationships to one another (simplicity) (**Rauterberg Matthias** 1996). In processing certain types of information, a cognitively complex style is valued more highly than a cognitively simple style (**Goldstein** and **Blackman** 1977).

Third, some cognitive styles do not relate to abilities, and values are not attributed to them. An example is the cognitive style '*breadth of categorization'* (**Gardner** 1953; **Pettigrew**, 1958), which describes a tendency to think of specified categories as broad and inclusive or as narrow and exclusive.

A number of questions remain unresolved in the cognitive style research. These include how cognitive styles are produced; the extent to which they are open to self, control and modification; and whether they indicate an actual capacity to process information in a certain manner or merely a preference for doing so. The conceptual adequacy of cognitive style and its related concepts have also been questioned (**Kurtz** 1969).

Perceptual: Cognitive Styles

Cognitive style implies a separation of the self from the environment or field. The general processing strategies that characterize different people are known as *perceptual-cognitive styles*. People are said to differ in the ways they typically and characteristically process information. Many studies on cognitive style have found cross-cultural differences (**Mishra *et. al*.** 1996; **Berry** 1981; **Sinha** and **Bharat** 1982; **Sinha** and **Shrestha** 1992; **Sinha** 1988; **Bagley** 1984, 1988; **Gruenfeld** and **Mac Eachron** 1975).

Among the many dimensions along which people vary in perceptual-cognitive style are (i) the degree to which their perceptions (and other aspects of their behavior and personality) are flexible or constricted (**Klein** 1970) and (ii) their field-dependence or field-independence (**Witkin** and **Goodenough** 1981).

People whose perceptions are at the flexible-constricted dimension are said to have a wider focus of attention, to be less affected by interfering influences and to be less dominated by internal needs and motives than people at the constricted end.

The dimension of field-dependence-field-independence has to do with the perception of whole or part. A field-dependent person is said to unify and organize sensory inputs so that it is difficult to break down what is perceived into parts or elements. The perception of a field-dependent person is thus said to emphasize the whole over its component parts. Such a person, because of his or her difficulty in breaking the whole down into its parts, may have difficulty with tests that require finding a simple figure within a complex whole. Field-independent people, who emphasize the parts in perception, do well on such embedded-figure tests and on other perceptual tests requiring the emphasis of parts over the whole. Thus, individuals who are field-independent are more effective in disembedding and analytical tasks and also tend to be socially autonomous and distant in their inter-personal relations.

Recent Trends in Cognitive Style Research: Toward Hierarchical Multilevel Models

Starting in the early 1970s, new trends in cognitive style research started to emerge; these can be roughly divided into three categories. The first includes studies identifying styles (e.g. mobility–fixity) that can operate on a metacognitive level (e.g. **Keller** and **Ripoll** 2001; **Kholodnaya** 2002; **Niaz** 1987). The second

comprises studies that attempt to unite existing models of style into a unifying theory with a limited number of central dimensions (e.g. **Allinson** and **Hayes** 1996; **Curry** 1983; **Hayes** and **Allinson** 1994; **Riding** 1991; **Riding** and **Cheema** 1991) as well as to build an entirely new theory (e.g. **Sternberg** 1997). The third includes few studies that aim to build multi-level hierarchical models of styles and relate cognitive style to other psychological constructs and processes (e.g. **Miller** 1987, 1991; **Nosal** 1990).

DETERMINANTS OF PERCEPTION

The following are some of the factors that direct and determine the perceptual process.

Sensation

'Sensation is a psychic phenomenon incapable of further division and is produced by external stimuli acting on the sensory organs; in its intensity it depends on the strength of the stimuli and in its quality on the nature of the sensory organs.' That is how H. Rohracher paraphrased the concept of sensation in the classical sense and he distinguished sensation from perception as follows: 'Perception is a complex psychic phenomenon consisting of sensory sensations and components of experience, the cause or content of which is located in space and so leads to the apprehension of objects belonging to the outside world.' Of course, this separation of sensation from perception is scarcely feasible in practice and the boundary between the two concepts in the literature is becoming increasingly obscure.

Irrespective of distinct boundaries, as discussed earlier, sensation is the first stage in the process of gaining knowledge. It is an important pre-requisite for perception, since all the information from the outside world are mediated by the sense organs. It will not be wrong to say that if there is no sensation, there will be no perception. The accuracy of sensations also affects our perception, which is related to the proper functioning of our sense organs. The type of sensation will determine the type of perception; for example visual sensation leads to visual perception.

Attention

Our perceptions are selective. We do not react equally to all stimuli acting on us from the environment. This *perceptual focusing* is called attention. Through attention, we keep in focus some selected stimuli and resist distracting stimuli. Therefore, attention is the basic determining factor in perception, besides sensation.

Preparatory Set

We often prepare ourselves to perceive and act upon stimuli that we expect to appear. Such a preparation is termed as preparatory set, which particularly is an anticipatory adjustment holding certain kinds of responses in readiness. **Brumer** and **Postman** (1949); **Soloman** and **Postman** (1952) and **Leeper** (1935) have shown this effect in their studies.

Motivation

The perceptual progress depends largely on the individual's particular motivation. It is likely that the individuals who are in a state of need may perceive the objects in the same manner that may satisfy his need. **Sanford** (1937) found that individuals who have been deprived of food for some time and are shown ambiguous pictures, they are apt to perceiving them as related to food. Similar results were obtained by

McClelland and **Atkinson** (1948) using blurred pictures. Recent studies have shown that visual perception is not a modular, encapsulated process, but rather one that is susceptible to affective or motivational influences (**Veltkamp**, **Aarts**, and **Custers** 2008; **Proffitt**, **Stefanucci**, **Banton** and **Epstein** 2003; **Stefanucci** and **Proffitt** 2009; **Teachman**, **Stefanucci**, **Clerkin**, **Cody** and **Proffitt** 2008).

Cognitive Style

Cognitive style refers to the individuals' own general method of dealing with the environment. (*For details on cognitive styles, refer above.*) According to **Witkin et al**. (1962), people use two approaches in perceiving the environment—field dependent and field independent.

Field-Dependent Approach

In this approach, the environment is perceived as a whole. According to *Gestalt psychology*, the properties of the 'whole' affect the way in which the parts are perceived. According to them, 'the whole is different from the sum of its parts'.

Field-Independent Approach

In this approach, the elements of the environment are perceived as separate and distinct from each other and they tend to draw each element as standing out from the background.

Value

Value plays an important role in the perceptual process of an individual. It is evident from the studies of **Brumer** and **Goodman** (1947) and **Carter** and **Schooler** (1949); that children of poor homes, while matching sizes from memory, tend to overestimate the sizes of the coins more than children from well-to-do homes. In another study, **Bruner** and **Postman's** (1948) used positive (dollar sign), neutral (a square) and negative (swastika) symbols projected on plastic discs of varying size. An overestimation was found for stimuli containing a symbol indicating something positive or negative. It was argued that what is salient to a person looms larger in his or her perception. Subsequent studies, however, yielded inconsistent results regarding the effect of value on size judgments (**Jenkin** 1957; **Tajfel** 1957; **Klein**, **Schlesinger** and **Meister** 1951).

Why do participants overestimated the size of the coins was not fully clear, but it was conjectured that because the coin size is typically positively correlated with value, coins of a given size were seen as larger than their non-valuable counterparts (**Smith**, **Fuller** and **Forrest** 1975; **Taifel** 1957). With the advent of the notion of embodied cognition, it has become evident that the human eye is not solely an organ for vision, but that visual perception is permeated by biological needs, emotional states, and action intentions, which in turn depend on the prevailing context (**Proffitt** 2006; **Proffitt**, **Stefanucci**, **Banton** and **Epstein** 2003). In another study done by **Niek R. van Ulzen et al**. (2008) examining the influence of affective content on size perception supports **Bruner** and **Postman's** (1948) proposal that what is salient to a person looms larger in his or her perception.

Past Experience

Perception becomes fuller, meaningful and accurate because of our experience. Unless we know the concepts, we will not be able to interpret objects in the environment. A person needs to interpret sensory information and this can be done on the basis of past experience of the same, similar or related phenomenon. Perceptual ability, therefore, heavily depends upon and is influenced by the amount of perceptual practice and experience

that the subject has had in the past. This implies that perception is influenced by past experiences and can also be improved tremendously through judicious practice.

Mental Set or Attitude

We perceive things not as they are but as we want them to be. The mental set or attitude of an individual plays an important role in determining his perception. When an individual is in a pleasant mood, he perceives things in a favorable way. On the other hand, when he is angry, he perceives the mistakes of people around him more easily than when he is in a happy mood.

In terms of perception, *a set*, a predisposition to respond in a particular fashion, may be one of the following several types:

Motor Set: When attending to a stimulus, an individual organizes muscular responses, a motor set, to be ready for the particular attention situation. For example, a golfer getting ready to hit a golf ball adopts a particular posture and a practiced way of holding the golf club; similarly, members of basketball teams adopt particular stances, motor sets, as they stand lined up and ready to jump while waiting for the free throw.

Perceptual Set: A perceptual set is the readiness to interpret a stimulus in a certain way. For example, if you have just run a red traffic light, you might be more inclined to view a flashing light as a police car than as just a bright turn signal. (Note that perceptual sets occur in all of the sensory modalities, not just vision.)

Mental Set: A mental set is a predisposition to think about a situation or a problem in a specific way. For example, a student's poor performance on a math assignment might be because of lack of preparation or because of the mental set 'I just can't do well on math problems.'

Stimulus Characteristics that Affect Set

A variety of stimulus characteristics affect perception and the set that is formed.

Stimulus Intensity: If other stimulus factors are comparable, a more intense stimulus attracts more attention than a subtle one. For example, a loud siren gets more attention than a faint one.

Stimulus Changes: Stimulus changes elicit more attention than sameness or monotony. A flashing light, for example, stands out in a horizon of steady city lights.

Stimulus Magnitude: Stimulus magnitude is also a factor in attracting attention. For example, a large advertising billboard attracts more attention than a small one.

Stimulus Repetition: A repeated stimulus affects attention; the public quickly recognizes a product seen in repeated advertisements.

ORGANIZATION OF PERCEPTION

When several objects are present in the visual field, we tend to perceive them as organized into patterns or groupings. Gestalt Psychologists studied such organization in the early part of the twentieth century. They said, '*the whole is more than the sum of its parts'*. This simply means that what is perceived has its own new properties, properties that emerge from the organization that takes place. Organization in perception partially explains our perception of complex patterns as unitary form or objects. We see objects as objects only because grouping processes operate in perception.

Besides the factors discussed before as determinants of perception, the famous psychologist, Woodsworth, has listed out certain factors that are responsible for grouping or organizing forces in the environment to make them meaningful.

Perceptual experience is filled with groups and patterns of stimuli, which are labeled as objects. The stimulation that people constantly perceive comes into their awareness as shapes and patterns. People do not ordinarily perceive the world around them as patches of color, variations in brightness and loud or high-pitched sounds. Instead, they see tables, walls and buildings and hear vehicle horns, footsteps and words. Some of these perceptions of objects are due to learning but a major part of it is probably an unlearned property of our sense organs and nervous system. These structures tend to organize sensory inputs into perception of simple patterns or objects.

As mentioned before, Gestalt psychologists have extensively studied the organizing tendencies in perception. They have pointed to the existence of such tendencies to strengthen their argument that the perceived world is not just the scene of simple sensory experiences. The principles of perception that helps to explain how objects are organized and perceived include Figure-ground perception, Grouping, Contour and Closure. We will discuss each one of these briefly.

Figure-Ground Perception

The most basic organizational tendency is the perception of figure and ground. The objects that fill our everyday experience are seen as standing out from the general background of our experience. For *example*, Pictures hang on a wall and words are on a page. Here the picture and words are seen as figure, whereas the wall and the page are seen as ground. Geometrical patterns are always seen against a background and thus they appear to be like objects with contours and boundaries. Regions that are convex, symmetric, smaller in area, enclosed, or surrounded are more likely to be seen as figure than contiguous regions that are concave, asymmetric, larger in area or surrounding. This primeval capacity to distinguish an object from its general sensory background is basic to all object perception.

In Fig. 4.3, we automatically see the dark area as the object, though it does not look like any object we have seen before. We still perceive it as a unitary whole or figure which is distinct from the page. Certain characteristics distinguish the figure from the ground in our perception. The figure seems to have some sort of shape or object quality, whereas the ground tends to be formless. The ground seems to extend continuously behind the figure i.e. the figure appears to be in front and the ground behind. In the light of recent research, it is important to point out that contrast with a background is, however, a cue for depth perception in that lower-contrast objects appear more distant than higher-contrast objects (**O'Shea et al**. 1994).

Fig. 4.3 Dark Area Seen as an Object

Geometrical patterns are always seen against a background and thus they appear to be like objects with contours and boundaries. Figure-ground organization is basic to stimulus patterning. Patterns do not have to contain identifiable objects to be structured as figure and ground. Patterns of black and white and many wallpaper designs are perceived as figure-ground relationships.

Very often figure and ground are reversible i.e. they show a reversible relation. What appears as figure at one moment is perceived as ground the next moment; what is perceived as ground at one moment, is perceived as figure the next moment.

Studies of people who have gained vision in adult life show that figure-ground organization is present even when other features of perception are missing. Adults seeing for the first time have no difficulty in seeing something as a figure on a background although they are unable to identify familiar forms by sight.

Figure-ground perception has been studied most extensively in vision, although there is some research on tactile (**Kennedy** 1993) and auditory (**Bregman** 1990) figure-ground perception. Thus, a figure-ground relationship can also be perceived through senses, other than vision. For example, the song of a bird is heard against a background of other outdoor noises. In observing a person's movements, the overall posture is considered as the ground and for the figure, the finer movements of the hands and arms.

The importance of classic configural properties for figure-ground perception was originally revealed via demonstrations (e.g. **Koffka** 1935; **Kohler** 1929/1947; **Rubin** 1915/1958). Empirical studies tend to support those demonstrations (e.g. **Kanisza** and **Gerbino** 1976), although some caveats apply. For instance, experiments assessing the effectiveness of symmetry as a *configural cue* (*the visual properties associated with figures rather than grounds; these properties are now known as 'classical configural cues*) have produced equivocal results (e.g. **Pomerantz** and **Kubovy**, 1986). In addition, the effectiveness of convexity as a configural cue has recently been seen to vary with context (**Peterson** and **Salvagio** 2008).

Grouping

Another form of organizing tendency in perception is called grouping. Whenever several different stimuli are present, we tend to perceive them as grouped into some pattern. Even simple patterns of lines and dots fall into ordered relationships when we look at them. We tend to organize various stimulus patterns according to a few basic principles of perceptual grouping. Perception is an active process because it not only selects a few stimuli but also combines them into a meaningful whole.

The question is how does this grouping occur? Recent research on perceptual grouping says that perceptual grouping binds together distinct elements that do not necessarily share borders in an image (**Palmer** and **Rock** 1994). Perceptual space around the grouped items is warped (**Coren** and **Girgus** 1980) and attention spreads within groups or preferentially selects grouped elements (**Dodd** and **Pratt** 2005; **Marino** and **Scholl** 2005). The outcome of perceptual grouping is a representation that is, on some level, treated as a whole by attention and perception, even though it clearly consists of distinct and, often, widely separated elements. Recent evidence also suggests that experience plays a significant role in some aspects of perceptual grouping (**Zemel**, **Behrmann**, **Mozer** and **Bavelier** 2002; **Kimchi** and **Hadad** 2002).

Traditionally, perceptual grouping has been measured by subjective report of grouping (**Kubovy** and **Wagemans** 1995), which, unfortunately, may be insensitive to short periods of training. Perceptual grouping is also sometimes measured by asking subjects to recognize the group or to trace the foreground object from camouflage (e.g. **Brady** and **Kersten** 2003), but recognition does not necessarily imply grouping. **Palmer** and **Beck** (2007) have recently developed an alternative measure to subjective report, using a paradigm called the *repetition discrimination task* (**Beck** and **Palmer** 2002; **Vickery** 2008).

We will now briefly examine the principles of perceptual grouping which include proximity (nearness), similarity, continuity, symmetry and a more recent one known as common regions.

Proximity

Stimulus elements that are close together tend to be perceived as belonging together. The following example illustrates the principle.

Figure 4.4 is seen as four pairs of parallel lines (ab, cd, ef, gh), instead of eight vertical lines. Items which are close together in space or time tend to be perceived as belonging together or constituting a group. It is practically impossible to perceive *b* and *c*, and *d* and *e*, and *f* and *g* as being members of the same perceptual pair.

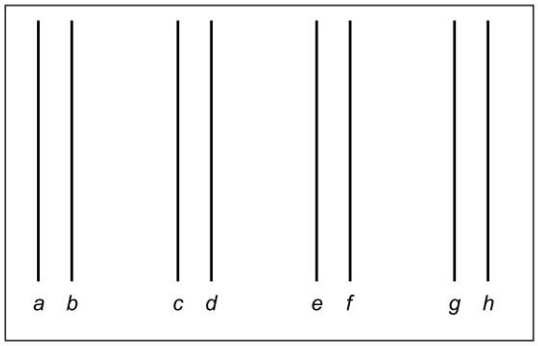


Fig. 4.4 Four Pairs of Parallel Lines: An Example of Proximity

Similarity

The principle of nearness does not hold for all stimulus constellations. In some situations, other factors operate to override the influence.

In Fig. 4.5, each black square is closer to a circle than it is to another black square, yet the black squares are perceived as being grouped with other black squares instead of their circles, which are closer to them. This perceptual phenomenon illustrates the principle of similarity. The greater the similarity among stimuli, the more likely it is that they will be perceived as part of a common group.

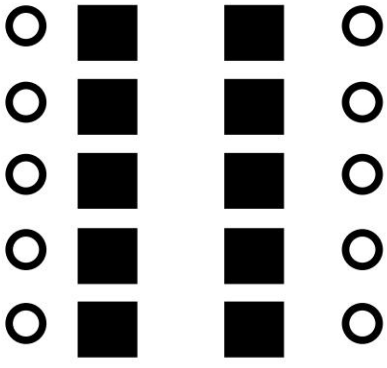


Fig. 4.5 An Illustration of Similarity

Symmetry

Though in most cases grouping to similarity occurs, there are cases when it does not occur. In Fig. 4.6, one would perceive it as a six-pointed star rather than one figure composed of dots and another figure composed of circles.

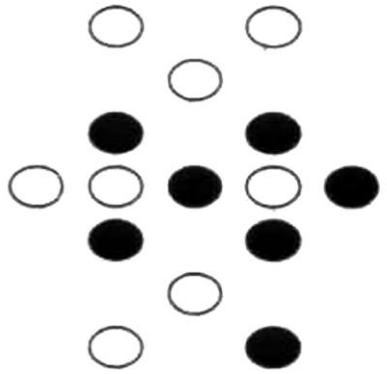


Fig. 4.6 An Illustration of Symmetry

Similarity is competing with the principle of symmetry or good figure. Neither the circles nor the dots by themselves form a symmetrical pattern. In either case, certain members are omitted. In general, the tendency to group is a tendency to form a balanced or symmetrical figure that includes all the parts.

Continuity

There is a tendency to group together stimulus elements that are a part of a continuous sequence.

Figure 4.7 is organized into two lines, one straight and one curved, with the straight line intersecting the curved line where they share a common dot. Though the curved and straight lines have dots in common, it is

Fig. 4.7 An Illustration of Continuity

only with effort that we can perceive a straight line suddenly becoming curved at one of these junctions. A straight line is seen as continuing straight and a curved line as continuing as a curved line.

These principles of grouping partially explain our perception of complex patterns as units or objects. We see objects as objects, units as units, only because the grouping processes operate in perception.

Common Region

This principle of perceptual grouping was given by **Stephen Palmer** (1992). According to this principle, there is a tendency to perceive objects that are in a common area or region as being in a group. It can be seen in Fig. 4.8 that the stars could be perceived in one group and the circles as another. This should be so with the operation of the principle of similarity. However, it is not as such. The dark background so visibly defines the common regions that instead people perceive three groups separately and not on the basis of similarity.

Fig. 4.8 Common Regions

Contour

Objects are separated from the general ground in our visual perception only because we can perceive contours. Contours are perceived at border line where there is an abrupt change from brightness to darkness (Fig. 4.9). Contours give shape to the objects in our visual field because they mark off an object from other objects or

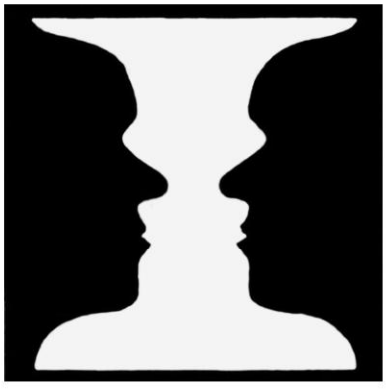


Fig. 4.9 Illustrating Organization of Perception by Means of Contours

from the general ground. However, contours are not shapes; they determine shape, but by themselves are shapeless. The process of contour detection involves identifying object surfaces by applying basic rules of perceptual organization to the individual line segments comprising the edges of the object.

However, sometimes it is difficult for a person to perceive contours distinctly. When this happens, it becomes difficult to distinguish objects from the background due to the inability to distinguish between figure and ground. Camouflage is a case where there is deliberate confusion of figure and ground and used widely by the armed forces.

While difference in energy levels of light across the retina are involved in the formation of most contours in our everyday experience, it has been found that contours can sometimes be seen without any energy difference at all on the two sides of the contour (**Kanizsa** 1976; **Coren** 1972). These are the so-called *subjective contours*.

The contour detection mechanism (the process of identifying object surfaces) operates by taking advantage of the ubiquity of orientation similarity between adjacent and nearly adjacent points for distinct objects in natural scenes (**Geisler**, **Perry**, **Super** and **Gallogly** 2001). The ability to perceive objects by this account depends upon the capacity to segment a scene into the distinct sets of edges and surfaces, a process usually termed 'figure-ground segmentation.'

Closure

The basic Gestalt principles such as co-linearity and proximity (**Koffka** 1935) give rise to the more complex construct known as closure, which allows for the representation of a unified border around the object surface. Closure may serve as the basis for figure-ground segmentation (and indeed, *may be essential* for shape representation, (**Kovács**, **Fehér** and **Julesz** 1998).

Our perception of objects is much more complete than the sensory stimulation we receive from them. Perceptual processes tend to organize the world by filling in gaps so that we perceive a whole object, not disjointed parts. This filling in is called closure or the tendency to complete in perception what is physically an incomplete pattern or object. The principle has been referred to as the *Pragnanz theory* in perception, indicating fullness, wholeness and completeness.

Figure 4.10 shows that viewers tend to supply missing elements to close or complete a familiar figure even though the figure is actually not there in its totality.

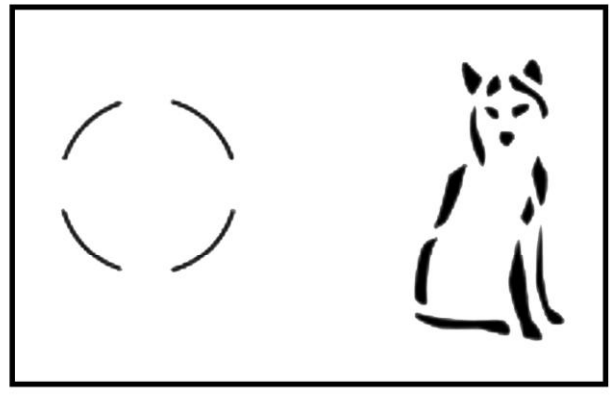


Fig. 4.10 Closure Viewers Tend to Supply Missing Elements to Close or Complete a Familiar Figure

EXPERIMENTAL PERSPECTIVE

When Does Grouping Happen?

Research on perceptual grouping done by **Stephen E. Palmer, Joseph L. Brooks and Rolf Nelson** (2003) describes with particular emphasis on identifying the level(s) at which grouping factors operate. Contrary to the classical view of grouping as an early, two-dimensional, image-based process, recent experimental results show that it is strongly influenced by phenomena related to perceptual constancy such as binocular depth perception, lightness constancy, amodal completion and illusory contours. These findings imply that at least some grouping processes operate at the level of phenomenal perception rather than at the level of the retinal image. Preliminary evidence has shown that grouping can affect perceptual constancy, suggesting that grouping processes must also operate at an early, preconstancy level. If so, grouping may be an ubiquitous, ongoing aspect of visual organization that occurs for each level of representation rather than as a single stage that can be definitively localized relative to other perceptual processes.

Gestaltists have emphasized the factor in pointing to perceptual organization. The human mind has a tendency to complete whatever is incomplete because a symmetrical form is more satisfying than a non-symmetrical one.

Perception is a process, which results in the awareness and interpretation of a sensory experience, but it is also a highly organized one, as is evident from the various constancies and organizing tendencies.

LAWS OF PERCEPTUAL ORGANIZATION

Law of Proximity: This law states that items which are close together in space or time tend to be perceived as belonging together or forming an organized group.

Law of Similarity: The law of similarity suggests that similar things tend to appear grouped together. Grouping can occur in both visual and auditory stimuli.

Law of Continuity: The law of continuity holds that points that are connected by straight or curving lines are seen in a way that follows the smoothest path. Rather than seeing separate lines and angles, lines are seen as belonging together.

Law of Closure: According to the law of closure, things are grouped together if they seem to complete some entity. Our brains often ignore contradictory information and fill in gaps in information.

Law of Pragnanz: The law of Pragnanz is sometimes referred to as the law of good figure or the law of simplicity. This law holds that objects in the environment are seen in a way that makes them appear as simple as possible.

BOTTOM-UP AND TOP-DOWN PROCESSING

'Ar-u-studyin-psycho-fo-som-purpos-n-ur-lif?'—I am sure you will be able to easily fill in the gaps and make sense into the sentence. It says: Are you studying psychology for some purpose in your life? Your ability to recognize this imprecise sentence lends support to the fact that perception proceeds along two different avenues—the top-down and the bottom-up processing. Let us examine how.

In the case of reading, as with other cognitive processes, psychologists distinguish between the two kinds of processing. *Bottom-up processes* are those that take in stimuli from the outside world (letters and words for reading) and deal with that information with little recourse to higher-level knowledge. With *top-down processes*, on the other hand, the uptake of information is guided by an individual's prior knowledge and expectations. In most situations, bottom-up and top-down processes work together to ensure the accurate and rapid processing of information.

PERCEPTUAL CONSTANCY

The world as we perceive it is a stable world and this stability is present early in life. Stability of perception helps us to adapt to the environment. The stability of the environment as we perceive it is called perceptual constancy.

Size Constancy

The size of the representation or 'image' of an object on the retina of the eye depends upon the distance of the object from the eye. The further away it is, the smaller the representation. Similarly, a representation of the same size can be produced on the retina by a small nearby object or a large object at some distance.

A.H.Holway and **E.G. Boring** (1941) emphasized the importance of distance and background information in maintaining size constancy in a classic experiment. They used ambiguous stimuli-disks of light, which could have no real assumed size, and they changed the amounts of distance and background information available to the subjects in the experiment. They found that size constancy decreased as the distance and background information available to the subjects decreased. In other words, the subjects perceived the size of a disk of light more in accordance with the size of the retinal representation when they lacked information about distance and background.

One interpretation of this result might be that people somehow automatically use information about distance and the background to 'correct' the size of their retinal representation, thus keeping their perception relatively constant.

Another interpretation is that no 'correction' is necessary, that size constancy occurs because the object and its background change together as the distance of the object changes. In addition, the retinal size of the object changes with the retinal size of the background objects. Thus, according to this interpretation (**Gibson** 1950), perceptual size constancy results when an object and its background change together in such a way that the relationship between them stays the same.

Size Constancy and Illusion

The various mechanisms for size constancy may provide explanatory framework not only for veridical judgments of size but also for illusions of size, conditions in which constancy fails and size is misperceived.

The Corridor Illusion

In Fig. 4.11, although the two cylinders are identical in physical size, they vary in the perceived size. The cylinders also appear to differ in spatial location.

This illusion has been explained in terms of the size-distance relationship. Thus, if objects of the same physical size are perceived to be at different distances, the observer, considering apparent distance, perceives the object that appears to be further away also as larger (**Gregory** 1973, **Miller** 1971 and **Richards** 1971).

EXPERIMENTAL PERSPECTIVE

Moving Shadows Contribute To The Corridor Illusion In A Chimpanzee (Pan troglodytes)

Previous studies have reported that backgrounds depicting linear perspective and texture gradients influence relative size discrimination in non-human animals (known as the 'corridor illusion'), but research has not yet identified the other kinds of depth cues contributing to the corridor illusion. A study done by **Tomoko Imura** and **Masaki Tomonaga** (2009) examined the effects of linear perspective and shadows on the responses of a chimpanzee (Pan troglodytes) to the corridor illusion. The performance of the chimpanzee was worse when a smaller object was presented at the farther position on a background reflecting a linear perspective, implying that the corridor illusion was replicated in the chimpanzee (**Imura**, **Tomonaga** and **Yagi** 2008). The extent of the illusion changed as a function of the position of the shadows cast by the objects only when the shadows were moving in synchrony with the objects. These findings suggest that moving shadows and linear perspective contributed to the corridor illusion in a chimpanzee.

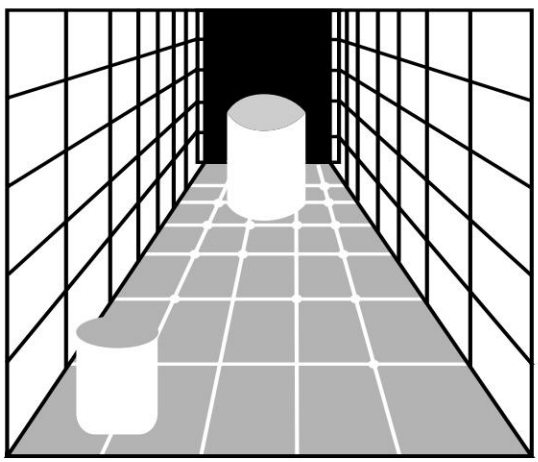


Fig. 4.11 **Corridor Illusion:** The Deeper of Two Cylinders Appears to be Larger due to Perspective Cues Despite the Fact that the Two Cylinders are of Exactly the Same Size

Moon Illusion

Whether the moon is high in the sky or on the horizon, its representation on the retina is the same size, but it is perceived as much larger on the horizon. One explanation for this illusion says that when the moon is closer to the horizon, building and trees provide depth cues indicating that the moon is indeed far away; further, up in the sky, these cues are absent (Fig. 4.12).

Many theorists have explained what is the scientific basis of the moon illusion but so far no single theory has adequately and accurately been able to explain the same. **Ross** and **Plug** (2002) comment in their book,

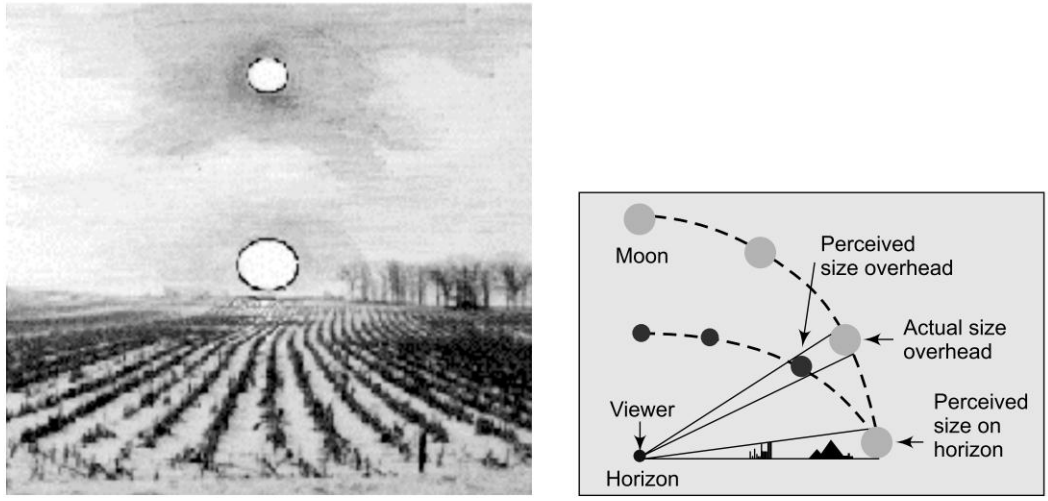


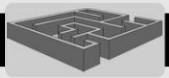
Fig. 4.12 Moon Illusion

The Mystery of the Moon Illusion, 'The moon illusion is one of the few perceptual phenomena that tap a broad spectrum of sciences: astronomy, optics, physics, physiology, psychology, and philosophy. Its explanation illustrates the history of scientific explanation, and in particular the history of perceptual psychology.' They evaluate current theories including the present 'new' theory (**McCready** 1965, 1985, 1986) and conclude that 'no single theory has emerged victorious'.

Another extremely important research has been done by **Murray et al**. (2006), in which they measured an angular size illusion and related it to the moon illusion. They assumed that two objects that project the same visual angle on the retina can appear to occupy very different proportions of the visual field if they are perceived to be at different distances and sought an answer to what happens to the retinotopic map in primary visual cortex (V1) during the perception of these size illusions? They investigated this by using the functional magnetic resonance imaging (fMRI), and concluded that that the retinotopic representation of an object changes in accordance with its perceived angular size. A distant object that appears to occupy a larger portion of the visual field activates a larger area in V1 than an object of equal angular size that is perceived to be closer and smaller. Their results demonstrate that the retinal size of an object and the depth information in a scene are combined early in the human visual system. They point out that their fMRI results do not support the currently 'most popular theories' about the brain activities involved in 'size' illusions. After all, these theories are based upon an assumption that the activity pattern in Area V1 that corresponds to a constant retinal image size would remain the same size when distance cues and the perceived distance for the viewed target is changed.

Brightness Constancy

Visual objects also appear constant in their degree of whiteness, grayness or blackness, even though the amount of physical energy reflected from them may change enormously. Our experience of brightness stays relatively constant despite great changes in the amount of physical energy reaching our eyes. Approximate brightness constancy makes us tend to see objects in terms of their reflecting power rather than the amount



PSYCHOLOGY IN EVERYDAY LIFE

Moon Illusion In Pictures: A Multi-mechanism Approach

The existence of the moon illusion in pictorial representations was demonstrated in six experiments. These experiments either judged the size of the moon in pictures, depicted as on the horizon or high in the sky, or drew horizon and elevated moons. The horizon moon was consistently judged to be larger than the elevated moon, independent of the angle at which the pictures are viewed. The distance paradox usually observed with the moon illusion (horizon moon apparently closer than the elevated moon) also exists in pictures. The magnitude of both size and distance effects depends on the salience of depicted depth cues. The pattern of results suggests that the moon illusion is caused by several interacting mechanisms and that use of pictorial stimuli may allow the separation of various cognitive from physiological contributions to the illusion (**Stanley Coren** and **Deborah J. Aks** 1990).

of light they actually reflect. Thus, we can almost always differentiate equally between the brightness of two colors under conditions of sunshine and shadow even though they actually reflects much less light to the eye in shadow than under sunshine. In its psychophysical basis, brightness constancy is closely related to general and lateral brightness adaption.

Thus, we have brightness constancy because in most situation, when the illumination changes, it changes over the whole field. The physical energy ratio between an object and its surround stays constant. In other words, unchanged brightness ratios give constant brightness experiences or brightness constancy (**Zeki** 2001). This rule must be accepted with some reservation because it probably does not hold for the entire range of stimulus intensities (**Jameson** and **Hurvich** 1964); it is a useful first step towards an explanation of brightness constancy. Furthermore, brightness constancy breaks down when changes in lighting are not equivalent for both the objects and its surroundings (**Sekuler** and **Blake** 2000).

PERCEPTION OF FORM

Perhaps the most fundamental process in form perception is the recognition of a figure on a ground. We see objects and forms of every day experience as standing out from a background. The ability to distinguish an object from its general background is basic to all form perception.

Contours in Visual Form Perception

We are able to separate forms from the general ground in our visual perception only because we can perceive contours. As explained before, contours are formed whenever a marked difference occurs in the brightness or color of the background. Contours give shape to the objects in our visual world because they mark one object off from another or they mark an object off from the general ground. When contours are disrupted visually, as in camouflage, objects are difficult to distinguish from the background. Contours determine shape, but by themselves, they are shapeless.

While difference in energy levels of light across the retina are involved in the formation of most contours in our everyday experience, it has been found that contours can sometimes be seen without any energy difference at all on the two sides of the contours (**Kanizsa** 1976; **Coren** 1972). These are called subjective

EXPERIMENTAL PERSPECTIVE

Integration of Contours: New Insights

Psychophysical, neurophysiological, and anatomical research of the last few years has converged on a new explanation of how the components of a contour become integrated. Borrowing from the Gestalt rules of good continuation, this research suggests that components of a curved contour become integrated when the alignment follows specific rules. Some of the behavioral, anatomical, and physiological findings that support the notion of an 'association field' that integrates the outputs of neurons through the use of long-range lateral connections were reviewed by **Robert Hess** and **David Field** (1999). Their results provide an interesting insight into how the information from arrays of neurons distributed across the visual field might be integrated. What emerges is a new concept of a 'receptive field', in which the output of a neuron is a time-dependent, complex combination of feedforward, feedback, and lateral connections that produce a rich description of the visual world at early stages of visual processing.

contours. Since contours are often not well-defined along their extent, the visual system needs to be able to infer their presence from partial/indirect evidence, such as discontinuities in oriented elements (**Kanizsa** 1976; **von der Heydt**, **Peterhans** and **Baumgartner** 1984; **Petry** and **Meyer** 1987; **Grosof**, **Shapley** and **Hawken** 1993; **Soriano**, **Spillman** and **Hawken** 1996). Such filling-in of missing contour information leads to the percepts of subjective/illusory contours.

Organization in Form Perception

When several objects are present in the visual field, we tend to perceive them as organized into patterns or groupings. The Gestalt psychologist studied such organization intensively in the early part of the twentieth century. Their aim was to investigate the global and holistic processes involved in perceiving structure in the environment (e.g. **Sternberg** 1996). They said, 'The whole is more than the sum of its parts'. This simply means that what is perceived has its own new properties, properties that emerge from the organization, which takes place. Organization in perception partially explains our perception of complex patterns as unitary form or objects. We see objects as objects only because grouping processes operate in perception.

PERCEPTION OF DEPTH

Depth perception refers to the localization of perceived objects in phenomenal (perceived) space concerning the distance between the objects of perception and the individual, or about the distance between objects of perception. Depth perception can occur in various modalities, though most precisely in the visual modality; it also occurs in hearing and by means of the *tactile-haptic*.

Depth perception arises from a variety of depth cues. These are typically classified into binocular cues which require input from both eyes and monocular cues which require the input from just one eye (**Goldstein** 2002). Binocular cues include stereopsis, *(the process in visual perception leading to the perception of depth from the two slightly different projections of the world onto the retinas of the two eyes*) yielding depth from binocular vision through exploitation of parallax. Monocular cues include size: distant objects subtend smaller visual angles than near objects (**Burton** 1945). A third class of cues requires synthetic integration of binocular and monocular cues.

Monocular Cues for Depth Perception

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

We can examine artwork and look for instances where monocular cues are used to create the illusion of depth. The picture showing monocular cues of depth perception uses all clues except for the motion parallax. These are interposition, relative size, linear perspective and texture gradient. Try identifying each of these in the picture shown in Fig. 4.13.

Fig. 4.13 Picture Showing Monocular Cues for Depth Perception

Linear Perspective

The distances separating the images of far objects appear to be smaller. This is so because of its depth effect to such linear perspective.

Clearness

In general, the more clearly we see an object, the nearer it seems. Ordinarily, if we can see the details, we perceive an object as relatively closer; if we can see only its outline, we perceive it as relatively far away.

Interposition

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

Shadows

The pattern of shadows or highlights in an object is very important in giving an impression of depth.

Gradients of Texture

A gradient is a continuous change in something - a change without abrupt transitions. In some situations, we can use the continuous gradation of texture in the visual field as a cue for depth (**Gibson** 1950). The continuous gradation of texture gives the eye and brain information that can be used to produce an experience or perception of depth.

Movement

The direction of movement of objects when we turn our heads can be a cue for the relative distance of objects. Furthermore, the amount of movement is less for far objects than it is for near ones.

Relative Size

With this depth cue, our visual systems recognize that if there are two objects that you *know* are of the same size, but you *see* one as smaller than the other, then the smaller one must be farther away. In the picture shown in Fig. 4.13, how much smaller people appear further in as compared to the ones right in front, helps us figure out how far they are. If they are not much smaller than the ones right in front, we know they are not too far away, and if they are much smaller, we then know that they are pretty far away.

Binocular Cues for Depth Perception

Most of us, though, look out at the world with both eyes simultaneously and we are thus are able to add binocular cues for depth perception to the monocular ones.

Convergence

This is a muscular cue and refers to the rotation of the two eyes in their sockets to focus on a single object. If the object is close, the convergence is great. If the object is far, the convergence is much less.

Binocular Disparity

By far the most important binocular cue comes from the fact that the two eyes, the retinas, receive slightly different or disparate views of the world. Therefore, this cue is known as *retinal disparity*. It is the difference in the images falling on the retinas of two eyes (**Hibbard** 2007; **Kara** and **Boyd** 2009). *Visual binocular disparity* is defined as the difference between the points of projection in the two eyes and is usually expressed in degrees as the visual angle (**Qian** 1997).

To understand retinal disparity, consider the geometry of the situation when the two eyes view an object (Fig. 4.14). The fovea in the centre of the retina is much more sensitive than is the rest of the retina. When we look at an object, we fixate our eyes in a manner so that the image of the object falls mostly on each fovea. However, since the two eyes are separated from each other by about 65 mm, they get slightly different views of the objects, and the two images are not exactly the same. Moreover, the images are more dissimilar when the object is close than when it is far in the distance. In other words, within limits, the closer an object is, the greater is the retinal disparity. The correspondence between distance and the amount of disparity is the reason retinal disparity can be used as a depth cue.

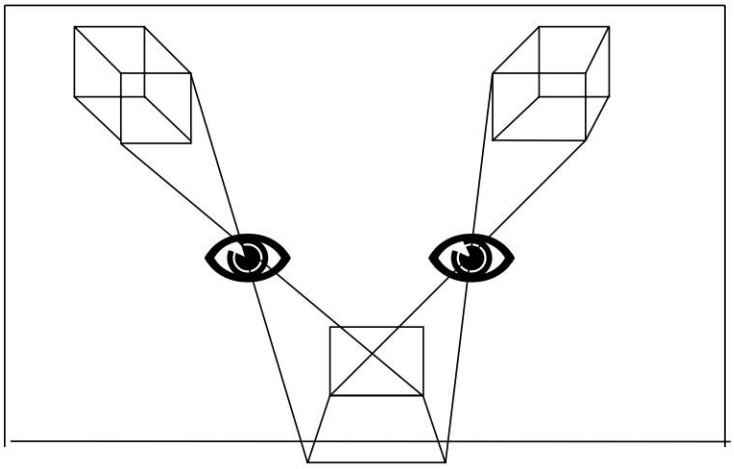


Fig. 4.14 Two Eyes Viewing an Object

PSYCHOLOGY IN EVERYDAY LIFE

Does a Failure of Motion Parallax Play a Role in Alcohol-Related Driving Accidents?

Motion parallax, the ability to recover depth from retinal motion generated by observer translation, is important for visual depth perception. Recent work indicates that the perception of depth from motion parallax relies on the slow eye movement system. It is well-known that ethanol intoxication reduces the gain of this system and this produces the horizontal gaze nystagmus that law enforcement's field sobriety test is intended to reveal. In a study (Disruption of Eye Movements by Ethanol Intoxication Affects Perception of Depth From Motion Parallax) done by **Mark Nawrot**, **Benita Nordenstrom** and **Amy Olson** (2004), they demonstrated that because of its influence on the slow eye movement system, ethanol intoxication impairs the perception of depth from motion parallax. Thresholds in a motion parallax task increased significantly by acute ethanol intoxication, whereas thresholds for an identical test relying on binocular disparity were unaffected. Perhaps a failure of motion parallax plays a role in alcohol-related driving accidents; because of the effects of alcohol on eye movements, intoxicated drivers may have inaccurate or inadequate information for judging the relative depth of obstacles from motion parallax.

PERCEPTION OF SPACE

The objects that we see, hear, touch and manipulate are localized in space: they occupy a definite position with reference to our borders. We take the localization of objects in space for granted.

The perception of space is highly complicated and must call into operation the utmost in constructive and integrative activity on the part of the perceiver.

Sensory Systems in Space Perception

Man relies heavily upon his eyes in his spatial adjustments and in our thinking, we tend to equate the spatial world with the visual world.

Visual Sensory System

Provides us visual cues about the location of objects and events in space.

Auditory Sensory System

We not only see things in definite location, we also hear them as coming from the right or left, from above or below.

Cutanious Sensory System

We also feel objects as touching our hand or arm or some other part of our bodies.

Kinesthetic System

Our muscles, tendons and joints are equipped with receptors, which respond to movements of these parts. The '*proprioceptive impulse'* coming from the muscles are particularly important in the maintenance of posture. In short, the kinesthetic system tells us about the movement of our bodies in space.

Vestibule System

The semi-circular canals and the vestibule of the inner ear contain receptors highly sensitive to movement and acceleration.

Several major systems (sensory systems) participate in the adjustments, which man makes with respect to the location of objects and himself in space.

Basic Visual Conditions for Perception of Space

The visual perception of space would be impossible if it were not for certain functional properties of the optical process. These properties ensure the stability of our visual world and the continuing success and precision of spatial adjustments.

Stabilizing Properties of the Optical Process

Correspondence between Retinal Image and Physical Objects

If the retinal image did not systematically represent certain features of the physical object, a stable visual world would be impossible. We are referring here to the eye as an optical instrument, which forms a retinal image preserving the spatial relations characteristics of the physical object. The relations among the parts of the object remain basically unchanged in their representation on the retina.

Law of the Visual Angle

The stability of the visual world is further aided by another optical property of the eye. As an object recedes from the eye, the size of the retinal image decreases in accordance with the law of the visual angle. This law states that the linear size of the optical image is inversely proportional to the distance of the object. Thus, if

we double the distance of an object from the eye, we halve the height and width of the retinal image, other than the case where size constancy plays its role.

The important point is that there is a lawful relationship between distance and size of retinal images. Unless this were the case, any lawful relationship between distance and perceived size would be impossible.

Resolving Power of the Visual System

When the eye focuses upon two objects in the environment, two retinal images are formed and the visual system maintains this resolution to an astonishing degree.

The visual perception of space is based to a considerable extent upon the spatial relations among objects. Therefore, we must first revolve these objects before their relations can become effective in perception.

SPATIAL FRAMEWORK

Our visual world is tri-dimensional. Objects are localized not only up and down or to the right and left, but also near and far. There is then a spatial framework, which must be described in terms of three dimensions. An important property of this framework is that two main directions anchor it: the vertical and the horizontal. These two directions inhibit a high degree of stability and provide a framework for the localization of objects.

Conditions for the Establishment of the Spatial Framework

1. There is no one-to-one correspondence between the direction of the lines of the retinal image and the perceived direction of those lines, for example pencil and head movement. The direction of the retinal line does not in itself determine the perceived direction.
2. What is seen as vertical and what is seen as horizontal depends upon the relations among the parts of the visual field. In a given visual field, there are usually main lines of organization—lines that serve as frames for a diversity of objects. The directions of other lines in the visual field depend upon their relation to the main lines of organization.
3. The organization of the spatial framework is flexible.

In Fig. 4.15, while looking through the cone, initially the lines look oblique but with time the main lines of organization 'right themselves' and the lines appear as vertical.

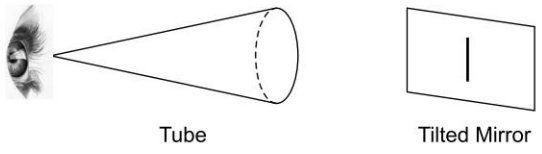


Fig. 4.15 Looking Through a Core

The various sensory systems cooperate closely in our spatial adjustments. If we snap our fingers, we localize them by seeing, hearing and feeling them in the same spatial position.

An enterprising psychologist invented his visual field by wearing a system of lenses. He saw a clock in one place and heard it ticking in another. To a certain extent, it was possible to adjust successfully to this

confusion by ignoring visual cues. What is striking is the fact that an inter-sensory re-education took place. As he continued to wear the lenses, the inter-sensory discrepancies became less and less noticeable. He saw objects where he heard and where he felt them. Upon removal of the lenses, a brief period of readjustment was necessary.

THE PERCEPTION OF DISTANCE

The images cast on the retina are two-dimensional and they preserve the correct spatial relations among parts of the visual field. The identification of 'right and left' and 'up and down' is a matter of relative judgment made possible by this correct preservation of the spatial relationships.

Monocular Determinants of Perceived Distance

Let us see if one eye can offer any clues to the perception of distance.

Apparent Size of Familiar Objects

Automobiles viewed from the tower of a very high building look more like oversized ants than like cars (see Fig. 4.16). We see them, however, as distant cars rather than oversized ants at close range. What the observer does in effect is to utilize the law of the visual angle (the linear size of the optical image is inversely proportional to the distance of the object). As a car recedes from the eye, the retinal image grows smaller and smaller. Clearly, this clue can be effective only with familiar objects. A person who has not seen a car cannot judge its distance by its apparent size alone.

Fig. 4.16 Apparent Size of Familiar Objects

Linear Perspective

An especially striking instance of linear perspective is the familiar convergence of parallel railroad tracks in the distance (Fig. 4.17). This is because the distance separating the images of far objects appears to get

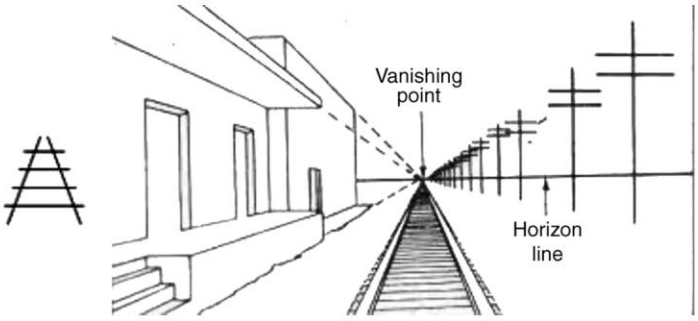


Fig. 4.17 Convergence of Parallel Railroad Tracks: Linear Perspective

smaller because the corresponding retinal image decreases in size the further away the tracks are. The artist can make good use of linear perspective to create the impression of distance on a two- dimensional canvas.

Interposition of Objects

Another monocular cue is interposition, which occurs when one object obstructs our view of another. When one object is completely visible while another is partly covered by it, the first object is perceived as nearer (Fig. 4.18).

Clearness of Detail

In general, the more clearly we see an object, the nearer it seems (Fig. 4.19). Ordinarily, if we can see the details, we perceive our object as relatively closer; if we can see only its outline, we perceive it as relatively far away.

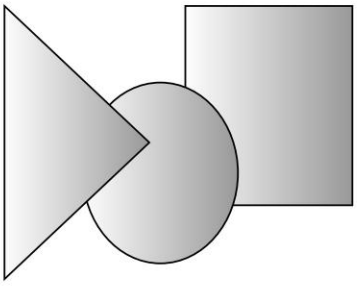


Fig. 4.18 Interposition of Objects

Fig. 4.19 Clearness of Detail

Changes in Color

The color of an object may undergo changes as the light waves reflected from the object travel through the haze of the atmosphere. Not only does the color tend to be more bluish as distance increases, but the apparent brightness of the object diminishes as well. The green leaves of a distant tree take on a bluish tinge. The bright, black car shines less as it speeds away (Fig. 4.20).

Fig. 4.20 Changes in Color

Fig. 4.21 Lights and Shadows

Lights and Shadows

If we know the direction of the illumination, then an object standing in a shadow is seen to bear a definite spatial relation to the object casting the shadow. The pattern of a shadow and its location help us to judge whether there is a depression or an elevation in the land (see Fig. 4.21).

Movement Parallax

Perception of relative movement aids in judging distance. This can be illustrated with the help of the following example.

Close one eye and hold up two fingers, one behind the other and about 10 inches apart. Fixate on the far finger. Now move the head from side to side, and you will see the near finger moving in the direction opposite to the movements of the head. This phenomenon is known as *movement parallax*. It is sometimes referred to as monocular parallax because it can be obtained with the use of only one eye. The explanation for this is that as the head is moved from side to side, the image of the far finger remains stationary on the retina by virtue of the fixation. When the head is moved to the right, the retinal image of the near finger also moves to the right (seeing it from the side of the finger - mirror image type). If we were to accomplish this retinal displacement of the near finger by moving it instead of the head, this finger would have to move to the left. It, therefore, appears to do so.

Accommodation

All the determinants discussed so far are visual in nature, i.e. they are characteristics of the visual field.

The muscles that control the accommodation of the lens to varying distances also provide cues for distance. Changes in accommodation affect the clearness with which details are seen, that is, the amount of microstructure perceived. These changes in microstructure provide visual cues for distance. However, accommodation plays a minor role as compared to visual determinants. Figure 4.22 shows how accommodation takes place.

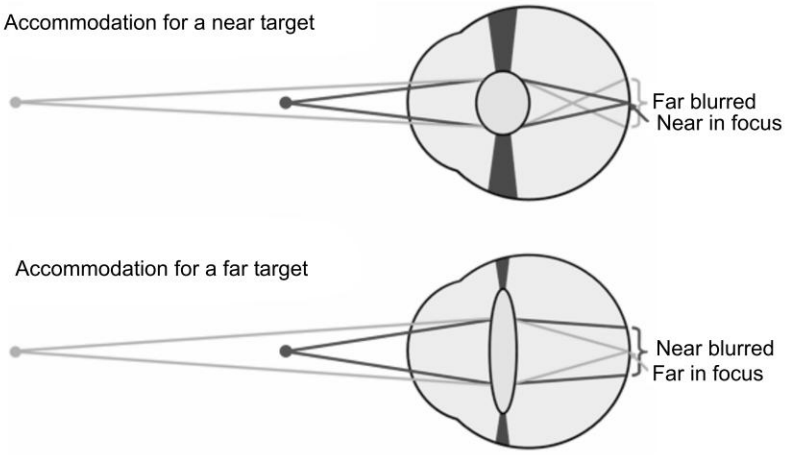


Fig. 4.22 Accommodation

Binocular Determinants of Perceived Distance

Some of the most effective determinants of visual space perception stem from the fact that we have two eyes located about 2.5 inches apart. To understand the nature of these binocular determinants, let us briefly review the main facts of binocular vision.

Fields of Binocular Vision

Each of the two eyes commands a visual field of approximately 130 degrees. The extent of the monocular field may be determined by closing each the eye in turn. The visual field is then determined by the extent of the environment that can be seen under steady fixation. When both eyes are open, there results an extensive field which is common to both eyes. This area of overlap is the binocular field of vision (Fig. 4.23).

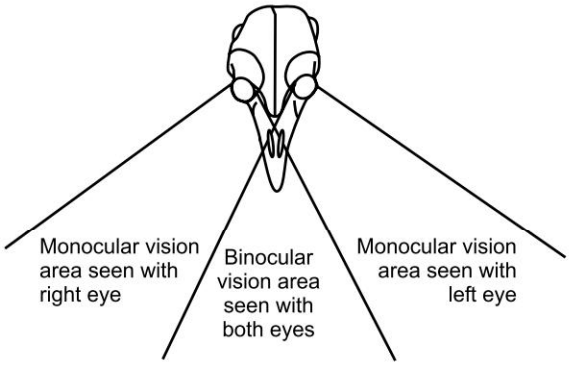


Fig. 4.23 Fields of Binocular Vision

Corresponding and Non-Corresponding Retinal Points

When the eyes are converged upon a point of fixation, this point is seen as single.

In Fig. 4.24, point *X* is the point of fixation and is seen as single. We call the points on the retinas of the two eyes that are stimulated by the single point *X*, corresponding retinal points (*aL* and *aR*, *bL,* and *bR*). In the same figure, the point *B'* and *A* do not correspond with the retinal points (*b'L* and *b'R).* When a single point can be seen as double, we call the two retinal points stimulated by it, one on each retina, non-corresponding points.

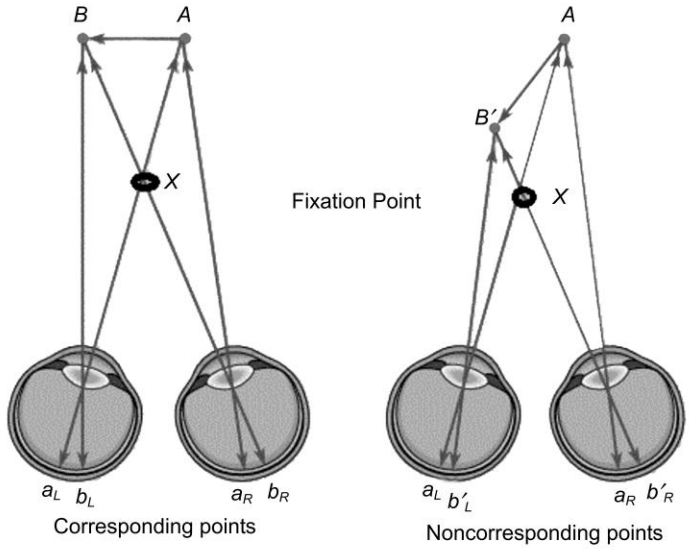


Fig. 4.24 Distinction between Corresponding Points (*aL* and *aR*, *bL* and *bR*) and Points that do not Correspond (*b´L* and *b´R*)

EXPERIMENTAL PERSPECTIVE

Do we Perceive the Environment in Terms of Our Intentions and Abilities to Act Within it?

Recent research demonstrates neurologic and behavioral differences in people's responses to the space that is within and beyond reach. A study done by **Jessica K. Witt, Dennis R. Proffitt** and **William Epstein** (2005) demonstrated a perceptual difference as well. Reachability was manipulated by having participants reach with and without a tool. Across two conditions, in which participants either held a tool or not, targets were presented at the same distances. Perceived distances to targets within reach holding the tool were compressed compared with targets that were beyond reach without it. These results suggest that reachability serves as a metric for perception. The third experiment found that reachability only influenced perceived distance when the perceiver intended to reach. These experiments suggest that the authors perceive the environment in terms of our intentions and abilities to act within it.

Binocular Parallax

When the eyes view a solid object, rather than a single point, they necessarily obtain somewhat different views of that object. This disparity in the two retinal images is known as binocular parallax.

PERCEPTION OF MOVEMENT

Perceptual process of movement is usually explained according to the stimulation of successive parts of the sensory surface. Often, our perceptual process fools us and we perceive movements even when the object in question is stationary. Here, we will discuss two types of movement's involved—*real movement* and *illusory movement.*

1. Real Movement

This refers to the physical displacement of an object from one position to another, depending only on the movement of images across the retina. Here, movement is perceived when the eye is stationary while the image moves across the retina. The brain is able to differentiate between these retinal images of the object moving against the immobile background and all the other moving images on the retina.

2. Illusory Movement

This refers to the apparent movement created by the stationary objects. Apparent movement is the perceived movement in which objectivity does not take place. It is the perception that a stationary object is moving and occurs when different areas of the retina are quickly stimulated, leading to the interpretation of motion (**Ekroll** and **Scherzer** 2009; **Lindemann** and **Bekkering** 2009). Good illustrations of illusory movement are the motion pictures. The projection and thereby screening of motion pictures is possible only by the operation of the *Phi phenomena*.

Another important related aspect is the ***Korte's law***, which states that *if the intensity is held constant, the time interval or optimal movement varies directly with the distance between stimuli.* Later on, Korte founded that *if the interval is held constant, the distance for optimal movement between stimuli is held constant; the intensity for optimal movement varies inversely with the time interval.*

Theories of Movement Perception

Wertheimer postulated two theories to explain the movement perception. They are as follows:

1. The Eye Movement Theory

This in essence states that it is not possible that if the eyes moved across from the initial to the final position, the eye movement might contribute to the sensation of motion since the two movements are in opposite direction in two suitable pairs. Photographs taken by Wundt show that the eyes are engaged most of the time in fixating objects just as they are in viewing an actual scene.

2. The Brain-field Theory

This theory was proposed by Wertheimer and is based on the hypothetical movement of stimulation in the visual cortex instead of in the retina. As per this theory*, the cortical excitation aroused by the first stimulus could spread and be attracted towards the region excited by the second stimulus and the movement of excitation along the cortex could give a sensation of movement*. This theory holds resemblance to **Exner's** (1875)

theory, which in effect states that *apparent movement is favored by imperfect accommodation, the retina is stimulated in the region lying between the initial and terminal positions and thus a sensation of movement is produced through this region.* However, this view of Exner was discarded since apparent movement occurs even if the first stimulus is applied to one eye and the second to the other.

Since there are several facts that are different to reconcile with Wertheimer's theory, *one is left without any acceptable theory of movement perception except accepting perception as a kind of response to the incoming sensory stimulation and applying the principle of generalization.*

EXPERIMENTAL PERSPECTIVE

Influence of Visual Motion on the Perception of Auditory and Tactile Motion

The past few years have seen a rapid growth of interest regarding how information from the different senses is combined. Historically, majority of the research on this topic has focused on interactions in the perception of stationary stimuli, but given that the majority of stimuli in the world move, an important question concerns the extent to which principles derived from stationary stimuli also apply to moving stimuli. A key finding emerging from recent work with moving stimuli is that our perception of stimulus movement in one modality is frequently and unavoidably modulated by the concurrent movement of stimuli in other sensory modalities. Visual motion has a particularly strong influence on the perception of auditory and tactile motion. These behavioral results are now being complemented by the results of neuroimaging studies that have pointed out the existence of both modality-specific motion-processing areas and areas involved in processing motion in more than one sense. The challenge for the future will be to develop novel experimental paradigms that can integrate behavioral and neuroscientific approaches in order to refine our understanding of multi-sensory contributions to the perception of movement. (**Salvador Soto-faraco**, **Charles Spence**, **Donna Lloyd** and **Alan Kingstone** 2004).

PERCEPTION OF COLOR

Color depends upon the nature of the stimulus, its wavelength, energy, degree of mixture and also what structures in the eye are important for vision. The color we see also depends on the conditions of the eye and brain at the time they are stimulated. A color patch will change color as it moves about in the visual field. This is because the periphery of the retina is less sensitive to color than the centre. Viewing of chromatic colors is attributed to the cones for the reason that they are most numerous at the fovea and become thinned out towards the edges of the retina.

As one continues to look at a colored surface without moving the eye, changes immediately begin to set in and continue as long as the same receptor cells are stimulated. Psychologically, the color loses saturation and in tint, it tends towards a neutral grey. The change in chroma and tint are so gradual as almost to escape detection. Suppose, after staring at a colored surface for half a minute, we turn our eyes upon a neutral grey background. There appears a patch of color of the same shape as the original but, of a color, that is complement of the original one. This phenomenon is called a '*negative after image*' or '*negative after sensation*'. Thus, after staring at blue, we are yellow-sighted; after red, we are blue-green-sighted, and vice versa.

Color-blindness: Individual Differences

A light stimulus may arouse a red or green color for one person and only some shade of grey for another; or any hue may arouse only yellow or blue color. Individuals, who see no hue at all, are totally color-blind. Individuals who see all hues as yellow or blue are partially color-blind. According to the results of the standard *Ishihara Test*, about eight percent of American men and one per cent of women are partially color-blind. The defect is a sex-linked, inherited trait. The color seen depends upon the person seeing it, whether he is normal or color-blind, upon what he knows about the object and upon what he can sense about the nature of the illumination under which the object is seen. We tend to see objects in their most natural colors, as when viewed under normal daylight illumination, no matter where they are or what conditions prevail at the given moment.

The figure and ground phenomenon is a characteristic way of closing an object off from things surrounding it. The important step in this is the formation of a boundary line. The protective coloration of animals and the use of camouflage both depend upon the confusing of boundary lines. An individual's chief concern with space is the accurate location of objects with reference to himself. The individual himself represents the frame of reference within which things are arranged. The visual sense gives the most accurate impression of the location of external objects, though it also makes errors.

The process of determining the distance of an object by sight depends upon many cues other than visual ones and other than those that help to place its direction. Two-eyed vision alone is responsible for our seeing objects as being solid and seeing outer space as having the third dimension.

The perception of visual movements depends upon the stimulation of neighboring receptors in sequence. Motion pictures and television views arise as illusions when still pictures are shown in rapid succession with unnoticed blank intervals between.

Theories of Color Vision

The first well-formulated theory of color vision was that of **Young** (1805), later elaborated by **Helmholtz** (1896). According to this theory, there are different kinds of receptors in the eye, each of which gives the sensation of red, green, and blue respectively, on separate stimulation. Combined stimulation of these three kinds of receptors in varying degrees of intensity produces all the different colors. Corresponding to the three types of specialized receptors in the eye, there are separate areas in the visual cortex and the mixing of colors may be a cortical function. Though this theory is admirable for its simplicity, it cannot explain certain observed facts, especially related to color blindness.

Herring (1964) formulated another theory according to which the three basic substances in the retina are each capable of two processes, that of breaking down (known as *catabolism*) and that of building up (known as *anabolism*). Anabolism produces black, blue and green, while catabolism produces the sensation of white, yellow and red. This theory accounts for the presence of different color zones and for the different types of color blindness.

Another theory giving an evolutionary aspect to color perception is the **Ladd-Franklin** (1929) theory, according to which the primitive aspect of color vision is the perception of black and white or the differentiation between light and dark, found in the periphery of the retina, where the receptors are just photosensitive. In the region just inside the periphery, the light sensitive material is capable of differentiating between blue and yellow. Still nearer the fovea, the color blue persists but the yellow substance splits again into green and red. This suggests that red-green blindness might be due to the absence of the last stage of differentiation in as much as the yellow color is retained instead of green-red. This theory also explains the facts about the presence of different color zones in the retina.

EXPERIMENTAL PERSPECTIVE

Does Color Improve Object Recognition?

Does color improve object recognition? If so, is the improvement greater for images with low spatial resolution in which there is less shape information? Do people with low visual acuity benefit more from color? Three experiments conducted by **Lee H. Wurm**, **Gordon E. Legge**, **Lisa M. Isenberg** and **Andrew Luebker** (1993), measured reaction time (RT) and accuracy for naming food objects displayed in four types of images: gray scale or color, and high or low spatial resolution (produced by blur). Normally sighted Ss had faster RTs with color, but the improvement was not significantly greater for images with low spatial resolution. Low vision subjects were also faster with color, but the difference did not depend significantly on acuity. In two additional experiments, it was found that the faster RTs for color stimuli were related to objects' prototypicality but not to their color diagnosticity. It was concluded that color does improve object recognition, and the mechanism is probably sensory rather than cognitive in origin.

PERCEPTION OF TIME

The ability on the part of the individual to interpret and evaluate time is a special ability. There are individual differences in the capacity to perceive time. In certain experiments, a group of individuals was asked to perform a certain task for a span of time, and in the end asked to guess how long they have been working at that task. Based on the time guessed, the subjects of the experiment were classified into three groups as follows:

1. Those who more or less correctly guessed the time are those whose time perception is well developed. They have the capacity to interpret correctly the various time intervals.
2. Those who underestimated the time.
3. Those who overestimated the time.

It is but obvious that the subjects in groups two and three had not developed the capacity to perceive time correctly.

PSYCHOLOGY IN EVERYDAY LIFE

Time Flies When We Read Taboo Words

Does time fly or stand still when one is reading highly arousing words? **Jason Tipples** (2010) using a temporal bisection task tested the effects of sexual taboo words on time perception. Forty participants judged the duration of sexual taboo, high-arousal negative, high-arousal positive, low-arousal negative, low-arousal positive, and category-related neutral words. The results supported the hypothesis that sexual taboo stimuli receive more attention and reduce the perceived time that has passed ('time flies')—the duration of high sexual taboo words was underestimated for taboo-word stimuli relative to all other word types.

There is variation in time perception not only due to learning process but also due to the nature of the situation: perception of time when the individual is occupied in a certain task and perception of time when the individual is not engaged in any task. Certain experiments have proved that subjects tend to underestimate the time when they are occupied in tasks, which are interesting and tend to overestimate the time when they are not occupied. Here, again individual difference exists in time perception.

The mood of the individual also affects the perceptual ability of the individual regarding time. Time seems to fly when in an enjoyable and pleasant task, while time tends to drag on when the task is unpleasant, difficult, and depressing.

EXPERIMENTAL PERSPECTIVE

How do Negative Emotionality Influences the Effects of Emotion on Time Perception?

In this study done by **Jason Tipples** (2008), he used a temporal bisection task to test if greater overestimation of time due to negative emotion is moderated by individual differences in negative emotionality. The effects of fearful facial expressions on time perception were also examined. After a training phase, participants estimated the duration of facial expressions (anger, happiness, fearfulness) and a neutral-baseline facial expression. In accordance to the operation of an arousal-based process, the duration of angry expressions was consistently overestimated relative to other expressions and the baseline condition. In support of a role for individual differences in negative emotionality on time perception, temporal bias due to angry and fearful expressions was positively correlated to individual differences in self-reported negative emotionality. The results are discussed in relation both to the literature on attentional bias to facial expressions in anxiety and fearfulness and also to the hypothesis that angry expressions evoke a fear-specific response.

SOME OTHER FACETS OF PERCEPTIONS

Phenomenon of Perception without Awareness: Subliminal Perception

Johann Herbart (1776–1841) introduced the word 'subliminal' to describe ideas that compete below the limen for consciousness. Accordingly, subliminal perception is the phenomenon of responding to stimuli below the awareness threshold. It occurs for all sense modalities and in the context of several research paradigms. The latter include presenting stimuli of low intensity or short duration, or at frequencies beyond the normal range for conscious perception. Signal to noise ratios for achieving 'perception without awareness' may also be brought about by masking or by presenting stimuli in sensory channels that are not currently mediating conscious perception.

Subliminal perception implies that the processes responsible for conscious perceptual experience are not identical with those which mediate the transmission of the information through the brain from *receptors* to *effectors*. Whereas the latter depends upon the classical sensory pathways linking peripheral receptors with their cortical projections, consciousness of sensory inflow necessitates a coincident contribution of cortical excitation from the ascending fibers of the *reticular system*.

The theory that subliminal perception occurs when external stimulation is too weak or too brief to produce sufficient activation of the reticular system, which is supported by the research findings of Libet and his co-workers. Recording from the *somato-sensory cortex* of fully conscious human subjects, they were able to detect electrical potentials initiated by tactile stimuli presentation at subliminal intensities. When stimulation was increased to supraliminal intensities, subjects reported awareness of the stimulus at the same time as the waveform of the evoked potential manifested a contribution from the reticular activating system.

Because of the threat subliminal perception poses to the notion of free will, there has been considerable resistance to accepting the reality of the same. One criticism has been that so-called subliminal effects are only responses to consciously perceived fragments of the stimulus array. Groeger has shown that semantic influences are greater for subliminal stimulus than for one presented at the awareness threshold. This suggests that subliminal perception cannot be explained away by this 'partial cue' hypothesis.

Subliminal Advertising and Subliminal Perception

When advertisement matter is presented without the viewers knowing that the same have stimulated them, then we talk of subliminal advertising. The message is so designed to reach the viewers so that it is effective in modifying one aspect of their behavior without modifying another.

For the subliminal technique to be effective, two requirements have to be fulfilled: (i) the viewers must not be aware of any stimulation from the message and (ii) the viewers behavior must be influenced in a very particular and gross way.

The technique involves flashing the message repeatedly on a screen. In order to ensure that the viewers are not aware of the message, it is flashed for brief durations since this would distract them from enjoying the program/ movie that they are watching and in turn might have the undesired effect. It has a low brightness level compared with that part of the screen on which it is flashed. It is thus important that the message must not only be unreadable but also its very presence should go unnoticed.

The distinction between 'unreadable' and 'unnoticed' is a very useful one. It is obvious that for a stimulus to be noticed, it requires less information than for it to be readable. Noticing the presence of a stimulus seems to require just about the least information of any perceptual task a person might be asked to perform. On the other hand, being able to read a message seems to require more information.

Thus, the advertising message contains insufficient information for a particular perceptual task to be successfully accomplished. It is 'below threshold'. The operation of subliminal advertising is possible since the input-receiving properties of the system are determined by the reference to the system's output - that is, task accomplishment. The individual must do something to reveal that the threshold value of stimulation has

EXPERIMENTAL PERSPECTIVE

The Magic of Subliminal Stimulation

In a study conducted by **Cook, H** (1985), graduate students were divided into several groups and exposed to either to a subliminal message or to a control message immediately after their statistics or measurement class. The subjects received 12 sessions of 10 exposures per session, of 4-msec visual subliminal messages. The final examinations for each course noted that students who had received the subliminal message performed better than students receiving the control message. Researchers concluded that stimulating students subliminally to feel better about themselves may enable them to learn more effectively.

been reached. The measure of accomplishment may be an increase in the sales following the 'subliminal' advertisement.

Theory of Subliminal Perception and its Applications in Various Researches

The theory that subliminal perception occurs when external stimulation is too weak or too brief to produce sufficient activation of the reticular system is supported by the research findings of **Libet** and his co-workers (1967). Recording from the somato-sensory cortex of fully conscious human subjects, they were able to detect electrical potentials initiated by tactile stimuli presentation at subliminal intensities. When stimulation was increased to supraliminal intensities, subjects reported awareness of the stimulus at the same time as the waveform of the evoked potential manifested a contribution from the reticular activating system.

Experiments have shown that people who are exposed so briefly to a descriptive label that they cannot report seeing it later form impressions that are influenced by the label to which they were exposed (**Bargh** and **Pietromonaco** 1982; **Merikle** 1992).

Yet other researches (**Dixon** 1981) have shown that visual evoked responses, galvanic skin responses, verbal behavior, conscious perception of supraliminal stimulus arrays and even dreams may be significantly influenced by the meaning of verbal and/or pictorial stimuli presented below the awareness threshold. The data from such studies imply that subliminal stimuli may be subjected to extensive preconscious processing involving unconscious long-term memory and emotional classification of sensory inflow.

The most extensively researched manifestations of subliminal perception are those of perceptual defense and vigilance. The data from a variety of experimental paradigms suggests that prior to awareness of a visually presented word or pictures, which is gradually increasing in brightness or duration of exposure, a preconscious semantic analysis of the latter's meaning may result in the raising or lowering of the threshold for conscious perception of the material in question.

Application of the Concept of Subliminal Perception

The fact that stimulation below the awareness threshold is not subject to conscious appraisal has led to several clinical applications of subliminal perception (mood disorders and cognition). These include the investigation of unconscious psychopathology (**Silverman** 1975), the treatment of various neurotic disorders and the identification of accident-prone candidates among applicants for flying duties in military air forces.

EXPERIMENTAL PERSPECTIVE

Effects of Subliminal Perception on Academic Performance

In a study conducted by **Parker, K.A.,** (1982) 60 college students were enrolled in an undergraduate summer session law course with the experimenter-instructor for 6 weeks. In addition to the normal course of instruction, all subjects received subliminal stimulation before 3 out of 5 lectures each week, as well as before and after a 10-minute counseling session with the experimenter. Subjects exposed to subliminal messages earned significantly higher grades than the control group. These results were viewed as consistent with findings of earlier studies on the effects of subliminal messages.

Subliminal stimulation has also been used in a therapeutic context. For example, the reduction of anxiety by subliminal presentation of reassuring messages has proved helpful in reducing compensatory overeating (**Silverman et al.** 1978) and improving performance at mathematics (**Ariam** 1979).

Subliminal perception has also found its use in advertising. The advertising message contains insufficient information for a particular perceptual task to be successfully accomplished. It is 'below threshold'. The operation of subliminal advertising is possible since the input-receiving properties of the system are determined by the reference to the system's output, that is task accomplishment. The individual must do something to reveal that the threshold value of stimulation has been reached. The measure of accomplishment may be an increase in the sales following the 'subliminal' advertisement.

Recent researches (**Bargh et al**. 1996; **Moore** 1988; **Pratkanis** and **Greenwald** 1988; **Trappey** 1996; **Vokey** and **Read** 1985) have demonstrated that subliminal perception does not work in advertising and thus advertisers are not actually trying to gain control over our mind or influence upon it through hidden messages.

EXTRASENSORY PERCEPTION

The sensitivities described so far can all be explained by normal science. They are extra sensory abilities but they are not supernatural. In other words, they do not defy the laws of physics or require as-yet-undiscovered forms of energy. By contrast, *extrasensory perception* or ESP is said to involve forms of energy that *cannot* be measured or are not yet acknowledged by the physical sciences. If an ESP phenomenon is explained as a regular form of information processing involving microwaves or magnetism or electric charges or correlation knowledge, then (in the view of most scientists) it ceases to be ESP and becomes classified as a variety of normal perception.

Believers in ESP sometimes attribute ESP-like phenomena to psychic energy or *psi power*. This is a form of purely mental power that does not involve any normal process of energy or information transfer, except perhaps little-understood quantum effects. Many scientists believe psi power does not exist. One proponent of ESP, Charles Tart accuses his fellow psychologists of 'Fear of Psi', which accounts for their inability to accept the phenomenon.

EXPERIMENTAL PERSPECTIVE

Paranormal Belief and Reasoning

Neil Dagnall, Andrew Parker and **Gary Munley** (2007) examined whether belief in the paranormal is linked to a general weakness in probabilistic reasoning, or whether belief in the paranormal is directly linked to the perception of randomness (misrepresentation of chance). Previous research investigating probabilistic reasoning errors and belief in the paranormal has assessed errors only on a limited number of types of probabilistic reasoning problem. This study used a range of probabilistic reasoning tasks (perception of randomness, use of base rate information, the conjunction fallacy and the derivation of expected value). Participants were given the four types of probabilistic reasoning problem and were asked to complete the paranormal belief scale (PBS) ([**Tobacyk** 1988] and [**Tobacyk** and **Milford** 1983]). The results indicate that only perception of randomness predicted paranormal belief. In addition to this, median splits revealed that high and low believers in the paranormal differed only on the ability to correctly answer perception of randomness problems. These results suggest that paranormal belief is not associated with a general weakness in probabilistic reasoning but arises from a specific deficit associated with perception of randomness (misrepresentation of chance).

A minority of psychologists do believe in something like ESP, (**Bem** and **Honorton** 1994; **Parra** and **Argibay** 2007a; **Storm** and **Ertel** 2001) and many of them point to quantum physics for a possible explanation. Physicists exploring quantum effects (which occur on a subatomic level) can demonstrate very odd phenomena such as action at a distance (one thing affecting another which is far away) under laboratory conditions. However, despite many speculative theories involving quantum processes, nobody has yet come up with a testable theory of how such quantum effects can influence psychological events and thus strengthening the belief of many psychologists against its existence (**David W. Moore** 2001, 2005; **Hyman** 1994; **Swets** and **Bjork** 1990).

In psychology, this is a phenomenon related to the study of perception and is well-known in the popular domain as **extrasensory perception (ESP)**. The belief is that one can have a perceptual experience without any sensory input. Types of reported ESPs include the following:

1. **Mental telepathy**—the ability to read another person's thoughts
2. **Forecasting**—the ability to predict future incidents accurately (for example, who will win a race or engage in a particular activity)
3. **Clairvoyance**—the awareness of some event that one cannot see (for example, knowing where a body is hidden)
4. **Psychokinesis**—the ability to cause things to move by virtue of thought processes

Psychologists known as **parapsychologists** study these phenomena, but the majority of psychologists feel that evidence for the existence of ESP phenomena has not been adequately documented

ROLE OF MOTIVATION AND LEARNING IN PERCEPTION

Role of Motivational Perception

The alteration or distortion undergone by perception because of the fact that the perceiving individual is in a state of need or emotional excitement, or the perceived object has a specific (positive or negative) value or valance for his personality. We therefore recognize that *perception is a result not only of the stimulus structure and sense organs but also of the personality structure and its motivational states*. Murphy *formulated the theory of motivational perception* in the concept of autism by which he indicated that *the true image*

PSYCHOLOGY IN EVERYDAY LIFE

See What You Want to See

People's motivational states—their wishes and preferences—influence their processing of visual stimuli. In five separate studies done by **Emily Balcetis** and **David Dunning** (2006), participants were shown an ambiguous figure (e.g. one that could be seen either as the letter B or the number 13) tended to report seeing the interpretation that assigned them to outcomes they favored. This finding was affirmed by unobtrusive and implicit measures of perception (e.g. eye tracking and lexical decision tasks) and by experimental procedures demonstrating that participants were aware only of the single (usually favored) interpretation they saw at the time they viewed the stimulus. These studies suggest that the impact of motivation on information processing extends down into preconscious processing of stimuli in the visual environment and thus guides what the visual system presents to conscious awareness.

given to us by the cognitive functions of reality is distorted towards the needs and wishes of the perceiving individual. Several hypothetical processes whose sequence has scarcely been studied as yet are assumed in the context of motivational perception, such as perceptual defense and projection. The new research line in this sphere has been defined as the '*new look'*.

Role of Learning in Perception

A host of perceptual phenomena seems to demand an explanation, which incorporates the concept of learning even though direct experimental evidence may be lacking for the specific manner in which the presumed learning has taken place. Several such phenomena are amenable to convincing demonstration. However, while often very dramatic, these demonstrations offer only circumstantial evidence that *learning does indeed influence the course of perceptual development.*

Adelbert Ames, Jr. and his co-workers in conjunction with their transactional theory of perception developed the so-called Ames demonstrations. This theory is based on the observation that *any stimulus pattern that impinges on the retina could have come from 'infinity' of objects*. Despite the infinity of possible perceptions that might arise from a given retinal distribution, the actual perception is usually quite restrictive. The transactional theory attempts to account for this restriction in perception by referring to the learning that takes place during the life of an individual. This learning occurs as a result of people's actively dealing with their environment. Somehow, through their 'transactions' with the environment people's perceptions become limited, and usually in a way that corresponds closely with the world or real objects.

The Ames demonstrations were designed to illustrate the role of learning in perception. They do this, by showing how, under specially constructed stimulus conditions, the correspondence between perception and reality can be made to break down. The 'assumptions' that people have developed in the course of their transactions lead them astray in these special circumstances. People do not see things veridically, but rather in ways that are compatible with their assumptions. The demonstrations are most dramatic when one set of assumptions must be violated in order to preserve another.

Ittleson and Kilpatrick remark: 'All experiments in this regard suggest strongly that perception is never a sure thing, never an absolute revelation of 'what is'. Rather, what we see is prediction—our own personal construction designed to give us the best possible bet for carrying out our purposes in action. We make these bets on the basis of our past experience.'

Perceptual Learning

It is also referred to as *perceptive learning* and defined as *the alteration of behavioral possibilities resulting from changes in perception*. It is useful to distinguish *mental learning* from the perceptual variety. Mental learning implies changes in behavioral possibilities, which arise without open behavior and only through cognitive processing of the assignment. *Spectacle experiments* are typical modes of investigation into perceptual learning. Prisms or mirrors are used systematically to disturb perception: For e.g. ones image of the environment is turned upside-down; through perceptual learning the disturbance is wholly or partially compensated after sometime, i.e. the testee sees the world upright again. In the meantime, however, *it has been adequately proved that this re-organization of disturbed perception depends on the extent of the testee's motor activity*. With reduced motor activity (sitting quietly, head still), there are special motor adaptation processes (e.g. the hand shows at a point corresponding to the changed perceptual conditions), without any change occurring in perception. The question whether motor or perceptual learning has occurred is decided by testing the kind of co-practice. In perceptual learning, the learning sequence generalizes by way of different motor effectors, e.g. from one hand to the other. A more specialized application of perceptual learning is its use for the increasing specificity of perception with a constant physical stimulus constellation.

In essence, *perceptual learning refers to an increase in the ability to extract information from the environment as a result of experience or practice with the stimulation coming from within.* Perceptual learning is a variety of the cognitive learning. It is also involved in determining what the focus of attention is.

Perceptual learning indicates that perception can be molded by learning and hence illustrates the modifiability or plasticity of perception.

PERCEPTUAL DEFENSE

The term perceptual 'defense' is used to refer to the fact that the perception of some stimuli requires a longer exposure than perception of other stimuli. In other words, the thresholds for recognition of certain stimuli are higher than the thresholds of recognition for other stimuli. This is so because the individual is being intentionally selective in his perception (*selective perceiving*) to protect himself from becoming aware of something unpleasant or threatening. For example, obscene words are not heard correctly, or violent acts are not seen accurately.

Processes of Perceptual Defense

Perceptual defense comprises three processes:

1. Emotionally disturbing or threatening stimuli have a higher recognition threshold than neutral stimuli, i.e. threatening stimuli take much time to be recognized than neutral stimuli.
2. Emotionally disturbing stimuli are likely to elicit substitute perceptions that are radically altered so as to prevent recognition of the presented stimuli.
3. These critical stimuli arouse emotional reactions even though the stimuli are not recognized.

Experimental Characteristics of Perceptual Defense

In an experiment done a long time ago to study the phenomenon of perceptual defense, **McGinnies** (1949) presented to subjects a series of words tachistoscopically beginning with exposures well below threshold and increasing by small intervals until the correct recognition occurred. For each presentation, the subject gave his opinion concerning what the word was. Eleven of the words were *neutral* in character and seven had an unpleasant or *socially tabooed* quality. A physiological measure—the *Galvanic Skin Response* (GSR)—of emotion aroused was used. This is an electric device that helps in measuring the drop in the electrical resistance of the skin that occurs when an emotional reaction is aroused in a person. It is popularly referred to as the *lie detector.*

The above experiment led to some striking findings:

1. GSRs occurred while the tabooed words were still being exposed so briefly that the subject was not reporting recognition of these words.
2. In addition, it was discovered that the *reaction time* (the overall time taken for a response to start after the presentation of a stimulus: S-R time interval) were longer for tabooed words than for neutral ones i.e. tabooed words were difficult to recognize.
3. It was also discovered that at brief exposure times, incorrect responses or guesses for the neutral words were often structurally similar whereas for taboo words, these guesses were structurally dissimilar.

At first, though this experiment appears to provide dramatic evidence for all three facets of the mechanism of perceptual defense but there appears to be a paradox as well. The question that arises is: How can a person avoid perceiving a stimulus object before he has actually perceived what it is?

One simple explanation to this can be that the subject may be failing to report taboo words even though he clearly perceives them. The failure to report thus may explain the GSRs to 'sub-threshold' taboo words, the defensive structuring of response words, and the 'higher threshold' for taboo words.

Another explanation to the above may be that response salience is low for taboo words: subjects in a psychology laboratory are unlikely to anticipate being exposed to 'dirty' words. Another interesting finding related with response salience is that after exposure to the first taboo words, subjects more readily perceived subsequent taboo words. Finally, another explanation involves the factor of frequency-response disposition is that probably taboo words occur less frequently in print, hence the higher threshold.

Later experiments have supported all the above explanations of the early 'perceptual defense' findings. It has been confirmed that response salience has its importance in determining recognition threshold.

Individual Differences in Perceptual Defense and Sensitization

It has been seen that stimuli with emotional connotations raise recognition threshold and this phenomenon is termed as perceptual defense. On the other hand, investigations also have indicated that stimuli with emotional connotations lower recognition threshold and this phenomenon is called *sensitization*. Both these phenomenon vary from individual to individual.

Luchins (1950) regretfully says that many studies on perceptual defense do not pay sufficient attention to individual differences. Because a word is socially a taboo does not mean that it is taboo for all individuals. Some persons utilize taboo words calmly; others may be shocked when they are confronted with them, and still others, because of personal dispositions or motives, may have special attitudes towards some taboo words but not others. Moreover, individuals may have different ways of handling the arousal of anxiety or emotion.

Persons have been shown to be consistent in their defense or sensitization reactions to pictures of people in aggressive or neutral scenes (**Stein** 1953). They reacted to successive pictures, which had aggressive content with either a consistently high threshold—defense—or a consistently low threshold—sensitization. These various individual differences are uncontrolled factors in many of the perceptual defense experiments, which simply compare group means.

Further, studies done by clinical psychologists have concluded that those persons who handle threatening content by repression and avoidance have higher recognition threshold for threatening material.

ILLUSION

Definition of Illusion

An illusion is a constant error in visual perception. It is a misinterpretation of a correct meaning of a perception. In plain simple words, it is a wrong or false perception. Hallucination, on the other hand, is dissimilar to illusion. The vision of an oasis at a distance in a desert is a hallucination. Some people see ghosts in the dark. Thus, hallucination is perception of objects not present at all.

Differences Between Hallucination and Illusion

1. In illusion, there is a distinct external stimulus, while in the case of hallucination the internal stimulus is often at rest.
2. While illusion often happens to very ordinary people, hallucination befalls the lot of mentally affected, tired or intoxicated people.

PSYCHOLOGY NUGGET

Early Studies in Optical Illusion

Many illusions actually were developed before the Cognitive Revolution of the 1960s, which bring about the increased interest in perception. For example, James Baldwin (1861–1934) developed the Baldwin illusion, in which a line spanning the distance between two large squares appears shorter than a line of the same length between two small squares (Colman 2006).

Another famous illusion, known by many psychology students, is the young lady/old woman figure. However, it was not developed for psychologists to use. Colman (2006) states that the image was originally developed from a German postcard in 1888 and published as a cartoon in the USA in 1915 by William Ely Hill (1886–1968). Colman (2006) states that originally, the image was entitled 'My Wife and my Mother-In-Law. They are both in this Picture—Find Them'.

An article entitled 'Seeing, Not Believing' appeared in the *American Phrenological Journal* in 1868, in which various illusions are discussed and illustrated. For example, the article begins by showing figure 1, in which two parts of a ring placed above one another.

3. In illusion, the stimulation is usually external while the stimulations in hallucination are in the person himself, which makes the latter a kind of subjective perception.
4. The perception of the same situation is identical to every person in the case of illusion; different people have different types of hallucination under the same conditions.

Table 4.1 summarizes the distinction between illusion and hallucination.

TABLE 4.1 Distinction between Illusion and Hallucination

Illusion	Hallucination
1. Stimulus is explicit.	Stimulus is not clear.
2. It happens in normal condition.	It happens in abnormal condition.
3. Stimulus is external.	It is in person himself.
4. Experience is identical.	Experience is not identical.

Types of Illusions

Personal Illusion

They are those which differ from individual to individual, e.g. mistaking a rope for a snake.

General Illusion

They are those which are of common types and are generally the same for all. Some of these general illusions are being discussed here.

(a) Zollner's Figure The vertical lines are parallel to each other but they do not appear to be such (Fig. 4.25).

(b) Muller-Lyer Figure One part of the Muller-Lyer figure (Fig. 4.26) suggests expansion and the other limitation and thus the first appears longer and so illusion occurs.

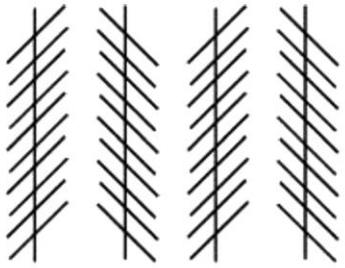


Fig. 4.25 Zollner's Figure

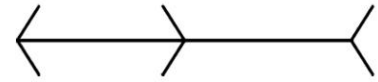


Fig. 4.26 Muller-Lyer Figure

(c) Dunlap's Figure It appears that the two parts of the circle are unequal but it is not so (Fig. 4.27).

(d) Poggendorfs Figure The two starting lines, in fact, are two parts of the sense strength line (Fig. 4.28).

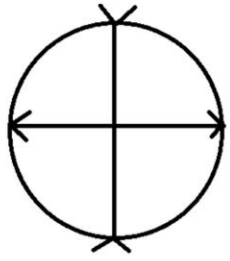


Fig. 4.27 Dunlap's Figure

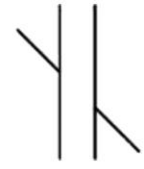


Fig. 4.28 Poggendorfs Figure

Causes of Illusion

There are many theories that were advanced to explain the phenomena of illusions. There are studies that indicate that illusions have multiple causes (**Schiffman** 1990). The following is a collection of the causes according to the various theories. Many of the causes have been explained in relation to perception earlier in this chapter.

1. **Confusion:** One of the major causes of geometrical and similar illusions is confusion. Confusion means the impurity or inaccuracy of perception of the various parts of the picture.
2. **Eye Movement**: The movement of the eyes has a lot to do with the creation of illusion (Fig. 4.29).

Fig. 4.29 Eye Movement

In Fig. 4.29, there was a greater strain on the eyes in viewing the perpendicular line than the horizontal line with the result that the former appeared longer.

3. **Tendency towards Wholes**: In perception, there is a tendency to view the whole. This is also known as the tendency towards the perception of good figure. This leads to illusion.
4. **Perspective**: Due to this, every object appears in three-dimensional.
5. **Emotion**: In an emotional state, perception is often false and this causes an illusion.
6. **Contrast of Stimuli**: A fair face looks fairer if viewed next to a dark face due to the sharp contrast.
7. **Perception**: This too causes illusion, e.g. a person is visited daily at a fixed hour by his friend but on a particular day when this friend does not turn up at the designated time, the person may feel that he had heard his name called out by that friend, who on that specific day actually does not put in an appearance.
8. **Habits**: Habits also cause illusions.
9. **Defects of Sense Organs**: They cause incorrect perception leading to illusion.
10. **Imperfect Isolation**: There is a possibility of deception due to imperfect isolation. 10 kg of iron kept in a small box will appear lighter than 10 kg of iron kept in a bigger box.

EXPERIMENTAL PERSPECTIVE

Tilt-Constancy Theory of Visual Illusions

William Prinzmetal and **Diane M. Beck** (2001) argue that changes in the perception of vertical and horizontal caused by local visual cues can account for many classical visual illusions. Because the perception of orientation is influenced more by visual cues than gravity-based cues when the observer is tilted, they predicted that the strength of many visual illusions would increase when observers were tilted 30°. The magnitude of Zöllner, Poggendorff and Ponzo illusions and the tilt-induction effect substantially increased when observers were tilted. In contrast, the Müller–Lyer illusion and a size constancy illusion, which are not related to orientation perception, were not affected by body orientation. Other theoretical approaches do not predict the obtained pattern of results.

THEORIES OF ILLUSION

Eye Movement Theory

In its simplest form, this theory says that the impression of length is obtained by moving the eye along a line from one end to the other. If the vertical movements of the eyes are most strenuous than the horizontal, a given vertical distance calls for more effort than the same horizontal distance and therefore seems longer.

Perspective Theory

This theory starts from the undoubted fact that a line drawing readily suggests objects in three dimensions. It infers that the perspective read into the figure affects the apparent length of the lines. For example, a short vertical line in a drawing may represent a relatively long horizontal line extending away from the observer.

Empathy Theory

Given by **Theodor Lipps** (1897), he sought to explain the esthetic effects of architecture. He held that even in looking at relatively simple figures, the observer's emotional and reactive nature is stimulated. A vertical line, resisting gravity, suggests effort and thus appears longer than an equal horizontal line. One part of the Muller-Lyer figure suggests expansion and the other limitation and thus the first line appears longer.

Confusion Theory

To judge the lines and angles of a figure requires analysis, which is difficult because the observer is engrossed in the appearance of the figure as a whole.

Pregnance or Good Figure Theory

Among the German Psychologists, a 'pregnant' figure is one, which expresses some characteristic fully. 'Goodness' of figure means in part the same thing. When the observer sees a figure as having some characteristics, his tendency is to see this characteristic as fully expressed as the conditions allow, according to this theory.

KEY TERMS

Perception
Sensation
Proximity
Closure
Retinal points
Illusion
Gestalt approach
Attention
Similarity
Size constancy
Perceptual learning
Visual sense
Grouping
Contour
Monocular cues
Hallucination

EVALUATE YOURSELF

Multiple Choice Questions

1. 'The whole is greater than the sum of its parts' is a concept associated with
(a) Functionalism (b) Structuralisms
(c) Behaviorism (d) Gestaltists

2. Subliminal perception refers to perception resulting from stimuli
(a) Below the threshold of conscious perception (b) Above the threshold of conscious perception
(c) Equal to the threshold of conscious perception (d) None of the above

3. Proximity is associated with
(a) When we perceive several different stimuli are perceived together as a group
(b) The tendency to group to form a balanced figure
(c) Stimulus elements that are close together tend to be perceived as belonging together
(d) The tendency to perceive objects that are in a common area or region as being in a group

4. The corridor illusion is associated with
(a) The size and distance relationship (b) The time and space relationship
(c) The size of the corridor (d) All of the above

5. Which of the following is not a monocular cue of depth perception?
   (a) Linear perspective (b) Interposition
   (c) Gradients of texture (d) Convergence
6. The kinesthetic system tells us about
   (a) Aesthetics (b) Movement of our bodies in space
   (c) Movement of our bodies in outer space (d) Esthetics
7. Binocular parallax is
   (a) Disparity in the two retinal images (b) Distortion in vision
   (c) A visual disorder (d) Parallel processing of information
8. The brain-field theory of movement perception was proposed by
   (a) Miller (b) Bruner
   (c) Wertheimer (d) Witkin
9. ESP is an abbreviation for
   (a) Especial sense perception (b) Extra sense perception
   (c) Endogenous sense perception (d) Extrasensory perception
10. Alternation of behavioral possibilities resulting from changes in perception is associated with
   (a) Perceptive learning (b) Motivated learning
   (c) Rote learning (d) Observational learning

Descriptive Questions

1. What is the nature of perception?
2. 'The Gestaltists elected to study perception in terms of inherent organization and configurational properties.' Explain this statement.
3. Explain the physiological approach to the study of perception.
4. Outline the sequence of events leading to perception of objects and events.
5. What do you understand by the term 'perceptual cognitive styles'? Outline the major ones with recent researches in those areas.
6. Which factors direct and determine the perceptual process? Discuss each one briefly.
7. State the laws of perceptual organization.
8. Discuss the principle responsible for perceptual stability.
9. What do you mean by depth perception? Discuss.
10. What is the role of motivation and learning in perception? Discuss with relevant studies.

Critical Thinking Questions

1. Which is correct—'seeing is believing' or 'seeing in deception'?
2. Which is the best way to describe the figure below—half filled or half empty?

3. How do reversible figures demonstrate the influence of learning in distinguishing form from ground?
4. Many of the perceptual organizations we make may be the result of perceptual mechanisms that have evolved to provide us with a perception of what is most likely. Relate this statement with the Phi phenomenon.
5. Can peripheral vision enable us to differentiate between our own movements and that of our surroundings?

PRACTICAL EXERCISE

1. Ask your students to give you an estimate of time while reading an article in a newspaper daily. Give a copy of the article to each of the students and ask them to read the article. Do you see any positive correlation between the time estimation given to you by the students? If yes why and if no why not?

Answers to Multiple Choice Questions

1. (d) **2.** (a) **3.** (c) **4.** (a) **5.** (d) **6.** (b) **7.** (a) **8.** (c) **9.** (d) **10.** (a)

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Chapter 5

Sleep, Dreams, Hypnosis, Meditation and Drugs

Chapter Objectives

After reading this chapter you will learn

- About sleep, dreams, hypnosis and meditation as various states of the consciousness and about psychoactive drugs.
- Various theories of sleep, stages of sleep, sleep disorders (their causes), sleep as a physiological process and findings of relationship between sleep and memory.
- What dreams are and why we dream; various approaches and theories of dream interpretation, including recent researches.
- That hypnosis and meditation are two of the few altered states of consciousness (ASC).
- The physiochemical action of psychoactive drugs like LSD and marijuana and their role in creating particular ASC.

Consciousness is defined as the state of awareness, the totality of experience at any given moment as opposed to the mind, which is the sum of past consciousness. This present state of awareness is not only of the external environment but also of the internal events such as thinking. In other words, it is the awareness or perception of the environment and of one's own mental processes. It refers to our subjective awareness of the world around us and our perceptions and internal thoughts. In fact, consciousness is a four-stage process: perception–thought–action–feedback.

It is a well-known fact that thought precedes an action. One first thinks and then acts. Thoughts, since the origin of psychology, have indicated the existence of the mind and have formed the basis of studying the mental processes. Consequently, the study of consciousness became a paramount issue for psychologists and psychology became to be defined as 'the description and explanation of states of consciousness' (**Ladd** 1887). However, in the past, the study of consciousness could not yield much scientific results due to lack

PSYCHOLOGY NUGGET

Altered States of Consciousness (ASC)

Ladd (1887) wrote the first systematic textbook on the new physiological psychology in English. In his book, he defended the importance of the physiological and experimental approach, provided considerable coverage to the nervous system, summarized primary results in psychophysics and devoted a chapter to chronometric studies. It also contained an argument for the reality of the mind as a spiritual being, presented a scientific hypothesis to explain the unity of consciousness. Ladd later on elaborated upon the distinction between descriptive, explanatory, empirical psychology of consciousness. The altered states of consciousness (ASC) as an expression thought was used by Arnold M. Ludwig early in 1966 but brought in wide use as an expression in 1969 by Charles Tart. Today an altered state of consciousness is also referred to as altered state of the mind and also at times referred to as 'altered states of awareness'. ASC is quite different from that of the normal waking beta wave state. It describes induced changes in one's mental state, which usually are temporary.

of technology but today we are fortunate enough to be well equipped, having objective ways to measure conscious states and study the same. Today, we study and examine conscious experience in many ways. Our conscious state is said to be altered any time the content or quality of conscious experience undergoes a significant change. There are many ways to alter conscious experience. Psychoactive drugs can alter one's conscious state and our perceptions of the world. Sleeping and dreaming are also considered to be states of consciousness. Hypnosis can alter conscious experience. Other causes are sleep deprivation, religious experiences, mystical or emotional experiences, sensory overload or deprivation, high fever, prolonged strenuous exercise or even being engrossed in the pages of a good book. However, most research into the states of consciousness has concentrated on sleep, hypnosis, meditation and psychoactive drugs; we will examine each one of these and try understanding consciousness through the same.

SLEEP

People spend one-third of their lives asleep. For most of us that means that about 25 years of our life will be spent in an unconscious state. This is a lot of time spent doing nothing. Truly, this would be an insfficient way to behave if we were really inactive, but recent research indicates that this is not the case. It is but obvious that all this activity has a purpose in our life cycle and sleep is essential for one's physical and mental well-being. Two theories of sleep, the *restoration* (repair) and the *adaptive theories*, attempt to explain why sleep occurs. In the restoration theory, sleep serves a biological need, replenishing key areas of the brain or body that get depleted during the day (**Adams** 1980; **Moldofsky** 1995). This theory helps to explain the importance of sleep in growth in children and if they are deprived of sleep, they suffer from delayed growth (**Gilmore** and **Skuse**, 1999; **Swanson**, 1994). The adaptive theory suggests that sleep as a function evolved over time because it prevented early humans from wasting energy and exposing themselves to nocturnal predators, thus aiding in survival (**Webb** 1992).

How Much Sleep is Required?

The answer of how much sleep a person needs varies from person to person and is determined by certain criteria such as age and possible inherited sleep needs (**Feroah et al.** 2004), but most people need seven to eight hours

of sleep each 24-hour period in order to function well. Some people are short sleepers, needing only four or five hours, whereas others are long sleepers and sleep for nine or ten hours (**McCann** and **Stewin** 1988).

Stages of Sleep

A healthy adult sleeps an average of 7.5 hours each night and most people (approximately 95 percent) sleep between 6.5 and 8.5 hours. Tracking brain waves with the aid of *electroencephalographs* (EEGs), researchers have identified six stages of sleep (including a pre-sleep stage), each characterized by distinctive brain-wave frequencies. Stage 0 is the prelude to sleep, which is characterized by low amplitude and fast frequency **alpha waves** in the brain. At this stage, a person becomes relaxed, drowsy and closes their eyes. Stages 1 through 4 are sometimes characterized as NREM (*non-rapid eye movement*) sleep. In Stage 1, the eyes begin to roll and rhythmic alpha waves give way to irregular **theta waves** that are lower in amplitude and slower in frequency as the person loses responsiveness to stimuli, experiences, fleeting thoughts and images. If people are awakened at this point, they will probably not believe that they were actually asleep. They may also experience vivid events called *hypnagogic images* (**Mavromatis** 1987; **Mavromatis** and **Richardson** 1984; **Sherwood** 2001**).** In Stage 2, electroencephalogram tracings show fast frequency bursts of brain activity called *sleep spindles*, marked by muscle tension and accompanied by a gradual decline in heart rate, respiration and temperature. The appearance of sleep spindles is associated with the loss of perceptual awareness. To many researchers, the appearance of the first sleep spindle during Stage 2 signals that the individual has truly fallen asleep (**Steriade**, **McCormick** and **Sejnowski** 1993). Stages 3 and 4 normally occur 30 to 45 minutes after falling asleep. In Stage 3, there are fewer sleep spindles, but high amplitude and low frequency delta waves appear. When these begin to occur more than 50 percent of the time, the fourth stage of sleep has been entered. **Delta waves** demarcate the deepest levels of sleep, when heart rate, respiration, temperature and blood flow to the brain are reduced and growth hormones are secreted. Delta wave sleep is sometimes known as **slow-wave sleep**. A person roused from Stage 4 sleep will be groggy and confused. Altogether, it takes about a half hour to pass through these four stages of sleep.

After spending time in slow-wave sleep, the sleeper typically returns to Stage 2 for sometime before entering the first period of *rapid eye movement* (REM). After the REM period, the sleeper usually returns to Stage 2 before sinking back into slow-wave sleep. This cycle may occur three or four times in a night before the sleeper finally ascends through Stage 2 and 1 and then awakens. Figure 5.1 shows the human EEG associated with different stages of sleep.

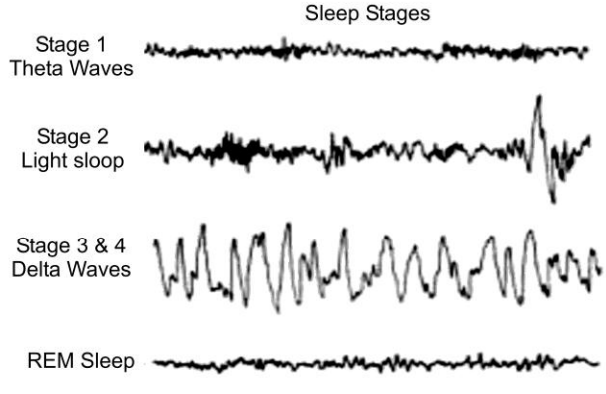

Fig. 5.1 Human EEG Associated with Different Stages of Sleep

Total deprivation of sleep leads to diminished ability to sustain attention and after about 60 hours, to occasional visual and auditory hallucinations or paranoid ideas. Selective deprivation of paradoxical sleep causes it to be subsequently enhanced in both its duration and its intensity. Selective deprivation of Stages 3 and 4 sleep is followed by similar enhancement.

Rapid Eye Movement Sleep

About 25 percent of our sleep each night (1½ to 2 hours) is REM sleep. The REM periods occur with considerable regularity, about every 90 minutes, with different stages of NREM or *orthodox sleep* occurring in the intervals between. Figure 5.2 shows the various stages of sleep. As the night goes on, Stages 3 and 4 of NREM tend to occur less frequently, the sleeper alternates mainly between REM periods and Stage 2. Near the end of the sleep cycle, there are also short periods of wakefulness.

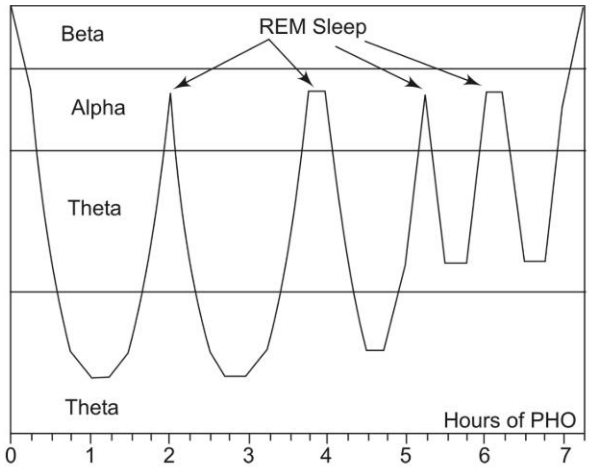

Fig. 5.2 Stages of Sleep

It is during REM sleep that dreams are experienced. In this state, the same fast frequency, low-amplitude beta waves that characterize waking states occur and a person's physiological signs, heart rate, breathing and blood pressure also resemble those in a waking state. However, muscle tone decreases to the point of paralysis (*atonia*), as measured by an electromyogram (EMG), with sudden twitches especially in the face and hands. This is why REM sleep is sometimes referred to as '*paradoxical sleep'* because the brain wave pattern is similar to that of a waking person, but the person is deep in sleep with no tension in muscle and no response to outside stimuli.

The REM periods may last from 15 minutes at the beginning of a sleep cycle to one hour at the end of it. Most people complete four to six complete sleep cycles each night, with each cycle lasting about 90 minutes. These cycles vary in composition, however; early in the night most of the time is spent in Stage 3 and 4 sleep, with Stage 2 and REM sleep predominating later on. Sleep patterns also vary in the course of a person's life. On an average, an infant sleeps for about 16 hours a day, in contrast to a 70-year-old, who sleeps for only about six hours. While REM sleep comprises about half of total sleep at birth, it eventually decreases to only 25 percent. Sleeping patterns also vary greatly among individuals and even among different cultures (in terms of napping, for example).

EXPERIMENTAL PERSPECTIVE

REM Sleep—By Default

The elements of three old and overlapping theories of REM sleep (REM) function, the Ontogenetic, Homeostatic and Phylogenetic hypotheses, together still provide a plausible framework—that REM (i) is directed towards early cortical development, (ii) 'tones up' the sleeping cortex, (iii) can substitute for wakefulness, and (iv) has a calming effect. This framework is developed in the light of recent findings by **J.A. Horne** (2000). It is argued that the 'primitiveness' of REM and its similarity to wakefulness liken it to a default state of 'non-wakefulness' or a waking antagonist, anteceding 'true' (non-REM) sleep. The 'toning up' is reflected by inhibition of motor, sensory and (importantly) emotional systems, together pointing to integrated 'flight or fight' activity, that preoccupies/distracts the organism when non-REM is absent and wakefulness unnecessary. Dreaming facilitates this distraction. In rodents, REM can provide stress coping and calming, but REM deprivation procedures incorporating immobility may further enhance stress and confound outcomes. REM 'pressure' (e.g. REM rebounds) may be a default from a loss of inhibition of REM by non-REM. The REM can be reduced and/or replaced by wakefulness without any adverse effects. The REM has little advantage over wakefulness in providing positive cerebral recovery or memory consolidation.

The REM sleep, in particular, has been thought to serve special functions. Research subjects whose REM sleep was interrupted made up for the loss by spending extra time in the REM stage on successive nights (*REM rebound*). It has also been suggested that REM sleep aids the activity of neurons that use the neurotransmitter norepinephrine, thus maintaining waking alertness. Persons deprived of REM sleep have shown poorer retention of skills learned during the day, leading to the hypothesis that REM sleep helps in assimilating daytime learning experiences.

PSYCHOLOGY NUGGET

Stages of Sleep

STAGE 1 NREM: LIGHT SLEEP	Your brainwave frequencies descend from relaxed alpha waves (8 to 12 Hz) to dreamy theta waves (4 to 7 Hz). You begin to lose muscle tone, causing twitches and hypnic jerks. You have *hypnologic hallucinations* and lose self-awareness.
STAGE 2 NREM: LIGHT SLEEP	Your brainwaves show sleep spindles (12 to 16 Hz) and K-complexes. You lose nearly all muscle tone in what is known as *sleep paralysis*.
STAGE 3 NREM: SLOW WAVE SLEEP	Your brainwaves descend to delta waves (0.5 to 4 Hz)—the lowest frequency marking a deep sleep. This is the stage where sleepwalking occurs.
STAGE 4 NREM: SLOW WAVE SLEEP	Your delta waves are more pronounced as you enter deep slow wave sleep. This is the deepest form of sleep.
REM SLEEP	Your brainwave frequencies jump to highly active beta waves (12 Hz). You have bursts of rapid eye movement and muscle twitches. The most vivid dreams happen during REM sleep.

Psychological Features of Sleep

The terms 'light' and 'deep' sleep are no longer valid in paradoxical sleep, especially concordance between differing criteria is lost. Progression from wakefulness through Stages 1 to 4 of orthodox sleep is associated with progressive decline in responsiveness to auditory stimuli. Meaningful stimuli are often woven into dream content on an assonant basis without causing awakening. Complex auditory discriminations and selective responses can be made during sleep.

Memory of the psychological events of sleep or of external stimuli presented during sleep is poor, but awakening from any stage of sleep can usually elicit recall of some immediately preceding mental life. In drowsiness, there occur hypnagogic hallucinations, namely brief, disconnected and often bizarre sensory experiences, coupled with internal verbal productions of schizophrenia–like nature. Awakenings from orthodox sleep usually elicits fragmentary reports, often characterized as 'thinking', whereas awakenings from paradoxical sleep usually elicits lengthy, colorful and adventuresome reports often characterized as 'dreaming'. The experienced observer can discriminate the type of sleep from which the dream was elicited.

In a study done by **Steptoe et al**. (2008) related with **positive effect, psychological well-being and good sleep,** they found that both positive affect and eudaimonic well-being (positive affect and purpose in life) are directly associated with good sleep and may buffer the impact of psychosocial risk factors. The relationships are likely to be bidirectional, with disturbed sleep engendering lower positive affect and reduced psychological well-being and positive psychological states promoting better sleep.

Neurochemical Regulation of Sleep

In a review of recent developments in the field of sleep regulation, **Steiger** (2007) examined the role of hormones and of synthetic GABAA receptor agonists. He found that certain hormones play a specific role in sleep regulation. A reciprocal interaction of the *neuropeptides growth hormone* (GH)-*releasing hormone* (GHRH) and *corticotropin-releasing hormone* (CRH) plays a key role in sleep regulation. At least in males, the GHRH is a common stimulus of non-rapid-eye-movement sleep (NREMS) and GH and inhibits the *hypothalamo-pituitary adrenocortical* (HPA) *hormones*, whereas CRH exerts opposite effects. Furthermore, CRH may enhance rapid-eye-movement sleep (REMS). Changes in the GHRH:CRH ratio in favor of the CRH appear to contribute to sleep EEG and endocrine changes during depression and normal ageing. In women, however, CRH-like effects of GHRH were found. Besides, CRH *somatostatin* impairs sleep whereas *ghrelin*, *galanin* and *neuropeptide Y* promote sleep. *Vasoactive intestinal polypeptide* appears to be involved in the temporal organization of human sleep. Beside peptides, steroids participate in sleep regulation. *Cortisol* appears to promote REMS. Various neuroactive steroids exert specific effects on sleep. The beneficial effect of *estrogen* replacement therapy in menopausal women suggests a role of estrogen in sleep regulation. The GABAA receptor or GABA ergic neurons are involved in the action of many of these hormones. Recently, synthetic GABAA agonists, particularly *gaboxadol* and the GABA reuptake inhibitor *tiagabine,* were shown to differ distinctly in their action from allosteric modulators of the GABAA receptor-like benzodiazepines as they promote slow-wave sleep, decrease wakefulness and do not affect REMS.

Common Sleep Disorders

Though there are approximately seventeen types of common sleep disorders listed, you need to be aware about only a few of them since most of the individuals suffer from either one of them. The rest of them are summarized under other common sleep disorders.

Insomnia

Many people lie down in their beds at night and try hard to sleep but they fail to do so. Such people if they do manage to go off to sleep have trouble maintaining it. Mostly all of us have experienced this problem sometime or the other. This problem is the resultant of various factors, which include stress, change in time due to travel across different time zones, change in sleeping schedule, a nap in the noontime, consuming stimulants like caffeine and nicotine, etc. If this insomnia is short-lived, there is nothing to worry but if it persists then it is sounding an alarm—a warning about the beginning of a sleep disorder.

Delayed Sleep Phase Syndrome

The delayed sleep phase syndrome is one of the most common complications of sleep-wake patterns. Patients with this syndrome are able to get plentiful sleep; it just differs from traditional sleep-wake patterns. This syndrome results when a person's internal biological clock does not match his or her external environment. This should not be confused with a jet lag because it is not activated by travel or a change in external environment. Rather, the patient's propensity to fall asleep is simply 'delayed' in relation to other people's. Subsequently, a patient with this syndrome is desynchronized with the routine that governs most of his or her life. People suffering from this syndrome are unable to fall asleep before 2 a.m. and have extreme difficulty waking up early in the morning that disturbs their daily scheduled activities—school, work, etc.

Hypopnea Syndrome

This is a condition when an individual experiences abnormally shallow breathing or slow respiratory rate while sleeping. This should not be confused with *sleep apnea* as some air is being passed through the mouth or nose. This disorder leads to the rising of level of blood due to decrease in oxygen intake and its level is proportionate to the degree of obstruction. Hypopnea interrupts sleep patterns and results in the individual feeling fatigued, inability to concentrate, irritability and headaches. They get extremely tired because they cannot sleep. This constant sleepiness is the biggest symptom for the individual. Other symptoms include severe snoring including intermittent bouts of choking noises or very loud snores that have a long silence afterwards. Along with this, there is also a feeling of depression, becoming forgetful, experiencing personality changes such as moodiness, inability of concentrate, feeling lethargic, anxiety and morning headaches. The syndrome negatively affects a person's quality of life. The excessive sleepiness can cause car accidents, inability to concentrate and reduced productivity. It can also lead to emotional problems and a lesser quality of relationships. Hypopnea, that is not severe, can be treated by the patient losing weight or by not sleeping on his or her back. Quitting smoking, not drinking alcohol and not using sedatives before bed can also be a useful treatment for this disorder. Physical exercise that also strengthens respiratory muscles can also be quite effective. Severe hypopnea, on the other hand, requires surgery.

Sleep Apnea

An interruption in breathing occurs during sleep for approximately more than ten seconds in this condition. This disorder is very common and can be very serious and life-threatening. The most common type of sleep apnea is *obstructive sleep apnea*. During an episode of obstructive sleep apnea, the effort to inhale air creates a suction that collapses the windpipe. Airflow may be blocked for a period of 10–60 seconds while the individual, in sleep, struggles to breath. When this blockage occurs, the oxygen levels in the blood drop and the brain immediately responds by waking the individual, thus enabling him to tighten the airway muscles and open the windpipe. The individual may snort or gasp, then go back to snoring. This entire episode can occur hundred times in one night. Upon finally waking up in the morning, such individuals always feel sleepy and may even experience personality changes such as irritability or depression. The effects of sleep apnea can also

lead to morning headaches, loss of interest in sex, decline in mental functioning, high blood pressure, irregular heartbeats and an increased risk of heart attacks or strokes. The causes of sleep apnea are generally physical in nature including excess weight or tissue, large tonsils or adenoids, nasal congestion or blocking or a unique shaped head, neck or chin. Treatment includes a combination of behavioral changes, ventilation assistance, drug therapy and surgery that allows most people with sleep apnea to be treated successfully, although it may take some time to determine the most effective and least intrusive treatment. Polysomnography testing is usually required after beginning a treatment to determine how effective it has been.

Narcolepsy

This is characterized by excessive daytime sleepiness, which often culminates in falling asleep spontaneously, but unwillingly at inappropriate occasions. Such people have sleep attacks during the day even if they have had a normal sleep at night. It is assumed that this sleep disorder is due to the brain's inability to regulate sleep-wake cycles normally. Narcolepsy may also be genetic but it also seems to be influenced by environmental factors. It can also be the result of brain damage from a head injury or any neurological disease. The effects of this disorder can be dangerous because such individuals tend to fall asleep even while performing critical tasks like driving or handling machines, which requires alertness and attentiveness. People with narcolepsy may also experience a loss of muscle control during emotional situations; have hallucinations, disrupted night-time sleep and temporary paralysis when they wake up. Treatment for narcolepsy includes stimulants and prescribed antidepressants. Taking short voluntary naps during the daytime can also be helpful.

Snoring

Snoring is one of the most common, mildest and irritating of all the disorders especially for others sleeping next to the snorer. This disorder, many a time, is confused with sleep apnea because of the snore, which in itself is not a permanent feature of sleep apnea. Snoring occurs when a narrow airway gets in the way of smooth breathing and creates the snoring sound. This narrowing happens because of either a poor sleeping posture, excessive body weight or some physical abnormalities of the throat. However, when one is snoring, it is not necessary that there is an obstruction in the airway as in the case of sleep apnea. Remedies for controlling snoring are many—sleeping on your side, elevating the head of your bed or losing some excess weight.

Restless Leg Syndrome

This is characterized by an irrespirable urge to move legs. This urge is the result of either feeling uncomfortable while lying down, tingly or creeping sensations in the legs or effected limbs. The movement eases these feelings but only for sometime. People suffering from this syndrome often also have *periodic limb movement disorder*, which is characterized by a sudden involuntary movement of the arms and/or legs during sleep—kicking the legs. Severe restless leg syndrome is most common in elderly people, though symptoms can develop at any age. In some cases, restless leg syndrome may be linked to conditions such as anemia, pregnancy or diabetes. Treatment includes alternative therapies, lifestyle changes and even nutritional supplements. Some prescribed drug therapies are also available.

Other Common Sleep Disorders

Other common sleep disorders are discussed here.

- *Bruxism*: It is characterized by involuntary grinding or clenching of the teeth while sleeping.
- *Cataplexy*: It is characterized by a sudden weakness in the motor muscles that can result in collapse to the floor.

- *Night terror*: Technically called *pavor nocturnes*, it is characterized by an abrupt awakening from sleep with behavior consistent with terror.
- *Parasomnias*: It is characterized by disruptive sleep-related events, involving inappropriate actions during sleep stages like sleepwalking and night terrors
- *Rapid eye movement disorder*: It is characterized by the acting out of violent or dramatic dreams while in the period of rapid eye movement sleep.
- *Sleep paralysis*: Often seen as a part of *narcolepsy*, it is characterized by temporary paralysis of the body shortly before or after sleep. It may be accompanied by visual, auditory or tactile hallucinations. This is not considered a disorder unless it is severe.
- *Sleepwalking* or *somnambulism*: It is characterized by engaging in activities that are normally associated with wakefulness, which may include walking without the conscious knowledge of the person.
- *Nocturia*: This disorder is characterized by a frequent need to get up and go to the bathroom to urinate in the night. It differs from *enuresis* or bed-wetting in which the person does not arouse from sleep but the bladder nevertheless empties.
- *Somniphobia*: It is a phobia that is associated with going to sleep and a disorder on both counts.

RECENT RESEARCHES ON SLEEP AND MEMORY

As research on the effect of sleep on memory rapidly proceeds, an increasing number of studies ultimately suggest a functional significance of the sleeping brain for the processing of newly acquired information (**Stickgold and Walker** 2005). Whereas early studies typically focused on declarative memory tasks such as nonsense syllables, word lists and paired associate lists (**Benson and Feinberg** 1975, 1977; **Ekstrand** 1967; **Hockey et al**. 1972; **Idzikowski** 1984; **Jenkins** and **Dallenbach** 1924; **Lovatt** and **Warr** 1968; **Nesca** and **Koulack** 1994), more recent research also established a sleep-related memory facilitation for a variety of perceptual (**Fenn et al**. 2003; **Stickgold et al**. 2000a, 2000b) and motor skills (**Fischer et al**. 2002; **Walker et al**. 2002), and even for complex cognitive tasks such as gaining insight into hidden rules or schemas (**Wagner et al**. 2004).

EXPERIMENTAL PERSPECTIVE

Influence of Different Sleep Stages on Memory

A new approach to the role of sleep stages in memory is discussed by **Vadim S. Rotenberg** (1992) in the context of the two opposite patterns of behavior—*search activity* and *renunciation of search*. Search activity is an activity designed to change the situation (or the subjects' attitudes to it) in the absence of a definite forecast of the results of such activity, but with the constant consideration of these results, at all stages of activity. Search activity increases general adaptability and body resistance while renunciation of search decreases adaptability and requires REM sleep for its compensation.

Unprepared learning, often accompanied by failures on the first steps of learning, is suggested to produce renunciation of search, decrease learning ability, suppress retention and increase REM sleep requirement. A prolonged REM sleep deprivation before training causes learned helplessness and disturbs the learning process, while short REM sleep deprivation cause the 'rebound' of the compensatory search activity that interferes with passive avoidance.

REM sleep deprivation performed after a training session can increase distress caused by a training procedure, with the subsequent negative outcome on retention.

Given the relative robustness of the night sleep effect on declarative memory on the one hand and the widespread presence of polyphasic sleep cycles on the other, it might be speculated that a sleep-related memory enhancement also applies to short episodes of napping, which usually consist mainly of Stage 1 (S1) and Stage 2 (S2) sleep, but of only little or no slow wave sleep (SWS) and rapid eye movement (REM) sleep as compared with a regular night sleep period. In a recent experimental study done by **Olaf Lahl, Christiane Wispel**, **Bernadette Willigens** and **Reinhard Pietrowsky** (2008), they found that memory performance was significantly enhanced after napping as opposed to waking but was not correlated with time spent in slow wave sleep or total sleep time within the napping condition. Further in their experiments, they also found superior recall for both nap conditions in contrast to waking as well as for long naps in contrast to short naps. These results demonstrate that even an ultra short period of sleep is sufficient to enhance memory processing. They suggest that the mere onset of sleep may initiate active processes of consolidation that once triggered, remain effective even if sleep is terminated shortly thereafter.

REM SLEEP AND DREAMS

Soon after the discovery of two different types of sleep, it was proposed by **Dement** and **Kleitman** (1957) that rapid eye movements (REM) indicate that the sleeper is dreaming. To prove this, they tried waking subjects each time the EOG indicated a pattern of rapid eye movements; about 85 percent of the subjects were able to recall a dream when they were awakened during a REM period. In a study done by **Shafton** (1995), he reports that when subjects who are in REM sleep are awakened they usually report of being in a dream state. However, not all REM sleep is associated with dreams and some dreams also occur during NREM periods. Though research studies (**Foulkes** and **Schmidt** 1983; **Takeuchi et al**. 2003) have suggested that dreaming does take place during NREM sleep also but these dreams are more-or-less thoughts about daily occurrences and far shorter than REM dreams that are more detailed, longer and more bizarre.

There have been several explanations of what rapid eye movements mean. One theory was that the rapid eye movements are actually attempts by the sleeper to visually follow the course of the dream, much like watching a movie; now, however, it seems more likely that rapid eye movements are simply indications of the intense brain activity occurring during these periods of sleep. What is not known is what function REM sleep serves in humans. It is clear, however, that it is very important. If people are deprived of REM sleep, by being awakened as soon as they enter the REM period, they become irritated and uncomfortable. Sleepers will tend to compensate for REM deprivation in one night by increasing the number of REM periods on the next night or nights (a phenomenon called 'REM rebound'). A similar effect does not occur with NREM sleep.

WHAT ARE DREAMS AND WHY DO WE DREAM?

Despite the importance of sleep and dreams for the understanding of human consciousness, science is yet to achieve a consensus about their functions and intricate phenomenology. More than a century after the publication of 'The Interpretation of Dreams' (**Freud** 1952), a scientific consensus about these two essential questions concerning human consciousness is yet to be achieved. While depth psychology focuses on dream meaning and wish fulfilment (**Freud** 1952; **Jung** 1953, 1969, 1974; **Fosshage** and **Loew** 1978; **Solms** 2004), experimental psychology scrutinizes sleep-dependent learning in search of less subjective dream purposes (**Jenkins** and **Dallenbach** 1924; **Fishbein** 1971; **Karni et al**. 1994; **Stickgold** and **Hobson** 2000; **Wetzel et al**. 2003, etc.). Neurophysiology, on the other hand, tends to the investigation of the systemic, cellular and molecular mechanisms related to sleep (**Aserinsky** and **Kleitman** 1953; **Dement** and **Kleitman** 1957) and its cognitive functions (**Gutwein et al**. 1980; **Hirase et al**. 2001; **Ribeiro et al**. 2004, etc). Due to their different

methods, each of these fields of investigation has, to a large extent, established a dream phenomenology of their own. We will now briefly examine some of theories of dreaming.

Psychoanalytic Interpretation of Dreams

To **Sigmund Freud** (1935/1969), dreams were the '*royal road to the unconscious'*. According to him, during sleep, the conscious mind is, for the most part, not active. As a result, many of those disturbing ideas, feelings and recollections that we try to avoid thinking about when we are awake spill over when we are asleep, because the conscious mind is not an effective monitor during sleep. Nevertheless, even during sleep, we defend against threatening thoughts by disguising them, often in fantastic images. These images make up our dreams and an interpretation of dreams can provide insight into the hidden, repressed corners of the mind.

The psychoanalytic interpretation of dreams first described by Freud argues that dreams are disguised representations of repressed desires that appear in symbolic form. This hidden meaning is known as the dreams *latent content*. In this view, the purpose of dreams is to provide unconscious gratification so that certain desires can be satisfied and thus will not intrude into sleeper's life when he/she is awake. Only the surface, or *manifest content*, of dreams is open to straightforward observation (people can tell you what they dream). According to his psychoanalytic theory, without in-depth psychoanalysis, the underlying purpose of the dreams is wholly lost. Unfortunately, because this deep interpretation of underlying purpose is not open to experimental investigation, it remains conjecture.

Neuro-physiological Approach

Activation-Synthesis Hypothesis

Sleep and dream researchers who are not receptive to Freud's view explain the issue differently. To better understand why humans dream neurophysiologists, (**Hobson** and **McCarley** 1977) focused their research on observing the biological causes of REM sleep. They discovered that REM sleep is induced by the release of the brain chemical *acetylcholine*. The release of this chemical stimulates nerve impulses that recreate random bits of one's internal information in a sequence that may not conform to logic. They named this new theory the *activation-synthesis hypothesis*. In simple words, **McCarley** (1977) suggests that dreams do not indicate 'a process of disguise or concealment, but a process of activation'. He feels that this might explain why so many dream reports mention strenuous activity such as running, climbing and so on. In addition, the bizarre quality of dreams, with their sudden shifts in space and time might be due to the activation of more than one brain system at the same time.

This theory answers all the questions about the meaning of dreams by the simple expedient of declaring them meaningless. According to the activation-synthesis theory, dreams are merely the brain's reaction to random biological processes that occur during sleep. Various parts of the brain, in particular the *pons* (part of the brain stem) continue to function and produce stimuli during sleep and REM sleep in particular. The brain then takes these internal stimuli and attempts to make some sort of sense of them. To do this, it uses other random stimuli and memories, especially those easily accessible in the short-term memory.

The activation-synthesis hypothesis has the advantage that it renders dreams meaningless and removes any need to understand or interpret them. Some would argue that this is also its biggest disadvantage.

Problems With Activation-Synthesis Theory

Dream content is more coherent, consistent over time and continuous with waking emotional concerns than the activation-synthesis theory would predict. It cannot easily accommodate the fact that children under age 5 have infrequent and bland dreams even though they have normal rapid eye movement (REM) sleep. It is not consistent with the fact that there are patients with forebrain lesions who do not dream even though they

have REM sleep. A neurocognitive perspective should focus on the forebrain system of dream generation and begin with the findings on dream content in adults and the developmental nature of dreaming in children.

Revision of the Activation-Synthesis Theory

From **McCarley** (1977) hypothesis, **Hobson et al.** (2000) update the activation-synthesis model and developed an idea of dreaming not as an arena in which to explore hidden urges, but as an opportunity for mental 'housekeeping'. He also believed that dreams could serve to solidify emotional ties to memories. He believes that dreams and their plots may result from order imposed on the chaos of random stimulation. This order appears to him as, 'a function of our own personal view of the world, our remote memories'. This interpretation of Hobson lends support to the works of psychoanalyst's such as Freud, Jung and to some extent Adler in their assertions that dreams might yield clues about the individual.

'Random Cortical Activation' Theory

According to this model, the bizarreness and hyper-associativeness of dreams can be trivially explained by random neuronal activation of the neocortex during the rapid-eye-movement (REM) phase of sleep. Thus, according to this anti-Freudian theory (**Crick** and **Mitchison** 1983; 1995), dreams arise from stochastic deep brain inputs to the neocortex, evoking a succession of neuronal firing patterns that correspond to randomly assembled memory fragments. The model proposes that such process has the function of erasing irrelevant memory traces, cleaning up storage space to allow the formation of new memories – also popularly known as *housekeeping*. A corollary of this theory is that dream content is intrinsically meaningless. This conclusion undermines the very significance of dream interpretation as a relevant window into human consciousness (**Freud** 1952).

Problem with the 'Random Cortical Activation' Theory

The 'random cortical activation' theory did not survive confrontation with the fact that dreams can be remarkably repetitive, especially when major trauma has occurred. Indeed, recursive nightmares are an important symptom of post-traumatic stress disorder that is characterized by disturbed, hyper-aroused REM-sleep (**Ross et al**. 1994, 1999). For instance, shark attack survivors usually go through a period of shark-related nightmares that may continue for several months following the injuries. Even more compelling is the situation lived by war veterans, who dream about battle events for decades after the end of combat (**Neylan et al.** 1998; **Esposito et al**. 1999). Given the colossal number of neurons and synapses in the human neocortex, it is impossible to explain the activation of nearly identical neuronal firing patterns over several consecutive dreams by way of random neocortical activation.

The 'random cortical activation' theory also fails to explain why dreams sometimes have sensible associations or why, if dreams involve sweeping the brain clean, many people report having the same dream again and again (**Brown** and **Donderi** 1986).

Other Explanations

There is also a theory proposing that the dream is a way of processing daytime memories (**Palumbo** 1978). So many events, big and small impinge on us in the course of our daily existence that if we were to stop and consider each one, we would become confused and overwhelmed. Nevertheless, much of this information is important to our adequate functioning and should be examined. What, then, is the role of the dream in this process? As these waking events come crowding in on us, they are held, many unevaluated, in a limited memory system. These experiences remain in the system until we fall asleep at night. Then, they are released and the dream acts to process, evaluate and organize our experiences for whatever use we may later find for

them (**Palumbo** 1978). Thus, we need to dream in order to sort out the events and solve some of the problems that might have arisen during the day.

Consistent with this idea is the finding that dreams show a pattern of alternating buildups of emotional tension followed by a release of tension; the number of buildup release cycles appears to depend upon the amount of tension present during the waking period (**Cartwright** 1978). In a recent study, **Cartwright et al**. (2006) investigated the relationship between dreams and waking concerns. To test that dreams are influenced by the pre-sleep waking emotional concerns of the sleeper and have an effect on waking adaptation, 20 depressed and 10 control subjects, who were all going through a divorce, were enrolled in a repeated measures study lasting 5 months. A current concerns test was administered on three occasions before nights when every REM period was interrupted to record recalled mental content. The degree of waking concern about the ex-spouse correlated significantly with the number of dreams in which the former partner appeared as a dream character. Those who were in remission at the follow-up evaluation had a higher percentage of well-developed dreams than those who remained depressed. Dreams of the former spouse reported by those in remission differed from those who remained depressed in the expression of dream affect and in the within-dream linkage among units of associated memory material. Dreams of the former spouse that are reported by those who are not in remission lack affect and connection to other memories.

RECENT RESEARCHES ON DREAMING

Advances in sleep research, and in particular research on dreaming, has convincingly shown that consciousness is indeed state-dependent and is at least bimodal (**Hobson** 2009, **Hobson** and **Voss** 2010, **Voss** and **Hobson** 2010). As described by **Allan Hobson** (2009, 2010), dreaming may be best understood as a state of consciousness that is akin to what **Edelman** (2005) refers to as primary consciousness. By primary, Edelman means a lower form of conscious awareness that includes perception and emotion but lacks reflection. As such, it is probably present in all animals that dream. Primates and humans are also able to reflect on their perceptions and emotions, which constitutes what Edelman refers to as secondary consciousness. Allan Hobson has speculated that secondary consciousness may be related to frontal lobe activation. A quantitative EEG study done by **Vosson** and **Hobson** (2010) on lucid dreaming has shown that this is indeed so. They have compared brain activation in dreaming lacking reflective awareness with lucid dreaming and waking both of which evince reflective awareness. What they found was that the difference between these states was located frontally, and strongest in the 40 Hz frequency band of the EEG that was more potent in waking and lucid dreaming than it was in non-lucid dreaming. It was, as if, a critical brain power was essential to lucidity and waking and that brain power was not available to the non-lucid dreamer. These main effects were quite robust and present in all three subjects who became lucid in the laboratory.

The scientific investigation of lucid dreaming – although still in its infancy – holds the promise of returning psychology to its base in introspectionism, now safeguarded with powerful third-person weapons, including quantitative rating scales, quantitative EEG and fMRI.

ALTERED STATES OF CONSCIOUSNESS

The past few years have witnessed a growing interest from all levels of society in those cognitive and affective awareness that fall beyond our normal day-to-day experience. These changes in mental and physical perception, regardless of their deviation have been lumped together under the label ‘altered states of consciousness’ (ASC).

Ludwing (1966) defined ASC as ‘any mental state(s) induced by various psychological, physiological or pharmacological maneuvers or agents that can be recognized subjectively by the individual himself (or by an

objective observer of the individual) as representing a sufficient deviation in subjective experience or psychological functioning from certain general norms for that individual during alert, waking consciousness'. Thus, this definition conveys the idea that any thought process or feeling that is out of the ordinary represents an ASC. **Ludwing** (1969) has defined ten characteristics as common representations of altered states experiences. Today, the altered states of consciousness, also called altered state of mind, as defined by **Bundzen et al.** (2002) is any condition that is significantly different from a normal waking beta wave state. We will discuss them as general characteristics of ASC.

General Characteristics of ASC

1. *Alteration in thinking*: Subjective disturbance in judgment, attention and memory.
2. *Disturbed time sense*: Subjective feeling of timelessness or of the rapid acceleration of time.
3. *Loss of control*: Often, the individual feels the fear of losing his grip on reality. There is a shift from a more natural internal locus of control to an external one. Stimuli demand attention and the ability to selectively attend may disappear.
4. *Change in emotional expression*: Emotions become more intense ranging from euphoria to profound depression.
5. *Body image changes*: Feelings of separation of mind and body may occur. The individual may become a passive observer of his own physical presence.
6. *Perceptual distortions*: Increased visual, imagery and senses, hyperactivity is reported to occur as well as distortions in figure boundary.
7. *Change in meaning or significance*: Ideas and perceptions suddenly become intense revelations.
8. *Sense of the ineffectable*: Individuals claim an inability to communicate the nature or the essence of the experiences to others.
9. *Feelings of rejuvenation*: A new sense of hope, a rebirth is often felt to have occurred.
10. *Hyper-suggestibility*: Increased responsiveness to suggestion, whether given implicitly or explicitly, occurs along with an increased tendency to 'misperceive' and distort stimuli.

Chemically Induced Altered States

A great many chemicals have been used to induce ASC. We will discuss them at length separately.

Marijuana

Mental set or the individual's cognitive preposition for an altered state experience is very important, particularly as the experience increases in intensity. The effect of mental set is more dramatic with drugs like LSD. The marijuana experience is also experienced by attitude. For example, if a person is particularly visually oriented, visual effects may predominate, for others visual effects may be minimal. If a person is in somewhat manic state at the time of ingesting the drug, the results may be a great deal of talk, laughter, dancing and other active pursuits. The social situation is also extremely important. Marijuana seems to increase suggestibility, so that the user is drawn to doing the same things as those around him.

The physiological effects of marijuana are limited and mild on human non-psychic functioning. Physiologically, the drug is not addicting, although extreme use (20–60 cigarettes) has been associated with poor health. In addition, heavy use of marijuana has been associated with both a loss of motivation and a loss of involvement with work and achievement. Some of the physiological effects marijuana may cause include increased alpha and relaxation; increased heart rate and dilation of blood vessels in the eyes, thus some redness. Though marijuana is of minimal danger to the user physiologically, it may be very dangerous psychologically and socially.

Marijuana has precipitated some acute anxiety reactions and depression in a small percentage of its users or in most part however, the dangers associated with the use of marijuana stem from the fact that it is illegal and that experience may be influenced by this factor.

LSD (D-Lysergic Acid Diethylamide)

In 1943, Albert Hoffman, a Swiss chemist, accidentally ingested a small quantity of the chemical that was to be labeled LSD. The description Hoffman reported bore a strong resemblance to description of what occurs

EXPERIMENTAL PERSPECTIVE

Psychoactive/Psychotropic Drugs

Psychoactive drugs, also referred to as Psychotropic drugs, affect the central nervous system and can cause a variety of changes in perception or behavior. There is a general misconception that psychotropic drugs are only of the illegal variety. Generally, people relate such drugs to LSD, angel dust and marijuana. Most of us are not aware that the coffee that we consume daily contains small doses of psychoactive drug known as caffeine.

The uses of psychoactive drugs are varied. They are broken into four major groups. These groups are *hallucinogens*, *antipsychotics*, *depressants* and *stimulants*. These types very often cross into other categories as they produce more than one type of effect. For example, marijuana is considered a depressant, stimulant and hallucinogen.

Marijuana as a psychoactive drug has its medical uses as well. It has been found useful for patients suffering with AIDS and cancer. This is so since marijuana can control nausea and promote appetite, as well as reduce pain, and thus is helpful for those experiencing intense suffering.

The most common and widely consumed psychoactive drug that is legally available is alcohol. Many people consume alcohol to drive away their depression not being aware of the fact that it is in itself a depressant. It can impair mood, causing either elation or depression, and can impair ability to think clearly or make rational decisions. Alcohol is considered far more toxic, potentially impairing and dangerous, as well as addictive, compared to marijuana.

Antidepressants, antipsychotics, mood stabilizers and tranquilizers are other psychoactive drugs that affect mood. The various effects of these psychotropic drugs are considered vital to the practice of psychiatry. Some antidepressants may help reduce depression or anxiety but they may however, provoke anxiety if they are of the stimulant type. Depressant class tranquilizers may be more effective for severe anxiety. Stimulant or antipsychotic class mood stabilizers can help people with bipolar conditions. Anti-psychotics are often used to treat schizophrenia.

Continued or long use of some psychotropic drugs belonging to either the stimulant or depressant classes can foster addiction. In many cases depressants like morphine, which is derived from opium, is used to alleviate symptoms of pain. Morphine is addictive. Patients receiving morphine have shown hallucinatory episodes when given high doses and have also shown difficulty in withdrawing from meditation after long term use of the same.

Other stimulants that can also be addictive are caffeine, Ritalin™, and illegal medications like crystal meth, crank and cocaine. People who drink lots of coffee may notice extreme headaches if they do not drink coffee for a day or two. This headache can be severe but disappears in a day or two even without drinking coffee. For those who smoke, nicotine is the addictive stimulant, which according to them gives them a relaxing effect. If one consumes cocaine for several weeks, he is sure to get addicted to the same.

There is still a lot of confusion about the action of psychotropic. Many researchers assume that some antidepressants increase the levels of serotonin in the brain. This is theory, and those using the medications seem to benefit. However, it is not proved and little explanation exists for those who have opposite reactions to medications used to elevate mood. As well, nicotine is thought to both relax and stimulate another unclear reaction.

during an acute psychotic reaction. The term *psychotomemtic* was applied to LSD and other major *psychedelics* (mescaline, psilocybin, marijuana) because of the resemblance to the experience of *schizophrenia*.

In contrast to marijuana, LSD is an extremely potent drug. The physiological changes caused after ingestion of LSD include pupilary dilation, dizziness and changes in body image, reduced intellectual and motor proficiency, perceptual distortions and a decrease in the mean energy content of the brain. In addition to these effects, there are indications that LSD may have some serious side-effects. 'Flashbacks' or spontaneous and frightening recurrences of the LSD experience without further use of the drug are frequently reported in the literature. A more speculative finding is that LSD ingestion may alter abnormal structure.

HYPNOSIS

Hypnosis is a term that has been applied to a wide range of phenomena. It is a type of ASC that occurs through the non-physical influence of one human being over another.

There is evidence of hypnosis in the ceremonies of illiterate people but modern interest probably dates back to about the end of the 18th century when Firanz Mesmer argued that hypnosis was due to 'animal magnetism'. Mesmer had been having great success curing a variety of psychological and physiological illnesses using hypnosis. Unfortunately, for both Mesmer and hypnosis, he attributed his cures to realignment of magnetic fields in the patient's body.

Hypnosis is at once an exciting and frustrating phenomenon to work with. It is difficult to think of one situation in which the discrimination between obeyed and subjective reality becomes more confused. It is the confusion that makes hypnosis appear almost mystical or supernatural. The hypnotist and the subject working together are able to profoundly alter the subject's perceptions, feelings, cognitions and body chemistry using nothing more potent than verbal suggestions.

Both **Hilgard** (1965) and **Eriksen** (1967) would agree that the development of the hypnotic state depends largely on the interpersonal relationship that is established between the hypnotist and the subject. If the induction is to be successful, the subject must have a certain amount of confidence and trust in the hypnotist.

There is almost no limit to the variety of induction techniques used but they all involve the ultimate focus of attention on the hypnotist and cooperation between hypnotist and subject. Whatever the technique employed, the hypnotist's success is measured by the subject's response both objectively and subjectively to suggestions.

A great deal of research has been carried out by Ernest Hilgard and his associates at the Stanford University to determine who is responsive to hypnotic suggestions and why. Hypnosis is not an all or none response. A subject's susceptibility to hypnosis can be placed on a continuum with approximately 5–10 percent of the population completely resistant to hypnotic suggestions. Another 5–10 percent of the population is capable of demonstrating virtually all of the phenomena (hallucinations, amnesia, anesthesia, analgesia, etc.) associated with a deep state of hypnosis. The remaining 80-90 percent of population is distributed fairly normally between these two extremes evidencing responsiveness to some, but not all of the hypnotist's suggestions.

Hypnosis and Alpha

One of the recent findings in the research literature has been that there appears to be a relationship between the amount of alpha activity in a subject's electroencephalogram (EEG) and his/her ability to respond to hypnotic suggestions. Alpha waves are slow (8–13 cycles per second) brain waves that occur when subjects are relaxed and not focusing their attention (**Glasses et al.** 1961). In a series of recent studies, investigators have shown both that the initial amounts of alpha are correlated with susceptibility to hypnosis. Apparently,

the more alpha subjects have initially, the more susceptible they are. In addition, as alpha increases within a subject, so does the subject's ability to respond to hypnotic suggestions (**London**, **Hart** 1968). These changes in alpha and susceptibility may occur as a function of increased trust and relaxation in the subject.

Psychological Effects of Hypnotic Induction

The experience of being hypnotized is not as unusual or alien as some people believe. Hypnosis has been described as that relaxed state many of us find ourselves drifting through just before we go to sleep. Often the hypnotized subject feels completely in control as though he/she could resist the suggestions of the hypnotist. However, the feeling of relaxation is so peaceful that it would not be worth the effort to fight the suggestions. Although the subject may feel like he is drifting off to sleep during the induction, these feelings may not remain throughout the hypnotic session. Once induction is over, suggestions may be given, which will help the subject feel alert and wide-awake, while still hypnotized.

Physiological Effects of Hypnotic Induction

When hypnotized subjects have not been given any particular suggestions, it is almost impossible to distinguish, on a physiological basis, between them and non-hypnotized controls (**Barber** 1969). With suggestions however, hypnotized subjects can be made to give evidence for a large number of physical changes including alterations in heart rate, skin conductance, respiration and gastric secretion. A review of the literature suggests that the subject's physiological responses to the induction procedure alone depend primarily on the subject's expectancy and on the specific suggestions of the hypnotist. The importance of the subject's expectancy can be illustrated by pointing out that when Mesmer hypnotized subjects, they responded to the induction by having an epileptic-like seizure.

Hypnotic Phenomena

Some of the phenomena that are associated with hypnosis will now be discussed briefly—as the depth of hypnosis increases, subjects are capable of evidencing more of the phenomena.

Catalespy: It refers to muscular loss of control. The subject's limbs remain in any position they are placed in.

Hallucinations: These refer to auditory, tactile and visual hallucinations. They are of two types: (a) Positive—seeing something that is not there, and (b) negative—denying the presence of what is there.

Anosmia: It refers to the loss of the sense of smell. Subjects may not smell ammonia or may tell it smells like whatever other odor is suggested.

Age Regression: The subject can be made to feel and act as though he has regressed to an earlier age or experience.

Amnesia: This refers to loss of memory. It can either be spontaneous—the subject has no memory for part or all of the hypnotic session or it can be suggested—the subject is requested to forget what has transpired.

Hypermnesia: This refers to an unusually good memory often due to abnormal mental states of excessively acute awareness. In hypnosis, the subject may often recall events that occurred in the distant past but only to the extent of a heightening of the possibilities that are already present in the normal state.

Analgesia: This refers to insensitivity to pain while in the possession of the other senses. To some extent, analgesia can be induced by distraction by means of, or the superimposition of, powerful sensory stimuli, or by the temporary elimination of certain brain centers. Analgesia is often the aim of non-specific pain therapy.

Anesthesia: This refers to reduction in sensitivity to all sensory stimuli. It includes loss of pain and skin sensitivity.

Distortion of Body Image: The subjects can be made to experience a separation of mind and body.

Distortion of Time Perception: The passage of time can be subjectively altered through suggestions.

James Esdailes, a Scottish physician living in India, performed the most dramatic uses of hypnosis in surgery in the early 1800s. Esdaile performed more than 300 major surgical operations using hypnosis as the anesthetic and analgesic. Hypnosis has been used in a variety of ways to reduce or block pain. Hypnosis has also been used to treat a variety of physiological illnesses.

MEDITATION

Meditation is a classical way of developing the receptive attitude. It is a practice in the skill of being quite (**Maupin** 1969). Meditation exercises involve a disciplining of self that has been used as a means of achieving an ASC. For most of the world, the practice of meditation is associated with religion or mysticism.

Narajo and **Orenstein** (1971) point out that there are a great many varieties of meditation. The particular exercises and behaviors engaged in by these schools differ dramatically. Their philosophy and practice may emphasize a greater involvement in the here and now as in Zen meditation, or it may involve transcending this physical existence as in Yoga practices (**Johnson** 1970). Irrespective of the philosophy, different forms of meditation have some characteristics in common. First, they recognize the importance of both physical and mental exercise. Second, they focus on harmony or the union of mental and physical processes. This emphasis on a union led to the development of fighting styles such as Karate and Aikido. Third, they train the individual to develop awareness of and control attention into a narrow beam or to broaden it at will. Finally, the meditative exercises appear to have similar effects on body physiology.

Physiological Effects of Meditation

Wallace (1970) and **Benson** (1975) have studied the physiological correlates of meditative procedures in American subjects. These and other authors in different studies have noted that meditation exercises result in blood pressure and heart rate, slower respiration, increased skin conductance and increased alpha productivity (**Barnes et al.** 2004; **Lee**, **Kleinman** and **Kleinman** 2007; **Travis et al**. 2009). Others have reported the correlational relationship of alpha to meditation in other cultures. **Anand**, **Chinna** and **Singh** (1961) found that the meditative exercises practiced by the yogis in India were accompanied by a high percentage of alpha rhythms. Finally, K**asamatsu** and **Hirai** (1966) studying Zen meditators in Japan found that alpha activity was correlated with both the quality and length of time (experience) of the meditator. It is this apparent relationship of the alpha wave to meditation that has led to the public interest in alpha training (**Nideffer** 1976).

The use of alpha training as a means of achieving spiritual enlightenment or an altered state occurred because of a series of studies and articles by **Joe Kamiya**. In a 1968 article, Kamiya reported that subjects could learn to recognize when they were in an alpha wave state, and once they learned to make this discrimination, they could control their production of alpha.

Varieties of special skills and powers have been attributed to Zen and Yogic meditators. Many Zen practitioners integrate their mental discipline with physical exercises, as do many Yoga practitioners.

Psychological Correlation of Meditation

As with drugs and hypnosis, meditation can be viewed as a method for inducing an ASC. The immediate feelings and perceptual distortions that occur are similar to the ASC experiences induced by other ways.

In fact, it is almost impossible to distinguish one ASC experience from another when they are taken out of context.

Towards an Integration of Consciousness

To understand and explain the effects of ASC, it is necessary to simultaneously look in two directions. First, objective variables like attention and information processing that lend themselves to direct experimental manipulation appear to be involved. In addition, subjective and only indirectly observable variables such as faith seem to be important. As has been postulated, the induction of ASC and most of the perceptual and temporal distortions experienced during an ASC can be attributed to change in information processing and attention alone.

Attention and Information Processing

Authors like **Sargent** (1957), **Frank** (1961) and **Deikman** (1969) have suggested that most of the phenomena like characteristics of ASC can be explained based on changes in attentional focus and information processing characteristics of the individual. In referring to attentional focus, we are talking about width of attentional span or number of possible stimuli that can enter consciousness in a given period of time within a particular environmental setting, the amount of information processed will increase as the attentional span is increased. However, if attentional span remains constant across environmental settings, the amount of information processed will change. For example, changes in the density of stimuli in the environment, from stimuli deprived conditions to saturated ones, will increase the amount of information processed even if the width of attentional focus remains the same.

Meditation and Psychology

The research literature on meditation suggests that practitioners experience subjective phenomena such as pronounced feelings of 'self-transcendence', 'felt meaning in the world', 'a heightened sense of connectedness with the world' and 'a sense of purpose and meaningfulness' (**Osis et al.** 1973; **Kohr** 1977; **Severtsen** and **Bruya** 1986; **Bogart** 1991). These subjective experiences involve radically revised perceptions of self and the external world. Mood changes include happiness, freedom from anxiety, content with self and greater vitality. Other articles also suggest that meditators gain enhanced confidence, a sense of self-control, empathy and self-actualization (**Hjelle** 1974). Several investigators conclude that the practice of meditation improves cognitive task performance, increases mental concentration and reduces susceptibility to stress (**Blasdell** 1973; **Orme-Johnson** 1973; **Appelle** and **Oswald** 1974; **Keller** and **Seraganian** 1984; **Severtsen** and **Bruya** 1986; **Gaylord et al.** 1989; **Dhume** and **Dhume** 1991; **Jin** 1992; **Tsai** and **Crockett** 1993, **Janowiak** and **Hackman** 1994; **Elias** and **Wilson** 1995; **Telles et al.** 1995). Many researchers also report that meditation reduces the biological components of anxiety. In general, meditation promotes psychological health (**Gaylord et al.** 1989; **Gelderloos et al.** 1990).

Other psychological consequences of meditation include decreased anger aroused in high-anger situations (**Dua** and **Swinden** 1992) and an increased concentration for mental as well as physical tasks **(Dhume** and **Dhume** 1991). Indeed, **Davidson** (1976) found that experienced meditators had significantly increased attentional absorption and that attentional absorption increased as the length of meditation experience increased. Long-term meditators appear to possess a more developed ability to voluntarily control attention.

A general profile of psychological well-being and perceptual sensitivity emerges from various studies on meditation. Some of the more commonly reported experiences include amplified perceptual clarity, widened range of psychological insights, and greater openness to experience (**Banquet** 1973; **Osis et al.**

1973; **Shapiro** 1980; **Walsh** 1984; **Brown et al.** 1984). As **Walsh** (1984) writes, 'Sensitivity and clarity frequently seem enhanced following a meditation sitting or retreat. Thus, for example, at these times, it seems that I can discriminate visual forms and outlines more clearly. It also feels as though empathy is significantly increased and that I am more aware of other people's subtle behaviors, vocal intonations, etc., as well as my own affective responses to them.' One of the fundamental objective observations of the enhanced perceptual sensitivity of meditators is a decrease in both absolute and discrimination sensory thresholds (**Davidson** 1976; **Brown et al.** 1984; **Freed** 1989; **Colby** 1991); these include a more subtle awareness of previously known concepts and an increased perception of previously unrecognized phenomena. Thus, both subjective and objective examinations agree that meditation enhances perceptual sensitivity.

INDUCTION OF ASC

There are a number of procedures used to induce ASC, which involve either a broadening or narrowing of attention. **Sargent** (1957) attributes the induction of many ASC to stimulus overload. Some examples of ASC developing from stimulus overload could include 'freaking out' at a light show or a rock concert. Along the same lines, it has been hypothesized that some of the psychedelic drugs have their effects because ingestion leads paradoxically to an inhibition of the inhibitory functions of the brain. The result is that more stimuli come into awareness than the individual can deal with. In the reverse direction, a dramatic reduction in the normal level of stimulation may result in an ASC, for example sleep, sensory deprivation, meditation as well as drugs such as alcohol and heroin.

Immersions

A characteristic that most of us share is a desire or need to structure and organize our environment. Gradually, as we grow older, we form conceptual relationships between the stimuli around us, and the responses that they elicit within us. That is, under normal conditions, we are capable of forming conceptual ties between all of the stimuli we are confronted with and the responses that we make. Immersion is hypothesized to develop when attentional factors and information factors suddenly change and an imbalance develops between the stimuli (external focus on the one hand, and the responses, internal focus, on the other).

It is established that if stimuli are coming in too rapidly (as in the case of LSD) to adequately process, the person will become confused and disoriented. This appears to result from the inability to respond rapidly enough to the demands that the stimuli are making upon them. For that period of sensory overload, the person is immersed in a 'stimulus' world. Depending on the sense receptors in use, he may become immersed in music, lights, tastes, sex and his own effect and so on.

Perhaps a bit more difficult to follow is the idea that a reduction in stimulation could also result in immersion. Examination of the physiology of the human nervous system indicates that to remain healthy, neurons (nerve cells) must be used. In support of this information is the finding that most humans actively seek sensory stimulation. In fact, it has been suggested that under conditions of stimulus deprivation the organism will self stimulate. From these observations, it might be hypothesized that a reduction in the normal amount of internal stimulation the organism receives will be compensated for by an increase in internally originated stimuli (thoughts and feelings). Under these conditions, there would be no external stimuli present to which, the internal responses could be attached. As with over stimulation, such an occurrence would lead to the perceptual, judgmental and temporal distortions. In addition, without external stimuli pulling at him, the person would become immersed in internal processes. This immersion may be used to explain the increased awareness of self that is often associated with meditation.

Personality theorists have suggested that man spends a great deal of energy repressing thought processes in order to defend against anxiety. Through a reduction in external stimulation, some of the objects or feelings that have been distracting and keeping attention away from one's hypothetical cruelty will be removed and then one may be unable to avoid being confronted with it.

Faith

The idea that pain may be intensified or reduced by simply altering attention seems reasonable. In fact, it may be possible to become so absorbed or immersed in other stimuli that pain even is not attended to (**Barber** 1970). The question is - how does a person agree to such an operation (e.g. removal of a leg). Obviously, the person must have faith in the procedures used.

Faith is defined as the ability of an individual to establish complete trust or confidence in himself or someone. It is only with the development of this trust and confidence that people are able to maximize their physiological functioning. It is their confidence (faith) that allows them to maintain an appropriate level of arousal and to function at maximum efficiency.

Impact of Immersion and Loss of Control

Sargent (1957) has pointed out that dramatic changes in the levels of stimulus input often leads to feelings of confusion and loss of control. When sensory processes have been assaulted in some way, for a short time afterwards the person wanders around dazed and confused. As normal functioning returns, he attempts to understand what had happened, to conceptualize and integrate his experience. Depending upon the intensity of the ASC, his typical explanation may or may not suffice. If extensive training or discipline (i.e. preparation of priesthood) has produced the experience, it would be easy and natural for the individual to use that preparation as the conceptual framework for understanding. Should such perception be absent, some other explanation will be sought.

KEY TERMS

Consciousness	Altered states of consciousness (ASC)	Rapid eye movement (REM)
Insomnia	Delayed sleep phase syndrome	Hypopnea syndrome
Sleep apnea	Narcolepsy	Snoring
Restless leg syndrome	Hypnosis	Meditation

EVALUATE YOURSELF

Multiple Choice Questions

1. Consciousness is defined as the state of
(a) Well-being
(b) Awareness
(c) Euphoria
(d) Meditation

2. According to the restoration theory of sleep,
(a) Sleep serves a psychological need
(b) Serves a psychosocial need
(c) Sleep serves a biological need
(d) Sleep serves all of the above

3. The fourth stage of sleep is characterized by
   (a) Alpha waves (b) Theta waves
   (c) Beta waves (d) Delta waves
4. Dreaming mostly occurs during
   (a) Orthodox sleep (b) Unorthodox sleep
   (c) Paradoxical sleep (d) Slow wave sleep
5. Hypopnea Syndrome is associated with
   (a) Slow respiratory rate (b) Interruption in breathing
   (c) Difficulty in breathing (d) Collapsing of the windpipe
6. A good night sleep benefits
   (a) Semantic memory (b) Episodic memory
   (c) Declarative memory (d) Iconic memory
7. LSD is the abbreviation for
   (a) Last seen dream (b) Lysergic acid diethylamide
   (c) Love sex dreams (d) Lathargicano sleepano dreamado
8. Hallucinations refer to
   (a) Seeing what is there (b) Seeing what is not there
   (c) Seeing things in distorted manner (d) Seeing nothing
9. Which of the following statement about marijuana is *not true*?
   (a) Its physiological effects are mild on human non-psychotic functioning.
   (b) Heavy use leads to a loss of motivation.
   (c) It increases suggestibility.
   (d) Physiologically, the drug is addicting.
10. Mesmer's name is mainly associated with
   (a) REM sleep (b) Faith
   (c) Hypnosis (d) Meditation

Descriptive Questions

1. Define consciousness. How is it studied and for what purpose?
2. Do we sleep in stages? Elaborate your answer with details.
3. What do you understand by rapid eye movement and how is it related with sleep?
4. Discuss the psychological features of sleep.
5. Does lack of sleep lead to disorders? Support your answers with examples.
6. How is sleep related to memory? Discuss in the light of recent researches.
7. How is REM sleep and dreaming related? Explain in detail.
8. 'Dreams are the royal road to the unconscious.' Who gave this statement and what does it mean?
9. What is the activation-synthesis hypothesis? Elaborate it.
10. What are altered states of consciousness? Write a brief note on them.

Critical Thinking Questions

1. Why do you think a person generally recalls the REM dream whereas not those associated with other states of sleep? To what extent, can one recall the REM dreams accurately and why?
2. Critically examine why meditation is prescribed by psychology experts as a useful stress management technique. Do you think mastering of a proper meditative technique helps in altering one's disposition? If so, in which manner?

3. In your opinion, why do people in almost every culture seek ways of altering their state of consciousness.
4. Should people working in an organization be allowed to engage in meditation during working hours?
5. Can you think of valid reasons as to why people begin to use drugs?

PRACTICAL EXERCISES

1. Ask your students to read the experiences of Ramakrishna Paramhansa. You may ask them to visit the site *http://www.self-realization.com/articles/sages/ramakrishna_paramahansa.htm*. Ask them to describe the state of consciousness of Ramakrishna when he went into 'trance', in the best possible manner and aggregate the responses. Share the findings with the students.
2. Ask your students to write down the details of dreams he/she has 'seen' last night. If responses are few, ask them to visit the site *http://www.near-death.com/experiences* and pick up any of the situations randomly. Ask them to explain the situation with any one of the approaches. Evaluate their explanation and give your suggestions.

Answers to Multiple Choice Questions

1. (b) **2.** (c) **3.** (d) **4.** (c) **5.** (a) **6.** (c) **7.** (b) **8.** (b) **9.** (d) **10.** (c)

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Chapter 6

LEARNING AND CONDITIONING

CHAPTER OBJECTIVES

After reading this chapter, you will learn

- What is learning and the bearing of learning on behavior.
- The process, forms and nature of learning.
- Classical and instrumental conditioning theories, experiments and processes: also a critical evaluation of the two types of conditioning.
- The various theories of learning and the milestone researches.
- Verbal learning and conceptual learning.
- The relationship between learning and the brain—unraveling of the neurophysiology of learning.
- The various methods of measurement of learning, the typology of various learning curves and their meanings and lastly the determinants of learning.

LEARNING AND BEHAVIOR MODIFICATION

Learning is one of the fundamental processes underlying human behavior. It is very difficult to think of any human activity that is not influenced by learning. Yet when one wants to define learning, it becomes a Herculean task. Also, learning has received more attention in terms of experiments than any other object of psychology. Still, there is no universally accepted definition of the term. Nevertheless, the various attempts to define it may be formulated as follows: Learning consists of relatively permanent changes in possible behavior in so far as they derive from experience. This restriction of the term excludes short-term changes and those that derive from certain structural alteration of the central nervous system. Keeping this in mind, we can say that *learning is the process by which a relatively permanent change or modification occurs in behavior as*

a result of practice or experience (**Hilgard** and **Atkinson** 1967). This definition of learning highlights three major aspects. **First**, learning is a process by which a certain change or modification in behavior occurs. The word 'behavior' refers to some actions which may be muscular, glandular, mental or a combination of these. This change or modification can either be for better or for worse, i.e. learning may be positive or negative. The **second** thing highlighted by this definition is that before any act can be termed as learning, the changes or modification in behavior must be relatively permanent. Temporary changes in behavior due to certain temporary conditions of the individual cannot be considered as learning. Temporary changes can occur as a result of illness, physical injury and fatigue. Drugs too can produce temporary changes in behavior. Research has also suggested that once someone learns something, it is always present in the memory (**Barsalou** 1992). The **third** point in the definition is that the change or modification that occurs in behavior should take place as a result of practice or experience if it is to be termed as learning. Thus, learning is an acquired skill that is dependent primarily on the external stimulation. In simple words, learning refers to those changes taking place as a result of special stimulation.

HOW LEARNING AND MATURATION ARE RELATED

How nice it would have been for you if you could have got a direct jump from the lower classes right into graduation and thus avoid carrying heavy school bags on your frail shoulders. But think, if your shoulders were frail to carry the heavy burden of books on your back, then so was your mental apparatus. Many parents in India complain about the advance level of studies that the syllabuses of some school educational boards follow. Their complaints are genuine but it is a highly competitive world and no one is ready to step backwards. Psychologists feel that being exposed to information which a child cannot comprehend naturally at their level of maturity does damage to many in terms of creating disinterest and aversion apart from stress-related disorders.

Let us now examine maturation in relation to the process of learning and also become aware about the way they are related with each other. Maturation is an autonomous process of somatic, psychological and mental differentiation and integration spread over developmental stages and phases that condition and build on one another in the course of time. It can also be said that maturation is the unfolding of the traits potentially present in the individual and is governed by heredity. On the other hand, learning is the acquisition of new skills due to environmental stimulation and training. It is a relatively permanent change or modification in behavior as a result of practice or experience.

Maturation and learning go hand in glove. As a child grows, it learns various sorts of things but a certain amount of maturity is essential to the acquisition of new skills. One just cannot start acquiring skills and learn concepts without reaching the maturity level required for those particular things. What is common in both learning and maturation is the end product. Both lead to modification in behavior. It is difficult at times to distinguish the relative role played by maturation and/or learning with regard to specific modified behavior/s. Many unlearned types of behavior that develop through maturation interact with learned behavior. Maturation can be considered as the development associated with growth of the neuro-muscular system, while learning can be associated with stimulating situation.

One point to note is that even though maturation and learning go hand in glove, it is not essential that learning always will take place along with maturation. Maturation is governed by heredity and learning on the other hand is the result of environmental stimulation that will not necessary be a privilege for all. Whether an individual is able to acquire certain skills and abilities depends upon the opportunities he gets to learn them and the kind and amount of practice in which he engages himself. What he learns depends to a great extent upon the nature of his environment and experiences.

PSYCHOLOGY NUGGET

Learning, Maturation, Reflex and Instinctive Behavior

For a child to begin walking on his own, it is essential that his leg muscles are strong enough to support his/her weight. This simply means that maturation provides the readiness to learn, i.e. certain level of maturity is required to acquire skills or knowledge.

Human behavior generally occurs as a result of growth and development. This fact can best and simply be understood by the earliest smiling behavior in an infant. This smiling is actually not a result of learning but an indication of maturation of muscular and neural development. Smiling becomes a learned behavior (response) only when the child associates it with certain pleasure-giving stimulus. This act of smiling represents learning. The same is applicable to the ability of walking, running and talking, which develops in human beings to a large extent due to maturation. Maturation may be considered as the development brought about by growth of the neural and muscular system, while learning is an outcome of stimulating situations.

The importance of practice and experience cannot be overlooked in the development of skills properly. By 'practice', we mean formal training, and 'experience' includes all types of happenings in life. Some other examples of unlearnt behavior in other species that simply occur due to maturation are flying of birds and swimming of tadpoles in water.

The common factor between learning and maturation is that they both result in change or modification of behavior. At times, it becomes difficult to distinguish their relative effects on behavior modification because their effects blend into each other. Other types of behavior that do not represent learning are those arising from instinctive and reflex actions. Instincts are complex patterns of behavior, e.g. building of nests by birds. Each animal type has some instinctive patterns of behavior which are necessary for their survival.

Reflex behavior is direct automatic and immediate response of a muscle or a gland to the stimulation of a sense organ, e.g. blinking of eyes in response to a sudden movement of an object in front of a person's eyes. These are innate tendencies and are not acquired through practice.

However, instinctive behavior can be modified by learning.

- Learning differs from other concepts such as maturation, reflex actions and instinctive behavior.
- Learning is a result of environmental' stimulus, whereas maturation is biological in nature.
- Maturation provides the readiness to learn and occurs due to neural and muscular development, while learning takes place through practice and experience.
- Learning and maturation both result in modification of behavior.
- Certain complex patterns of behavior, which occur innately are called instinct.
- Reflex is a direct and immediate response of a muscle or a gland to the stimulation of a sense organ.

Nature of Learning

There is no end to learning. One is never too old to learn. It is a continuous process. A whole lifetime is spent learning. All activities, simple or complex, involve learning. Everywhere, at every place one, is mostly in the process of learning—at home, at school, at social gatherings and at countless other places. Thus, there is no limit to various things one can learn. However, learning is not an easy a process as it seems. It takes a lot of time to learn an activity properly. As we have seen, while discussing the definition of learning that behavior modification has to be of a permanent type induced by practice or experience. This is indeed a difficult prerequisite. Individual differences are also there in learning. Some people learn with relative ease, while others may find the same task difficult. Whether one finds a task easy or difficult to learn, the psychological process underlying learning remains the same.

As one progresses in learning his behavior becomes more efficient and precise. With learning, new skills are learned or learned skills are improved. Also, there is an increase in the speed of performing an act and

PSYCHOLOGY NUGGET

Nature of Learning

- All activities, simple or complex, require learning.
- Learning is a continuous process.
- There is no limit to various things that can be learned.
- Individual differences are there in learning.
- Learning is indicated by the efficiency and precision of behavior.
- Learning involves both acquisition of new skills and improvisation of learned ones.
- With the progress in learning, speed of performance enhances.
- Errors are also drastically reduced as learning progresses.
- With learning, there is an increase in precision.

errors are drastically reduced. This reflects that with learning, there is an increase in precision that leads to increase in speed of performance and reduces the errors as well. This is true for all types of learning.

It must be mentioned that it is not possible to observe all types of behavior modifications. Behavior modifications can be in feelings, believes, values, etc. We can also have difficulty in observing changes in processes like *acquisition*, (a new response added to the organism's repertory of responses through learning (2) gaining of possessions; stealing or grasping things; working or bargaining for goods), *retention* (the persistence of a learned act or experience during an interval of no practice (2) one form of the four processes of memory: memorizing, retention, recall and recognition. A distinction is made between immediate retention and memory) and application of knowledge and different skills, solving problems, acquiring appropriate forms of emotional expression and control, developing interests, attitudes and ways of thinking.

How do these modifications occur is a key question of interest. What are the processes involved is a point to discuss. The process of learning constitutes of three major elements. These are the *stimulus, the learner and the response (S-O-R)*. The *stimulus* (an event that produces responses or results in sensory experience (2) any change in physical energy that activates a receptor (3) any change in external or internal energy that alerts or activates an organism) is the variation in the physical energy inside or outside an *organism* (a person or animal) capable of influencing the afferent nervous system through receptors, condition, signal or a cue to which a response is made. A *response* is (i) any muscular or glandular process elicited by a stimulus, (ii) an answer, especially to a test question or questionnaire, or (iii) any behavior, whether covert or overt. The term *response* is a very general one and most widely used term in psychology, usually with qualifiers) is an action by an individual such as saying or doing something, generally involving the action of his muscles or glands. It is a unit of behavior that can be identified in terms of its relation to a specific response. It is a general term used to represent a variety of behavior. Response to a stimulus might be verbal, muscular, postural or glandular. When these responses are readily observable, they are called *overt responses* (behavior that is readily observable without the aid of instruments) and when not, they are called *covert responses* (behavior that cannot be directly established by an observer but must be concluded from measurement values, from the observation of the further behavior of the subjects, or from the verbal report obtained by the introspection of the subject).

In a learning situation, the learner is presented with a stimulus to which he may not respond adequately. On consequent presentation of the same stimulus, the learner begins to respond in the required manner. When

PSYCHOLOGY NUGGET

Learning Process: S-O-R

- Observing all types of behavior modification is not possible.
- Observing changes in processes can also be difficult.
- The process of learning consists of the stimulus-organism-response.
- The stimulus is the variation in the physical energy inside or outside an organism.
- A response is an action by an individual.
- Readily observable responses are called overt responses.
- When responses are not readily observable, they are called covert responses.
  When the stimulus-response bond is perfected we can say that learning has occurred.
- The S-R bond should be of a permanent nature else we can't term it as learning.

the stimulus-response bond is perfected, we can say that learning has occurred. However, an important point is that this S-R bond should be of a permanent nature else we cannot term it as learning.

PRINCIPAL FORMS OF LEARNING

Having discussed so far about the definition of learning and its nature, we are now in a position to look into the principle forms of learning. Learning can be done through various forms and there are different theories and laws on which they are based. We will take up these various forms one by one and discuss them in detail relating them with the theory and laws they are based upon.

Learning by Imitation

This is one of the most important forms of learning. Experiments on animals, children and adults have shown that the observed behavior of a model may provoke more or less similar behavior in the observing

PSYCHOLOGY NUGGET

Imitative Learning

- Imitation is the most important form of learning.
- The human child learns mostly through imitation.
- In imitation, the learner exactly copies the behavior of another person without understanding or thinking.
- The imitator has never done the activity being imitated before, but performs it only after seeing it in another.
- The imitator does not know earlier the activity to be imitated.
- In imitation, the learner exactly copies the activity performed before him.
- Learning by imitation finds wide use in education.

subject, even when the latter did not show similar behavior pattern before. This, then, is termed as learning by imitation. The extent and nature of imitation are dependent on features of the model, the traits and experience of the observer, and the observed reward or punishment for the model behavior. Behavior is said to be imitative if there is a similarity between the behaviors of the model and of the imitator and further if the behavior of the model and not other stimuli is the determining factor in the behavior of the imitator.

PSYCHOLOGY NUGGET

Observational Learning

Learning is achieved not only by practice or direct experience on the learner's part of the consequences of performing a particular action, but also by observing another person perform. **Thorndike** (1911) was one of the first psychologists to study imitation as a species of observational learning in animals - with uniformly negative results. However, later experiments by others showed that animals can learn the solution to a problem by observing the performance of another trained animal.

According to psychologist **Albert Bandura** and his colleagues, a major part of human learning consists of **observational learning** that they define as learning through observing the behavior of another person called a *model* (**Bandura** 1977). Bandura and his colleagues demonstrated rather dramatically the ability of models to stimulate learning.

According to Bandura, observational learning takes place in four steps: (1) paying attention and perceiving the most critical feature of another person's behavior, (2) remembering the behavior, (3) reproducing the action, and (4) being motivated to learn and carry out the behavior. Instead of learning occuring through trial and error, then, with successes being reinforced and failures punished, many important skills are learned through observational processes (**Bandura** 1986). Observational learning is particularly important in acquiring skills in which shaping is inappropriate.

Not all behavior that we witness is learned or carried out, of course. One crucial factor that determines whether we later imitate a model is the consequences of the model's behavior. Models who are rewarded for behaving in a particular way are more apt to be mimicked than models who receive punishment. However, observing the punishment of a model does not necessarily stop observers from learning the behavior. Observers can still recount the model's behavior - thay are just less apt to perform it (**Bandura** 1977, 1986).

Despite its positive help in learning, observational learning has its negative effects as well. It is at the center of a controversy regarding the effects of exposure to violence and sex in the media.

Imitation had found its base in the *instinct theory*, but this theory has been discarded since about 1920. **Allport** (1924), **Piaget** (1951) and **O.H. Mowrer** (1960) have emphasized on the importance of associative and classical conditioning mechanisms, while **N.E. Miller** and **J. Dollard** (1941) as well as **B.F. Skinner** (1953) stressed on instrumental mechanisms. According to **Bandura** (1968), for imitative learning, the contiguity of sensory events is essential, and for imitative behavior the nature of reinforcement.

Trial and Error Learning

The term trial and error was applied by **L. Morgan** to behavior that occurs when an organism is presented with tasks which it is unable to solve because of its lack of appropriate behavior patterns. **C.L. Hull** called such behaviors '*operants'*. Complex behavior patterns are developed by means of directed positive reinforcement of desired and negative reinforcement of non-desired trials (operant conditioning).

PSYCHOLOGY NUGGET

Tolman's 'Cognitive Map' Theory

Some psychologists like Thorndike and Pavlov believe that animals learn each section of a maze by trial and error. Other psychologists like Tolman believe that animals acquire a 'mental map' of the maze and can 'think' their way through to the goal – rather than respond reflexively and unconsciously to the specific stimuli in each situation. In fact, animals such as rats seem to do a little bit of both and thus seem to be more 'insightful'.

Tolman's Comments on Thorndike

Tolman writes, 'The psychology of animal learning, not to mention that of child learning, has been and still is primarily a matter of agreeing or disagreeing with Thorndike or trying in minor ways to improve upon him … all…seem to have taken Thorndike overtly or covertly, as our starting point'.

Thorndike's Comments

Thorndike first presented his theory in his book *Animal Learning* published in 1898. He comments, 'Both theory and practice need empathetic and frequent reminders that man's learning is frequently the action of the laws of readiness, exercise and effect.' In his opinion, man's learning takes place according to these laws.

The trial and error method is used in the following circumstances:

- When the learner is completely motivated and can see the goal clearly
- When perception alone or learned activities are not sufficient
- When the learner fails to find the solution of the problem

Trial-and-error learning occurs in situations where no behavior is at hand. Aroused individuals exhibit an extremely variable, apparently indirected and random behavior. If a behavior or a sequence ultimately results in success, in successive trials this behavior gradually occurs more quickly until finally it appears immediately in the appropriate situation. Such a behavior is said to have been learnt through trial and error.

Experiments in this regard have been conducted since about 1900 (**E.L. Thorndike**) using puzzle boxes and later on using mazes. Thorndike had theorized that animals learn to escape from puzzle boxes by trial and error. They perform various responses in a blindly mechanical way until some action is effective in securing their release from the box. On the succeeding trials, the animal learns that certain types of behaviors, such as moving around in the puzzle box, are much more effective in getting it out of the situation than are other ones like simply sitting and grazing. Over the period of experimentation, the ineffectual responses not bringing about much satisfaction tend to drop out or disappear quite automatically from the animal's repertory. Simultaneously, those responses done by the animal that brought about its release and lead to food as reward become more and more effectively connected to the stimuli in the puzzle box, leading to enhancement in probability of their occurrences the next time the animal is put in the puzzle box. The observed behavior patterns were interpreted as meaning that neither insight nor goal-directed behavior was necessary in problem-solving situations. So, it was said that learning could be explained by the gradual extinction of ineffective, and reinforcement by effective, behaviors.

EXPERIMENTAL PERSPECTIVE

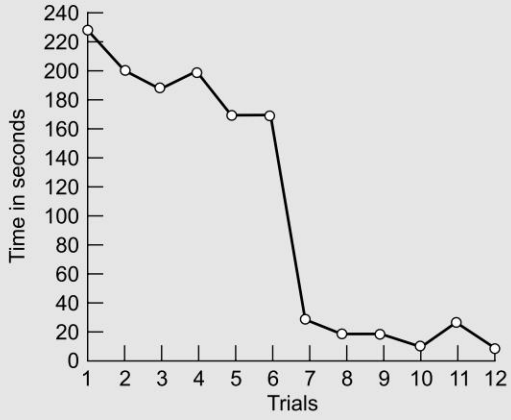
Thorndike's Puzzle Box Experiment: The basis of his learning laws

One of the first laboratory studies performed on animal intelligence involved putting them inside a 'puzzle box'. If the animal succeeded to find out how to unlatch the door and thus escape, it was given a bit of food as reward. Observing the behavior of the animal inside the 'puzzle box' gave many vital clues that helped in understanding some of the processes involved in learning. Upon these observations, the famous trial and error theory of learning was conceptualized by Thorndike and also the laws of learning were formulated.

When a cat was put in the puzzle box, Thorndike observed that there was a lot of restless behavior like scratching or licking itself, mewing or crying, pacing, biting at the bars on the side of the box or trying to squeeze between the bars. Thorndike termed this as 'random behavior'. After some 'random behavior', the cat accidentally bumped into the latch that leads to the opening of the door. Thereafter, the cat came out of the box and was fed.

The experiment continued and the next time when the same cat was put in the same puzzle box, it repeated its previous 'random behaviors' and eventually accidentally hit the latch and gained freedom once again leading to a reward in terms of food. Thorndike noted that on subsequent similar trials, the cat spent more time in the vicinity of the latch and would manage to get out of the puzzle box sooner and sooner with each successive trial. Finally, after some trials the cat learned the appropriate response required from it and the moment it was placed in the box it would hit the latch, escape and claim its reward.

Thorndike, after experimentation, plotted on a graph the amount of time it took for the cat to come out of the puzzle box on subsequent trials. He came up with what is now known as a 'learning curve'. Such experiments on monkeys, chickens and even human beings have yielded the same-shaped curve (shown in the figure below) confirming Thorndike's original belief that animals and humans solve simple tasks in the same fashion.



The seventh trial shows a remarkable improvement in the time it took one of Thorndike's cats to open a puzzle box

EXPERIMENTAL PERSPECTIVE

Bringing About Behavior Change: Some Practical Methods

Despite its positive help in learning, observational learning has its negative effects as well. It is at the centre of a controversy regarding the effects of exposure to violence and sex in the media. Separate studies (**Triandis** 1994; **Lull** 1988; **Lippman** 1992; **Gerbner** 1993; **Radecki** 1989; **Eron** 1987; **Turner et al.** 1986; **Centerwall** 1989, etc.) have revealed that anti-social models - in one's family, neighborhood or on TV - may have anti-social effects.

However, there is a positive side too. **Prosocial** (positive, helpful) models can have pre-social effects. People who exemplify non-violent, helpful behavior can prompt similar behavior in others. Mahatma Gandhi and Martin Luther King Jr., both drew on the power of modelling, making non-violent action a powerful force for social change. Parents are powerful models.

Models are most effective when their actions and words are consistent. Sometimes, however, models say one thing and do another. Many parents seem to operate according to this principle 'Do as I *say*, not as I *do'*. Experiments suggest that children learn to do both (**Rice** and **Grusec** 1975; **Rushton** 1975). When exposed to hypocrite, they tend to imitate the hypocrisy by doing what the model did and saying what the model said.

Reinforcements and punishments received by the model and imitator determine whether a model is imitated or not. We look and we learn. By looking, we learn to anticipate a behavior's consequences in situations like those we are observing. We are especially likely to imitate those we respect and admire, those we perceive as similar to ourselves, and those we perceive as succesful.

Learning by Insight

Insight (in learning and problem-solving, the relatively sudden solution of a problem (2) in psychotherapy, the understanding of one's owns motives and their origins) was a term used by the Gestalt *psychologist* (a school of psychology emphasizing that immediate experiences results from the whole pattern of sensory activity and the relationship and organizations within this pattern) **Wolfgang Kohler** (1925) to denote a form of intelligent problem-solving. Kohler set adult chimpanzees tasks that required solution by indirect means, for example, retrieval of bananas out of reach by means of stick or by stacking boxes to form a step ladder. The chimpanzees succeeded only when all the constituent elements of the problem had been seen within the same field of view. They behaved as though their perception of the problem had undergone a sudden radical restructuring and they would then rapidly arrive at an appropriate solution. When the elements were widely separated in space, 'insightful' learning did not occur and the chimpanzees continued to attempt ineffective 'trial and error' strategies.

EXPERIMENTAL PERSPECTIVE

Koehler's Experiment

Much of Koehler's work at the University of Berlin in the Canary Islands involved presenting various 'intellectual' problems to chimpanzees to see what kind of solutions they might come up with. His most famous subject was Sultan, a bright chimpanzee.

Sultan in Action

First Sultan learned to reach through the bars of his cage and rake in a banana on the ground outside using a stick as a tool. After Sultan had having mastered this trick Koehler put him through a much more difficult task of putting two sticks together to get the bananas. The bananas were moved further away from Sultan's cage and he was given two bamboo poles that, when fitted together, were just long enough to gather in the reward. Initially Sultan was perplexed. He tried the older method of getting to the banana's using one stick only but it fell short since the banana's had been moved further away. After having failed this way he pushed the longer of the poles out towards the banana and let it lying on the ground. After having done this, he used the tip of the shorter stick to prod the longer one out until it touched the bananas. He had reached his objective but only partially and his mission yet to be completed. Since the two sticks were not joined together in any way he was unable to get the bananas back into his cage. Koehler had to assist Sultan by handing him back the larger pole as it was out of reach for the animal. Over time Sultan after playing around with the two sticks happened to hold one stick in each hand so that their ends were pointed towards each other. Gently, he pushed the tip of the smaller one into the hollow of the larger. They fitted. As soon as he did so, Sultan ran towards the bars of his cage and using the combined stick began pulling in the bananas towards him. However, as luck would have it for Koehler, the sticks came apart. Sultan gathered the sticks and pushed them firmly together, tested their bond and finally managed to pull in the bananas.

Insightful learning occurs whenever, after the learning of more simple rules, behavior follows new and more general rules. If the principle of solution can be transferred, problem solving is the typical form of insightful learning.

PSYCHOLOGY NUGGET

Insightful Learning

Insight is found in the higher class of animals and human beings.
Insight means 'mental penetration'.
It is the best method among the methods of learning.
Gestalt psychologists say that a person can deduce the solution by insight if he perceives the situation as a whole.
Insight occurs suddenly and alters perception.
By virtue of insight, old objects appears in new patterns and organization.
Insight is related to the intellectual level – higher species have more insight.
In insight, understanding is more important than dexterity of hands.
Insight is sometimes hindsight and at others it is foresight.
Hindsight is observing that a lead is good or bad after trying it.
When important characteristics of the situation have to be discovered by exploration and manipulation, hindsight is brought in use.
Foresight is seeing the way to the goal before taking it or perceiving the usefulness of a certain lead without trying it.
Previous experience is at times of assistance in insight.
Maturity also affects insight.
If the pieces essential for the solution of the puzzle are present together when perceived, insight comes about earlier.
Some psychologists say that learning by insight is associative learning.
The insight gained in particular circumstances is of assistance in other circumstances.
The chimpanzees name on whom Kohler experimented was Sultan.

LEARNING STYLES

There are many ways to classify learning styles. Most classifications are based on perceptual modalities—the primary way our bodies take in information. Usually, researchers classify learners into four classes: *visual/verbal*, *visual/nonverbal*, *auditory/verbal* and *kinesthetic/tactile*.

Usually, people retain combination of two or more classes and we call them dominant and auxiliary learning modalities. Once the learning style of a learner is determined, that style can be used and thereby an increase in the information learned brought about. Suitable learning styles not only help in better learning but also make the process easy and interesting for the learner.

Visual/Verbal Learners

Visual/verbal learners learn new skills by seeing and learn new information best through visuals, especially those which are presented before them in written form. Such learners learn better when they are shown written material using projectors, or when they make notes, read textbooks and so on. Such types of learners learn best in solitude rather than in a group environment.

Visual/Nonverbal Learners

Visual/nonverbal learners are also visual learners but as opposed to visual/verbal learners they learn best when presented with diagrams, charts, videos, and other image-oriented materials as compared and other visual methods of learning are recommended for these types of learners.

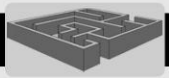
Auditory/Verbal Learners

Auditory/verbal listeners take in information best by listening. They learn best through the use of verbal communication and lectures. Auditory/verbal learners can have information revealed to them through written works, but in most cases, the information is not going to make sense or 'click' until the information has been heard. There are many things that auditory learners listen for while they are learning a new skill. They listen for the tone of voice, the pitch within the voice and even the speed of the person that is teaching the new skill or information. All of this information that has been interpreted is then used when learning.

Auditory learners will benefit from creating recordings of the information that is being taught, as well as benefit from information that has been played back from these recordings. Most auditory learners tend to repeat things aloud, so they are able to easily learn the information that is being repeated.

Kinesthetic/Tactile Learners

There are some people that learn better by completing the actual. These people are referred to as 'kinesthetic' or 'tactile' learners. Through this learning method, the person learns best when they take a hands-on approach to learning. Tactile learners may suffer from a short attention span which can make it difficult to learn new skills unless the hands-on approach is taken. There are many approaches that tactile learners can take while trying to master new skills. Tactile learners can use a hands on approach to take part in experiments, as well as other approaches where the individual can use their hands.



PSYCHOLOGY IN EVERYDAY LIFE

Are You a Visual Learner?

The visual learner easily and readily absorbs the information through the use of handouts, charts and visual information. If you learn best and take notes when visual information is being presented and create your own charts and graphics while learning, then you may be a visual learner.

How to Determine your Learning Style?

You can determine the learning style through observation of your skills that are used while learning. You can determine the learning style through observing which ways that you learn best and which method are used to ensure that you are absorbing the highest amount of information.

Guidance counselors and many other services within the school environment are often available to help students to determine which type of learning style that works best for their particular needs, as this can help the student to excel.

Alternatively, there are many tests that will help you to determine your learning style. After answering a series of questions based on situations that occur in learning, as well as asking basic personality questions throughout the test, you are able to determine which learning category that you fall under.

Some of these benefits of learning which category that you fall under when it comes to learning type include:

- Being able to learn and absorb information the first time that you hear it and reducing the amount of time and repetition that is required when learning.
- Reducing the amount of reviewing and study time using methods of learning that are not compatible with your learning ability.
- Defining your learning type can help you to choose the best study method for you. The majority of people are unsure about which methods that they should use to study and therefore learning which method enables you to learn best can enable you to learn effectively with the least amount of knowledge.

PSYCHOLOGY NUGGET

Laws of Readiness, Exercise and Effect

Law of Readiness

This law describes those situations in which the person who learns either invites the object of his learning or rejects it.
Readiness includes all those preparatory adjustments that immediately precede the action.
It includes – past experiences, mental preparation, attention and environmental adjustments.
Readiness creates a desire for learning and turns the learner's mental attitude towards the subject to be learned.

Signs of the Readiness for Learning

It is known by the tendency for learning in the learner.
The tendency for learning results in self-contentment after learning.
If learning is obstructed discontentment may result.

The law of readiness is thus related with mental preparation – it means a mental preparation for action.

This law was accepted until 1930. In 1932, in his book 'Fundamentals of Learning' and 'The Psychology of Wants, Interests and Attitudes' published in 1935. Thorndike has considered wants, interests and attitudes to be the contributing power in learning in place of the word readiness.

Law of Exercise

This law is based on the laws of use and disuse.
The repeated application of an activity fixes it firmly in the mind while on the other hand, no physiological reference is intended.
Whenever there is an appropriate situation, the activity that is firmly entrenched might take place.
This law emphasizes upon repetition in the activity of learning.
Repetition results in the formation of a habit in the muscles and the nerve fibers of the brain.

This law has been criticized because the element of understanding in repetition has not been adequately stressed upon. Elaborative rehearsal (see memory) is an essential prerequisite for information to travel from the short-term memory to the long-term memory and thereby be organized in specific categories to aid in retrieval.

Thorndike later on, along with repetition, included the association of ideas, clarity of meaning, maximum effort in learning and the use of cues of learning.

Law of Effect

The meaning of the law of effect is the effect of learning.
Success or failures have very significant bearing on the law of effect.
Success brings with it satisfaction and along with it a strengthening of the relation of the facts.
Failure increases dissatisfaction and the absence of the relation among the facts weaken them.
Thus, we may compare success to a reward and failure to a punishment.

In 1932, Thorndike propounded a new theory about the law of effect. He postulated that the activity of learning does not confine its effect to itself – its effect spreads to other aspects also. This is termed as the *spread of effect*.

In 1935, Thorndike made some modifications in the law of effect, based on experimental findings. He said:

The influence of reward or punishment is not equivalent.
The effect of reward is far more influential than that of punishment.

CONDITIONING

Another a principal form of learning is the conditioned response. Conditioning can be described as *a procedure for studying learning in which a discrete response is attached to a more or less discrete stimulus*. In modern psychology, there are two types of conditioning - Classical conditioning given by **Ivan P. Pavlov** (1849-1936) and Instrumental conditioning given by **Thorndike** (1857-1924). In experimental studies of both types of conditioning, the experimenter presents an event of biological or motivational significance usually termed as a reinforcer; it may be food, water or access to a sexual partner; or it may be a painful or distressing event such as a brief electric shock or the administration of a drug which causes nausea.

Classical Conditioning

This type of conditioning is also referred to as Pavlovian conditioning after its original experimenter **Pavlov** (1927). In his classic experiment, Pavlov designed an apparatus that could measure how much a dog's mouth

waters *(salivates)* in response to food or other things in the environment (Fig. 6.1). The dog was strapped comfortably in a harness, standing on the experimental table in a sound proof room. A tube was connected from the duct of the dog's salivary gland to a dish to accumulate saliva for measurement purpose. Pavlov then sounded a tuning fork and noted that other than looking around the dog did not do any other response. After some time, a plate of meat powder was placed before the dog. On getting the smell and eating the same, the dog salivated. After the dog had eaten, the plate was removed. After some time, the tuning fork was sounded again and the same procedure was repeated and observations made. It was noted that after repeating this procedure, a few more times the dog on hearing the sound of the tuning fork started to salivate.

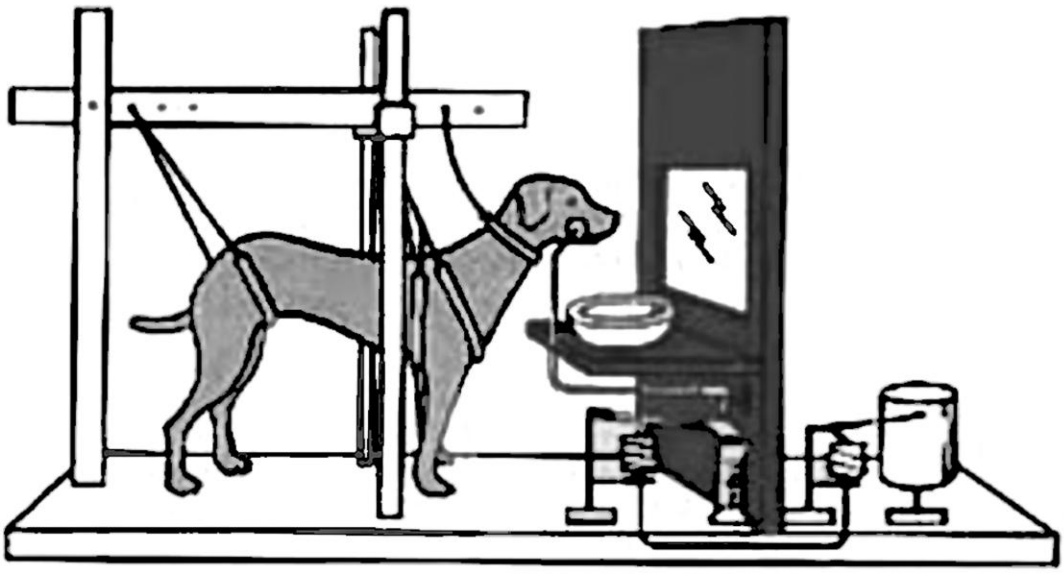


Fig. 6.1 Pavlov's Classical Conditioning Experiment Apparatus

Components of Pavlovian Conditioning

The following constitute the fundamental components and procedures of Pavlovian conditioning:

Unconditioned Stimulus (UCS): Pavlov referred to the meat powder in his experiment as a UCS. The word unconditioned means that the stimulus in question need not require prior training to produce the desired response. The essential feature of a UCS is that it should reliably elicit a response without prior training.

Unconditioned Response (UCR): The UCR is that response that is elicited by the UCS. Here, again, unconditioned means that no prior association of stimulus - response is essential for producing the required response. Since the primary feature of the UCS-UCR relationship is that the UCS reliably elicits the UCR, the UCR is often referred to as a highly reflexive response, one that happens quickly and quite automatically when the UCS occurs.

Conditioned Stimulus (CS): The CS is that stimulus that comes to elicit a response by being paired properly in time with the UCS. In a very real sense, the appearance of the newly emerging response comes to be 'conditional' upon the presentation of the CS, hence its name. The important feature of a CS is that it must be some stimulus that is within the sensory range of the organism and previously must have had a neutral effect with respect to the reflex under study. In the case of Pavlovian conditioning under study, the CS can either be a tuning fork or a bell.

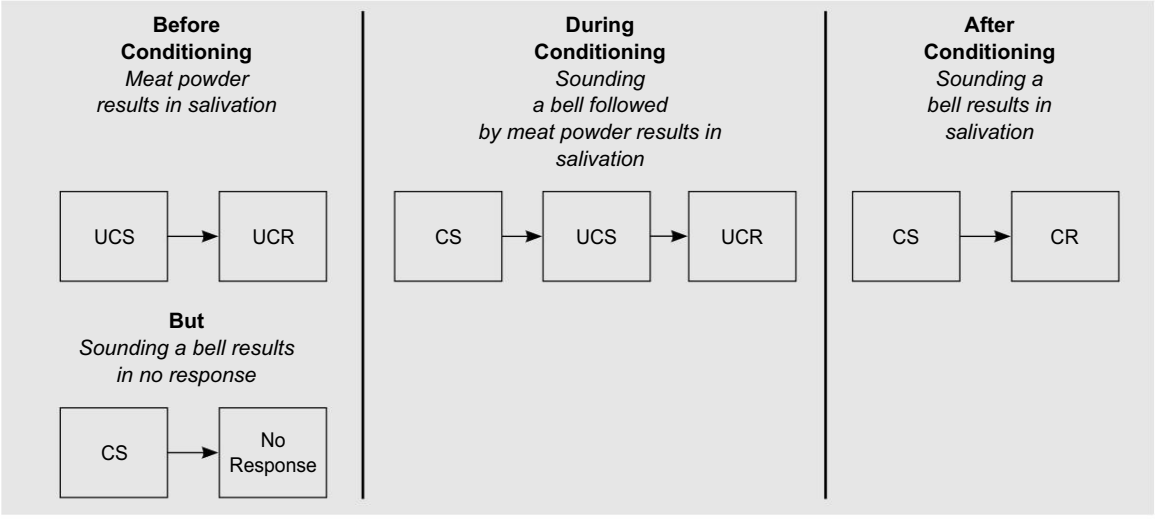


Fig. 6.2 Pavlov's Basic Conditioning Model

The Conditioned Response (CR): The CR is that learned reflex that arises when the CS is paired, properly in time, with the UCS. Sometimes, incidentally, the CR is referred to as a '*conditioned reflex*' for it becomes conditioned upon the presentation of the CS.

Figure 6.2 shows Pavlov's basic Conditioning Model.

Difference Between UCR and CR

It is important to recognize that the CR may not be exactly the same thing as the UCR. While both may share a great deal in common, difference does exist. This difference is attributed to the fact that since UCR is not a learned but an innate response being generated by natural stimulation, it is bound to be more intense as compared to the CR that in contrast is a learned response being generated after association of the CS-UCS pairing. The UCR is a natural response, while the CR is a response being produced artificially. We can best and most simply describe the CR as a preparatory response; in a real sense, the response prepares the organism for the arrival of the UCS. Figure 6.3 shows how dog training works.

CS-UCS Relationship in Pavlovian Conditioning

It is one thing to say that the fundamental experimental operation for Pavlovian conditioning is the '*pairing in time*' of CS and UCS, and quite another to specify just how this should be done. In practice, psychologists have adopted a scheme that shows several ways in which CS and UCS can be arranged with respect to each

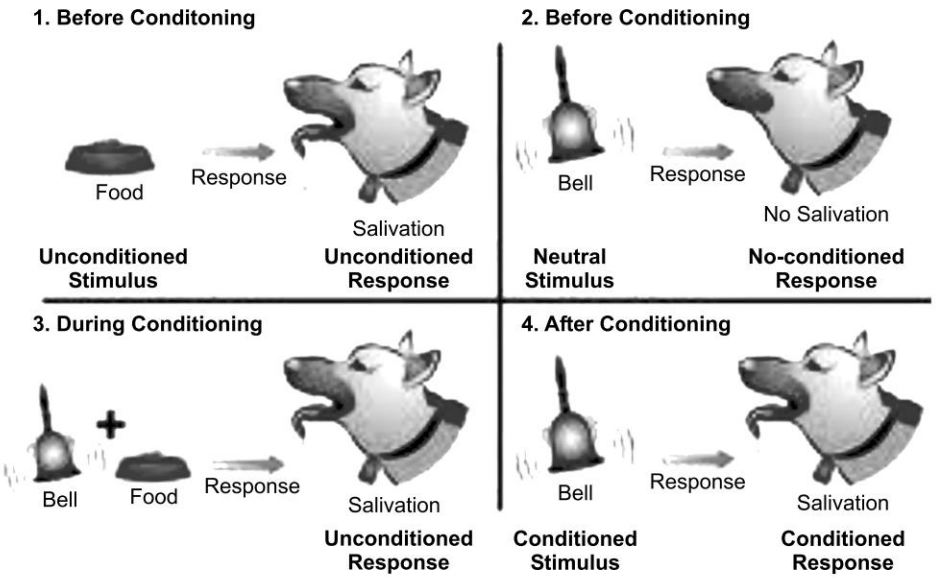


Fig. 6.3 How Dog Training Works

other in time. The CS-UCS can be paired in four different ways. However, they are not the only possible temporal relationships. We will limit our discussion to the four generally accepted combinations between CS-UCS pairings.

In the *first case*, as shown in Fig. 6.4, one can set both, the CS and UCS on at the same time. This type of pairing is called **simultaneous**. In the *second case*, the UCS can be set on after the onset of the CS. This is referred to as **delayed**. In the *third case*, the CS is set on and put off, thereafter, the UCS is put on. This is called **trace**. What is important in this type of pairing is the timing. There should not be much delay between the CS being put off and the onset of the UCS. This is so, because if conditioning is to take place, then it is dependent on some trace of the CS left behind in the nervous system. If the timings are not correct, the trace

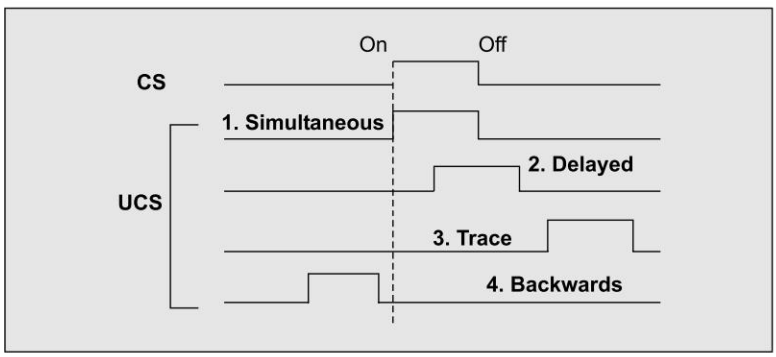


Fig. 6.4 Four Different Ways in which CS-UCS can be Paired

may disappear and required effects thereby not produced. The *fourth case* shown in the figure is a reverse procedure. The UCS is being put on and being put off before the onset of the CS. This is termed as **backward conditioning**. Research has shown that conditioning is most effective if the CS precedes the UCS by between a half second and several seconds, depending on what kind of response is being conditioned (**Bitterman** 2006; **Wasserman** and **Miller** 1997).

Three Basic Laws of Pavlovian Conditioning

1. **Law of Excitation:** It says that if a previously neutral, CS is paired with a UCS, the CS acquires excitatory properties, that is, it acquires the property of exciting the CR.
2. **Law of Internal Inhibition**: One of the things Pavlov did was that he established a conditioned salivary reflex in the dogs he was studying. Now what happened to an established CR when the CS was turned on but was not followed by the UCS? Pavlov, on investigation found the dog eventually stopped salivating. This procedure is known as '*experimental extinction*'. Pavlov gave the name '*extinctive inhibition'* to the process associated with the procedure, and he saw it as an example of a law encompassed by a more general process called *'internal inhibition*'.

   A question arises as to what actually happened to the CR as it underwent the extinction process. If we say forgetting, it will not be correct since evidence indicates that animals do not forget a conditioned response when they undergo extinction procedure. We can say that the dog is 'actively' inhibiting the CR when the CS is turned on (after not being followed by the UCS on a number of trials).

   If we take another case in which we have two different CR's for two different CS's respectively and we extinguish either one of them and then turn on the CS of the extinguished CR along with the functional CS, it will be noted that there will be a fall in the magnitude of the CR of the functional CS. Thus, the CS of the extinguished CR has the property of inhibiting or suppressing the CR of the functional CS.

   We see on evaluation of both the cases that the extinction procedure not only leads the animals to inhibit behavior associated directly with the CS, but also endows the CS with the power to actively inhibit or suppress other conditioned behavior.

   This law is known as the law of internal inhibition since it characterizes a group of inhibition phenomenon that are caused by changes in the conditioned association itself and unlike the various forms of unconditioned inhibition, are acquired in learning processes.
3. **Law of External Inhibition**: Pavlov had a dog with a well-established CR and when he turned on some novel or distracting stimulus at the same time he presented the CS for the response, he often noted that a CR of reduced magnitude was the result. On the other hand, he noted that if he had a well-extinguished CR and turned on a novel or distracting stimulus, he observed that the CR reappeared, often at considerable strength. This phenomenon also supports the fact argued above that extinction does not involve forgetting for events entering into the conditioning process.

   In both cases mentioned above, we see that a novel external stimulus has the power to disrupt an ongoing process. In essence, this law states that excitatory or inhibitory processes in conditioning can each be disrupted by novel, distracting stimuli. This is called the law of external inhibition since the inhibition is not being acquired in the learning process but from outside.

Extinction, Spontaneous Recovery and Generalization in Pavlovian Conditioning

When learned acts are no longer reinforced, they usually diminish in strength. It is said, for example, that babies learn to cry sometimes so that they will get extra attention. In such a case, parents are advised to avoid their crying baby so that they may stop crying for attention.

Psychologists apply the term *extinction* (in classical conditioning, the procedure of presenting the conditioned stimulus without the unconditioned stimulus to an organism previously conditioned (2) in operant conditioning, the procedure of omitting reinforcement (3) the decreased likelihood of response resulting from these procedures) to the operation of removing reinforcement following the occurrence of some response that has been reinforced in the past. The general effect of this operation is to reduce the strength of responses that gradually fade away with time.

As in Pavlovian conditioning, if after conditioning the CS is not followed by the UCS on a number of trials, there will be a gradual decrease in the amount of salivation and at a point the dog would eventually stop salivating after the CS has been presented. This process is termed as *extinction*.

Thus, we see that there is a gradual decline in performance of learning activities if reinforcement is withheld. Some aspects of learning require reinforcement for the establishment and the maintenance of the response. If the reinforcement is removed, the response will start to get extinguished. Extinction is due to a learned inhibition of the original learned response, and not due to forgetting, as also mentioned earlier. This can be shown by the *spontaneous recovery* (after an interval of time, an increase in the strength of a conditioned response which had undergone extinction. In spontaneous recovery, the response strength is usually diminished, and it will quickly extinguish again if no reinforcement is given) of the original response that sometimes occurs when the animal is placed in the training situation some time after the response has been extinguished.

PSYCHOLOGY NUGGET

Classroom Learning Debate

Laboratory experiments on learning have had a great impact upon the methods adopted for classroom learning and its applications much debated upon. Those teachers who have been influenced by Thorndike emphasize upon learning the material bit by bit, in one tiny increment after another. Those under the influence of Tolman and his associates emphasize upon learning to be spontaneous and rapid and believe that it occurs in big bursts of insight. These followers of Tolman's learning ideologies hold that each child learns at his or her own pace and in his or her own way. According to them, the role of a teacher is to give the child as rich and permissive an intellectual environment as possible, and then sit back and wait for the cognitive map-making to occur spontaneously. These breed of educators however, are unable to specify exactly what stimulus conditions promote insightful learning hence the most they do is to expose their students to 'routine-free' classrooms hoping for the best output to be generated.

The rate of extinction is partly a function of the similarity between the learning situation and the condition of extinction. The greater the difference between the two sets of circumstances, the more quickly extinction occurs. This effect is known as *generalization* (the process of forming an idea or judgment applicable to an entire class of objects, people, or events (2) the process of applying a general idea to a new data (3) a broad principle or law in science).The rate of extinction is also influenced by the reinforcement that operates during learning.

PSYCHOLOGY NUGGET

Treating Bedwetting (Enuresis) Using Classical Conditioning

In many cases of bedwetting, the child has simply failed to learn to wake up in response to the stimuli arising from a full bladder. An imaginative use of conditioning can help bring about this necessary bit of learning by following this simple procedure which requires some special arrangements. The child will have to be put to sleep on a special fine mesh sheet so designed that the first drop of urine on it sets off an alarm bell. Now let us assume that the bladder of the sleeping child is full and a loud bell (unconditioned stimulus) is sounded which will reliably awaken him. After a few such paired presentations, the response of waking up, which at first was made only by the bell, will begin to occur in response to the stimulation from a full bladder. When this happens the child can go to the toilets instead of wetting the bed while asleep. This arrangement assures that soon after the sleeping child is stimulated by a full bladder, he will be awakened by the sounding of the bell. With a few nights of this treatment, most children begin to wake up in response to the stimulation from a full bladder before wetting the bed. If the specially designed mesh is not available, then the parents will have to put in special efforts in waking the child up at peak times when they feel that his bladder must be full. This will also work like the above conditioning procedure.

Classical Conditioning and Bedwetting

Before Conditioning	During Conditioning	After Conditioning
Sounding a loud buzzer results in waking up.	*Bladder tension followed by buzzer results in waking up.*	*Bladder tension results in waking up.*
UCS → UCR	CS → UCS → UCR	CS → CR
But *Bladder tension results in no response.*		
CS → No Response		

PSYCHOLOGY NUGGET

Thorndike, Pavlov and Tolman: A Comparison

Pavlov accepted the views of Thorndike more than those of Tolman's. This is because of the fact that there is much of a strange similarity between the explanations offered by Pavlov for classical conditioning and Thorndike's law of exercise. In Pavlovian conditioning, when the conditioned stimulus (CS) is paired properly in time with the unconditioned stimulus (UCS) a sufficient number of times, it acquires the property of eliciting a conditioned response (CR) i.e. an S-R bond is formed. The more this bond is exercised, the stronger it becomes. Thus, we see that the mere closeness in time between the CS and the UCS is enough to bring about an association between these two stimuli, and hence a connection or contiguity between the CS and the CR.

On the other hand, Thorndike's believed that one remembers things better if they please us. This personal satisfaction in learning was what Pavlov did not seem to care about. Finally, it took a pigeon used by Tolman for his famous bowling experiment to show Pavlov the narrowness of his views and also to many others to map out a common ground between Thorndike and Tolman.

HIGHER ORDER CONDITIONING

You have seen that an organism learns to respond to a previously neutral conditioned stimulus in a similar fashion as it responds to an unconditioned stimulus. Let us try something different and move a step forward from this point. Suppose we condition a dog to produce the conditioned response using a tuning fork as our conditioned stimulus. Now once this connection is established, lets also sound a bell along with sounding the tuning fork, with no food present, and we will find that the bell, when even sounded alone, elicits salivation. Thus, we find that the newly-acquired strength of the tuning fork (CS) can also be used to condition the same response to other stimuli (bell in this case). This process is called *higher order conditioning*.

Instrumental Conditioning (Operant Conditioning)

Edward L. Thorndike, in the United States, was one of the first to do studies on what has come to be known as operant conditioning. These studies of Thorndike were being done around the same time when Pavlov was experimenting upon conditioned reflexes. Thorndike's inspiration was Darwin's theory of evolution and he thus set about to study the way in which 'animal intelligence' served to adjust the animal to the world in which it must live. Thorndike choose the cat in a 'puzzle box' for the purpose of his experimentations (refer Thorndike's Puzzle Box Experiment – The basis of his learning laws) and concluded that responses that are followed in time by a 'good effect' tend to be repeated when the animal is next in the same situation. The gradual strengthening of effective responses was viewed by Thorndike as a blind and automatic 'stamping-in' process. He concluded that the animal was so built that the *consequences* of a response would affect to some degree the likelihood that the response would be made again. However, it is important to note that the law of effect does not refer to the *logical* consequences of a response – it refers only to whatever actually does happen right after a response is made. Critically looking at it, we can clearly see that in Thorndike's experiment, there was a connection between accidentally bumping against the latch and its opening. This was an unnecessary coincidence as far as the cat's learning was concerned. If we go by the law of effect, then had Thorndike opened the puzzle box every time the cat scratched its right ear, the cat would have learned to scratch its right ear in much the same fashion it had learned to brush against the latch. However critical we may get but the fact remains that Thorndike's law of effect today still remains alive, only the apparatus and

language have changed. Today we do not talk about 'good' or 'satisfying' effects but use what Pavlov had coined as *reinforcements* (in classical conditioning, the pairing of the conditioned stimulus and the unconditioned stimulus (2) in operant conditioning, the presentation or termination of a stimulus or event which, when made contingent on the occurrence of a certain response, makes that response more likely to occur in the future). This term is applied both to operant as well as classical conditioning.

Before we start our discussion about instrumental conditioning, let us first talk about *reinforcers* and the process of reinforcement. Reinforcement is the process in which a stimulus event occurs in the proper temporal relation with a response and thus tends to maintain or to increase the strength of the stimulus-response connection. In more simple terms, it can be stated that it is that stimulus which increases the possibility of responses. There are two types of reinforcers we have to mainly deal with: *Positive and negative reinforcers.* In common terms, a positive reinforcement is a reward. It is a stimulus that we give to the organism after it has produced the desired response. On the other hand, negative reinforcers are stimuli which strengthen a response when they are removed if the response occurs (**Magoon** and **Critchfield** 2008). Negative reinforcement involves the use of a stimulus event that has aversive properties, a stimulus event that an organism will ordinarily avoid, if it can. Such stimulus events can also be used to punish a response.

Role of the Organism in Instrumental Conditioning

In Pavlovian conditioning, the learning organism plays a purely passive role in so far as the delivery of the conditioned and unconditioned stimulus is concerned. In the case of experimental salivary conditioning, the dog has absolutely no control over the delivery of the meat powder. Instead, the dog stands passively in its harness while the experimenter decides when the CS and the UCS are to be presented. A second operationally-defined type of learning can be distinguished when we let the organism assume some active role in the learning situation. In particular, we can set things so that the organism cannot obtain reward or cannot escape from punishment of some kind until and unless it somehow makes the response we want it to make. In cases such as this, when reward is made deliberately contingent on the prior occurrence of the response we want the organism to learn, we speak of instrumental conditioning or as **B.F. Skinner** (1938) called *operant conditioning* (learning in which reinforcement is contingent on a particular response). The organism must literally operate upon its environment for the purpose of obtaining reward and avoiding punishment.

Basic Procedures in Instrumental Conditioning

Three basic features that characterize most instrumental conditioning experiments can be identified.

First of all, the typical experimental plan will use procedures that involve reward or punishment, they being termed as reinforcers or reinforcing stimuli and the process being called reinforcement.

Second, our experimental plan can lead an organism to either produce or withhold some specified response.

Third, a *discriminative cue* (a discriminative cue is a stimulus of some sort that tells the organism, in effect, when reinforcement can be obtained and when it cannot be obtained. It sets the appropriate occasion for the behavior that leads to reinforcement) will be used in some experimental plans but not in others. A discriminative cue is a stimulus of some sort that tells the organism, in effect, when reinforcement can be obtained and when it cannot be obtained. It sets the appropriate occasion for the behavior that leads to reinforcement.

Reward Training

In this experiment, we place a hungry white rat in a twelve inches square box. This is a sound-proof box known as *Skinner's box* named after B.F. Skinner (Fig. 6.5). It is also at times referred to as an 'experimental

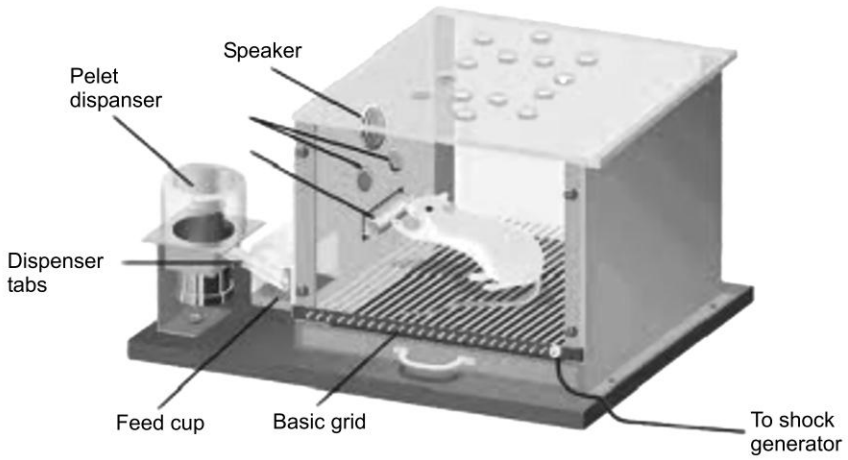


Fig. 6.5 Skinner's Box

box'. In the box, at one end there is a small lever projecting from the wall. This lever is connected to a food magazine in such a manner that when it is pressed, pellets of rat food will be released in a small cup. It is also connected with a recording device so as to record the rate and frequency of lever pressing.

When the rat is placed in the box, it will explore its new environment, sniffing the air, pawing the walls and biting here and there. After sometime, it will accidentally press the lever that in turn will release a food pellet into the small cup. The rat may or may not notice the pellet at that moment. When it does discover the pellet, it will surely eat it since it is hungry. There is a fair certainty also that the rat will press the lever a second time. Maybe this time it will discover the food instantly. If and when this happens, the behavior of the rat in terms of lever pressing will drastically change from accidental to intentional with increased frequency.

The general procedures associated with simple reward training are not new. We have seen that **Thorndike** (1898) had shown that cats learn to escape from 'puzzle boxes' in order to get pieces of food. The course of learning was marked by much trial and error. As we have seen in the Skinner box experiment, the rat at first accidentally presses the lever but when he discovers the reward associated with the pressing of the lever, his lever pressing becomes intentional, directed towards the attainment of positive reinforcement.

Discrimination Training

The apparatus is set up in the same manner as in the case of reward training, other than a small white light that is located in the wall of the box, is added. This is referred to as a *discriminative cue*. Now, here we switch on the light and put a hungry white rat in the box and use reward training to a point where the rat is pressing the lever in a rapid and consistent fashion. At this point, we turn off the light and disconnect the food magazine from the lever. After a few minutes, we turn the light on and reconnect the food magazine with the lever. If we repeat this procedure a few number of times - alternate periods of light on with reinforcement, and light off with no reinforcement, choosing time period intervals which are not consistently of the same length, we note that the rat comes to learn the appropriate occasion for lever pressing in terms of obtaining reinforcement.

A point to mention here is that if we withhold reinforcement indefinitely, the rat would stop pressing the lever altogether, a process known as *experimental extinction*. If such a point is reached and we want the rat to revive its reinforcement attaining behavior during the period, the white light is put on, again we will have to wait for some time but eventually the rat will start pressing the lever again. This process of response recovery is termed as spontaneous recovery.

Escape Training

A dog is placed in one compartment of a two-compartment box. The two compartments are separated by a door that can slide up and down. The door is arranged such that it can be dropped partway through a slot in the floor, creating a hurdle over which the dog can jump from the first compartment to the second. Both compartments are equipped with floor made of stainless steel bars through which an electric current is passed. The bars are wired in such a way that when current is passed through them, a shock of moderate intensity is delivered to the dog through the dog's feet. There are different control switch for both the compartment bars. At some time determined by the experimenter, the door drops and at the same instant, current is turned on in the compartment the dog is in. The shock continues until the dog jumps over the hurdle and reaches the safe compartment, in which the shock is not present. The door closes and the dog 'rests' until the experimenter again drops the door and turns on the shock in the second compartment. The dog must then jump the hurdle once again, moving back to the original compartment that is now safe. This process continues for as many trials as the experimenter may call for.

The first time when the dog feels the punishing stimulus of the shock in such a 'shuttle box', there will be a good deal of yelping, some urination and defecation and a great deal of agitated activity. Eventually, however, the dog will stumble over the hurdle and reach the safe compartment. The second time the shock comes; it will show much less agitation and will move over the hurdle much more rapidly than the first trial. After a few trials, the dog will jump the hurdle and escape with a very short latency.

It might seem reasonable to think of escape training as a rather special case of reward training, on the assumption that escaping a noxious stimulus like shock is rewarding.

Avoidance Training

This procedure can be described by using the same apparatus as that used in the escape training paradigm. However, a few modifications are to be brought about. An overhead light is put in each compartment at a place easily noticeable by the dog. The dog is placed in the compartment with the light turned off. At an appropriate moment, we turn on the light and drop the separating door between the compartments. Ten seconds after, the current is passed through the door of the compartment the dog is in. During this ten second interval, the dog can jump into the other compartment to avoid the punishing stimuli. Thus, this discriminative cue sets the occasion for the dog's response. When the dog moves into the safe compartment, we close the door and allow the dog to take rest.

This procedure can be compared with discrimination training. The dog slowly begins to understand the cue provided by the light and comes to learn the appropriate occasion for escaping punishing stimuli.

This procedure can also be labeled as '*two-way active avoidance training'* since the dog must not only actively produce a response to avoid punishment, but also, at the same time jump across the hurdle separating the two compartments, each of which is 'dangerous' at specified times. However, we can use only one compartment in which the shock is delivered the other being permanently safe. If this procedure is used, though it being cumbrous to the otherwise smooth process, we can then label the same as 'one-way active avoidance training'.

Punishment Training

As mentioned before, while discussing about the basic procedures in instrumental conditioning that our experimental plan will also use procedures that will lead an organism to either withhold or omit a response in order to obtain reward or avoid punishment. Probably the most common experimental procedure involving this is that of punishment training.

In this type of training, we continue beyond the point where reward training was accomplished. However, a few modifications have to be made in the Skinner box. The lever is to be connected to an electricity regulating device so that mild current can be passed on to the lever as required. Now since the rat has learned that lever pressing is being reinforced with food pellets, it will actively be pressing the lever. At this junction, the current is passed on to the lever and the rat on pressing the lever receives a mild electric shock. It is now caught in an approach-avoidance conflict. It wants the food pellets and at the same time wants to avoid the shock. It chooses the latter and becomes passive as far as lever pressing is concerned. This passiveness as a result of punishment training can be also called '*passive avoidance learning'*.

Omission Training

This type of training is more or less similar to punishment training other than the basis for obtaining reinforcement. Here, reinforcement is based on a positive response rather than avoidance due to a punishing stimulus. Here also, we continue beyond the point where reward training was accomplished. Thereafter, we reverse the process in the sense that lever pressing is no longer reinforced but failure to do the same is. This could be done with any rules binding the process. It can be done by dropping a food pellet into the food cup at the end of each five-second period that the rat fails to press the lever. Under these prevailing conditions, the rat will learn to withhold or omit the lever pressing response in order to assure a continued flow of food pellets.

Discriminated Punishment and Discriminated Omission Training

This is an extension of the punishment and omission training procedure other than it requires the addition of a discriminative cue that tells the organism in advance when lever pressing will lead to reward and when it will lead to punishment in the first case, and in the second case when lever pressing will not lead to reward and when failure to do the same will be rewarded and vice-versa - that is when the light is off we could reintroduce simple reward training, and lever presses could once again produce food pellets.

Table 6.1 shows types of instrumental conditioning at a glance.

Free vs Controlled Responding

Instrumental conditioning can involve either of these two procedures. These, at times, are also referred to as *free-operant* and *discrete trial* procedures respectively. The difference between the two is based on the controls of the opportunity to make the instrumental behavior in question. It is termed free-operant when the subject controls the opportunity to make the instrumental behavior and when the experimenter controls the same; it is termed as discrete-trial or controlled responding. This difference is an important one, since which of these two procedures is being used will determine the kind of measure of behavior that is used in the experiment. Another important distinction is that these procedures lend themselves in some cases to a study of different experimental variables.

EXPERIMENTAL PERSPECTIVE

Shaping: A Behavior Modification Technique

In operant conditioning, a response must occur before it can be reinforced. It is impossible to strengthen a behavior that, in fact, never occurs. Skinner developed a technique known as **shaping** (also known as the *principle of reinforcing successive approximations*) and showed how new behaviors can be created through conditioning.

There are many complex behaviors, ranging from auto repair to zither playing that we would expect to occur naturally as part of anyone's spontaneous behavior. In cases such as these, in which there might otherwise be no opportunity to provide reinforcement for the particular behavior (since it never occurs in the first place), a procedure known as shaping is used. Shaping is the process of teaching a complex behavior by rewarding closer and closer approximations of the desired behavior. In shaping, any behavior that is at all similar to the behavior one wants the person to learn is reinforced at first. Later, only those responses are reinforced that are closer to the behavior that ultimately is to be taught. Finally, only the desired response is reinforced. Each step in shaping, then, moves only slightly beyond the previously learned behavior, permitting the person to link the new step to the behavior learned earlier.

Shaping allows even non-humans to learn complex responses that would never occur naturally. In his experiments, Skinner used shaping and gradually guided an animal's behavior towards a desired behavior. Shaping also underlies the learning of many complex human skills.

TABLE 6.1 Types of Instrumental Conditioning

Reinforcement Type	Discriminative Cue Available	Response Comes to Be	Based On
Reward training	No	Produced	Reward
Discrimination Training	Yes	Produced	Reward
Escape Training	No	Produced	Punishment
Avoidance Training	Yes	Produced	Punishment
Omission Training	No	Withhold	Reward
Punishment Training	No	Withhold	Punishment
Discriminated Omission Training	Yes	Withhold	Reward
Discriminated Punishment Training	Yes	Withhold	Punishment

Distinction Between Classical and Instrumental Conditioning (A Critical Evaluation)

In classical conditioning experiments, the experimenter's rules for delivering the reinforcers or US make no reference to the behavior of the subject. In Pavlov's experiments, we have seen that the dog receives food on every conditioning trial, irrespective of its behavior when the CS is turned on and the organism can do nothing to prevent the happenings, i.e. it is a passive part of the experimental process. This basically marks the distinction between classical and instrumental conditioning. In an instrumental conditioning experiment, the delivery of the reinforcer depends on the experimental subject's performance of a designated, instrumental response. The difference thus between the two types of conditioning is defined in terms of the

PSYCHOLOGY NUGGET

Premark Principle: Do Individual Reinforcement Hierarchies Exist?

It is quite apparent that many different stimuli can serve as reinforcers. The question is whether one can find out which of the several available reinforcers can be the most effective in strengthening a given behavior. Suppose, you are the CEO in a corporate sector and you have to reward several of your employees for their excellent performance, then how will you do so using your knowledge on reinforcers. I am sure you will think in terms of individual differences and reward them accordingly either in terms of cash bonus or more vacation time or give them greater opportunities to participate in management decisions. This is so because your knowledge of psychology will tell you that different employees rank the desirability of these rewards in different way. This thinking of yours is based on the work of **David Premark,** who stated that the desirability of potentially reinforcing behaviors varies from one individual to another and also from time to time.

David Premark (1962, 1965), after extensive experimentations on rats and children, has stated that individual reinforcement hierarchies exist for all humans and other animals. Reinforcers at the top of the hierarchy are those behaviors most likely to be engaged in, given the opportunity. He further states that for a given individual, any behavior in the hierarchy may reinforce any of the behaviors listed below it and may itself be reinforced by any behavior listed above it. This latter point has come to be known as the Premark principle.

How Can You Apply the Premark Principle At Home?

We can apply this principle in an effective way to encourage children to do their studies. Most children today like to watch cartoons and other soap operas and waste a lot of time doing so and neglecting their studies. The problem before most parents is how to tackle this situation. Tackling this issue becomes very simple if we apply the Premark's principle. TV viewing can be used as a reinforcer to persuade children to study first and then later watch TV. In this way, TV viewing becomes contingent upon completing their academic assignments, rather than the other way round. The simple rule is academic assignments first and thereafter TV viewing.

PSYCHOLOGY NUGGET

Distinction Between Classical and Instrumental Conditioning

1. In classical conditioning, there are no reference rules as regards to behavior for delivery of the reinforcers. Reinforcement is not conditional on response emitted. Thus, it is a passive process on the part of the organism. This marks the basic distinction between classical and instrumental conditioning. The difference is defined in terms of the experimenters rule for delivering a reinforcer.
2. A second difference is that the responses that are learned in classical conditioning are relatively stereotyped, reflex - like ones that are elicited by the UCS. In instrumental conditioning, the learned responses are part of the stream of behaviors engaged in by people and animals as they interact with their environments; these responses are not simple reflexes to stimuli and are emitted in the process of adjusting to the environment.

Extensive research has shown that the difference between the two is rather one of degree than of kind.

experimenter's rules for delivering a reinforcer. But this is hardly sufficient to prove that there is any fundamental distinction between the two. Many psychologists have followed Skinner's lead in believing that the operational distinction may have some further significance.

As we have seen that in Pavlov's experiment, the dog started salivating to the CS after the CS-UCS were paired properly in time. The reason for the salivation being produced by the CS was explained by **Konorski** (1948). According to him, salivation is a part of a set of responses unconditionally elicited by food; an association of the two events ensures that the presentation of the one will activate a representation of the other; the presentation of the CS will activate a representation of food and this activation will elicit salivation just as it would have it generated by the presentation of the UCS itself. Classical conditioning thus depends upon the establishment of an association between CS and UCS, and the CS thereby acquires the ability to elicit responses normally elicited by the UCS alone.

The above explanation does not easily apply to instrumental conditioning. When a rat is rewarded with food for pressing a lever (reward training), this new response, not previously elicited by food, increases in probability. It is true that the last thing that will normally happen before a pellet of food is obtained is that the rat will have been in contact with the lever, sniffing it or touching it with its paws, but it remains to show how any association between these stimuli and the delivery of food could generate the efficient instrumental response that rapidly emerges from the rat's initially accidental or exploratory contacts. However, in some cases, it turns out to be possible to apply the analysis proposed by **Konorski** (1948) as an explanation for Pavlovian conditioning. In the case of instrumental conditioning experiments where a pigeon is trained to peck a small illuminated plastic disk on the wall of a Skinner box, we see that on pecking, the pigeon is rewarded with food whenever they perform the required response. The association between illumination of the disk (CS) and the delivery of the food is sufficient to ensure that the former comes to elicit the pecking response normally elicited by the later alone (pecking is a pigeon's consummatory response to food). Here, then is a purely Pavlovian explanation of what had always been regarded as a case of instrumental conditioning (**Brown** and **Jenkins** 1968).

One swallow does not make a summer. This analysis will not easily work for many cases of instrumental conditioning. It cannot easily explain why rats learn to press the lever with a particular force (**Notterman** and **Mintz** 1965), or to hold it down for a particular length of time (**Platt**, **Kuch** and **Bitgood** 1973). It is equally unsuccessful at explaining why a dog should learn to flex a leg either to obtain food (**Miller** and **Konorski** 1969). Here, and elsewhere, instrumental conditioning occurs in accordance with Thorndike's law of effect that states that responses are modified by the consequences, increasing in probability if followed by a satisfying consequence, decreasing, if followed by an aversive consequence. Though there is a dispute regarding this law being a theory or a circular description of observed data, it certainly captures what we intuitively see as the essential feature of voluntary actions - that they are performed because of their consequences.

If we cannot explain or describe instrumental conditioning without recourse to the law of effect, then the distinction between classical and instrumental conditioning can only be denied by dismissing Pavlov's account of classical conditioning and applying the law of effect here also. Several psychologists, notably **Hull** (1943), have attempted to do just this but their attempts do not seem entirely successful. A pigeon conditioned to peck a disk whose illumination has served as a CS signaling food will continue to do so even if the delivery of food is cancelled on those trials when the pigeons pecks at the disk. The only way for the pigeon to earn food now is to refrain from pecking when the disk is illuminated, but it is unable to do so. The association between light and food remains strong, so the pigeon cannot help approaching and pecking the light, in spite of the adverse consequences of its action. This, according to the law of effect, should not have been the case (**Williams** and **Williams** 1969). There are many other examples of involuntary responses being conditioned by Pavlovian procedures in spite of their having adverse consequences. It is difficult to see how such conditioning could be analyzed in terms of the law of effect.

Unless a newer theory is proposed, there is reason to believe that the distinction between classical and instrumental conditioning is real and important. This difference is one of degree rather than of kind.

LEARNING THEORIES

The term 'learning theories' is misleading in as much as theories of learning are not concerned exclusively with the explanation and systematic representation of the learning process, but are more or less general theories of behavior that merely happen to start out from the common assumption that the environmental influences operative in learning processes are of major importance for our understanding of the ways in which the individual adapts to his environment. The first attempt to define learning theories of this kind coincides with the beginning of the experimental learning research. Even though knowledge of the empirical conditions of learning process was not immense, it was nevertheless assumed that the laws of imprinting and memory were known: the laws of association described the mechanisms of content association and Darwin's theory of evolution seemed a useful model for the development of new models of behavior. Just as the evolution of species could be explained as a result of selection and mutation, so by explaining the conditions for behavioral selection, the learning process could be interpreted as a result of a selection process.

Since the ideas governing the first learning experiments (**Ebbinghaus** 1885; **Thorndike** 1898) were considerably influenced by this primitive conception of learning mechanisms, it was possible to view the success of such experiments as justifying those presumptions. This was of decisive significance for the future development of the psychology of learning.

S-R Theories

These theories share the assumption that learning consists of an association of stimulus and response (S-R). According to the type of additional mechanisms postulated, there are S-R reinforcement and S-R contiguity theories.

S-R Reinforcement Theories

First among them is **E.L. Thorndike's** (1913, 1932) *connectionism* (the doctrine that the functional mediators between stimulus and response, or between associations and neural bonds or links that can be either inherited or acquired through learning). According to this theory, if an organism is placed in a problem situation, it will react to that situation in a way possible to it, until one of its responses happens to have a successful outcome - this is trial and error behavior. In certain circumstances, there is a greater probability that prominent features of the situation will be taken into account, thus making possible solution characterized as 'insightful' behavior, even though they do not occur through 'insight'. New habits (behavioral) are formed on the basis of the connection of situation and response(s). If this association is directly followed by a 'satisfying state of affairs' that causes its intensity to increase and hence the probability that on the next similar occasion, the appropriate behavior will occur again - this is referred to as the law of effect. Negative consequences of behavior that accompany the connection of situation and response after only a short time interval reduce the probability of the recurrence of the response in question. Even though **Thorndike** (1913) attributed this to a diminution of associative intensity, he later on in 1932 discarded the explanation, without cause depriving the law of effect of its central position among other 'laws' and principles of learning. Although most learning theories comprise of 'principles of effect', there is, as **Postma**n (1947) pointed out, the danger of a circular argument: if the eventful gratifying state of affairs is understood as a set of conditions in which the animal does not undertake anything in order to avoid it, but is often concerned to achieve or maintain it (as we saw

while discussing the difference between the two types of conditioning), the law means only that the animal does what it does because it does it.

Second among the S-R reinforcement theory is **C.L.Hull's** (1943) systematic theory of behavior known as the *reinforcement theory*. This theory is in some aspects related to Thorndike's idea and represents the first logical attempt to derive empirically testable proposition from a series of general assumptions. In its most recent versions, **Hull** (1952) emphasized on the importance of reinforcement in learning and considered it as the basis of all learning. According to him, 'any stimulus, occurring 'in close temporal contiguity' with a reinforced response becomes connected with that response so as to evoke it later'. This theory also goes by the name of *Mathematico Deduction Theory*. As per Hull's statement, the inference can be drawn that the CR and the UCR are similar, the only difference being that the CR gets attached to a new stimulus.

The primary reinforcement results from the reduction of a drive; a response which has the effect of supplying food to a hungry organism is consequently reinforced whereby the other stimuli related to environmental and somatic experiences produced by the response may become secondary reinforcers and confirm the response made at each stage of a performance. These reinforcing stimuli later on determine the relative strength of a possible alternative response in a learning situation. Hull's theory reveals that the reaction potential is the outcome of an individual's habit strength and drive and the influence of the intensity of the stimulus and incentive power.

Hull never embarked on very much of an experimental program to test his theory of reinforcement. It remained for Neil Miller to do that (**Miller** and **Dollard** 1941; **Miller** 1951, 1959). For Miller, a drive could be produced by any stimulus if it were made strong enough to 'impel action'. According to Miller, then, a reinforcing state of affairs is simply that which produces a rapid reduction in the intensity of a drive stimulus.

S-R Contiguity Theory

Against the backdrop of **Pavlov's** (1928) physiological and **J.B. Watson's** (1914) 'behavioristic' approaches, **E.R. Guthrie** (1952) conceived a theory of instrumental learning in which the reinforcement of an S-R connection played only a secondary role. A combination of stimuli that took effect at the same time as a movement, will tend on recurrence to be followed by that movement (**Guthrie** 1952), in which case the stimulus pattern has its full associative strength even on its first association with the response. The fact that learning curves show a gradual increase leads Guthrie back to the complexity of the observed actions. The significance of reinforcement resides exclusively in its capacity of interruption: since it brings the trial to an end, it prevents the formation of new S-R bonds after the last, i.e. successful movements.

Classical Conditioning Theory

This theory was originally conceived by **Pavlov** (1928) in order to explain the laws of movement of nervous processes that enable the conditioned reflexive activity of the brain to occur; despite its many neuro-physiological references, this is essentially a learning theory. According to Pavlov, the adaptation of the behavior to the environment occurs on the basis of the acquisition of conditioned reflexes. As a result of repeated temporal contingency between neutral stimulus (CS) and unconditional reflex releasers (UCS), the organism begins to react to those stimuli without any intrinsic biological significance. Hence, they become first order signals. On the basis of the same physiological mechanisms, a second system of 'signals of signals' can be formed that represents an 'abstraction from reality'. The orienting reflex that controls orientation to new objects plays an especially important part in the adaptation process. The occurrence and interaction of complexes of cortical excitation are countered by central inhibition processes, whereby the external inhibition is produced in that,

simultaneously and during the operation of any (one) centre, some other centre is activated by the stimulation of other afferent nerves or by some other automatic stimulation. As against this, inner inhibition is directly attributed to inhibitory physiological accompaniments of the innervation process. As in the case of generalization of conditioned stimuli, an inhibitory irradiation i.e., an extension of the inhibition to considerable areas of the cortex is also possible.

Operative Conditioning Theory

B.F. Skinner's work elaborated a simple fact of life that Edward L. Thorndike called the *law of effect*: Rewarded behavior is likely to recur. Using Thorndike's law of effect as a starting point, Skinner developed a '*behavioral technology'* that enabled him to teach pigeons such un-pigeon-like behaviors as walking in a figure 8, playing ping-pong and keeping a guided missile on course by pecking at a moving target displayed on screen. Skinner and other operant researchers explored the precise conditions that foster efficient and enduring learning.

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What does Cognitive Approach to Learning Mean?

Clearly, not all learning is due to operant and classical conditioning. In fact, instances such as learning to drive a car imply that some kinds of learning must involve higher - order processes in which people's thoughts and memories and the way they process information account for their responses. Such situations argue against a perspective that regards learning as the unthinking, mechanical, and automatic acquisition of associations between stimuli and responses, as in classical conditioning. Or that it may be a consequence of the presentation of reinforcement, as in operant conditioning.

Indeed, some psychologists view learning in terms of the thought processes or cognition's that underlies it - an approach known as **cognitive learning theory**. Although psychologists using cognitive learning theory do not deny the importance of classical and operant conditioning, they have developed approaches that focus on the unseen mental processes that occur during learning, rather than concentrating solely on external stimuli, responses and reinforcements.

In its most basic formulation, cognitive learning theory suggests that it is not enough to say that people make responses because there is an assumed link between a stimulus and a response due to a past history of reinforcements for the response. Instead, according to this point of view, people - and even animals - develop an expectation that they will receive a reinforcer upon making a response. Support for this point of view comes from several quarters.

In **B.F. Skinner's** (1938) 'descriptive' learning theory, reinforcement is of major importance, yet Skinner does not attribute it to specific mechanisms. According to him, every aspect of the environment that may be said to influence behavior is a possible reinforcer. If the learning process depends on a reinforced association of stimuli and responses released by them, Skinner refers to type S conditioning. Nevertheless, more importance is attached to changes in the probability of the class of behaviors for which no releasing stimuli can be identified. This is referred to as type R conditioning. This obeys the following laws: If the occurrence of an operant is followed by the presentation of a reinforcing stimulus, its strength is increased. In this way, a specific action potential is formed with ordains, e.g. How often and at what speed the action will be performed in future, in which case individual stimuli can assume a controlling function.

Cognitive Learning Theories

This group includes several distinctive approaches that share above all a critical attitude to all S-R models and an emphasis on perception and representation processes. Among the prominent cognitive learning theories is E.C. Tolman's 'purposive behaviorism'. He developed and expanded what he called a 'purposive theory of learning'. His theory de-emphasized Pavlovian conditioning as the prime model for the learning process and replaces that model with what he calls 'sign learning'. In contrast to Guthrie's approach, Tolman's theory stresses the notion that organisms learn relations among stimuli rather than relations among stimuli and responses per se.

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Tolman's Concept of Value and Valence

For Tolman, learning lies in the development of means-end-readiness. Tolman's approach does not require that practice be reinforced for the means-end -readiness to develop; nor does Tolman advocate some particular strong definition of the concept of reinforcement. Yet, he does attempt to account for the fact that positive and negative reinforcing stimuli have powerful effects upon behavior. This, he does through the concepts of value and valence.

If a motive such as hunger is induced by depriving an animal of food, then food as a goal object has positive value for the animal in the sense that it is needed to repair internal deficits produced by starvation. Whether food, in fact, does have positive value for a particular animal could be determined objectively by finding out if the animal will eat food when given the opportunity, or, more generally, by finding out if the animal will repeat behavior that leads to food. In addition to their value, however, goal objects also have a valence. Valence, in Tolman's terms, reflects the 'goodness' or 'badness' of the particular goal object that the animal expects to find at the end of a maze on some particular occasion. If a hungry animal has been rewarded on a number of past occasions with positively valued food, for example, the animal expects something of the particular goodness associated with food to be in the goal box when it begins to run the maze on a new occasion. This expectancy constitutes the valence of the goal object of food on that particular trial.

In Tolman's view, every situation is divided up for the organism by diverse signs that signify the way to specific goals or goal objects. The 'sign' and 'signified' are related spatially (sign gestalt). If the organism possesses no specific sign-gestalt for a given situation, 'expectations' are aroused. These are to be understood not as conscious anticipations but as sign-gestalts formed in earlier, similar situations. According to whether, the route taken on the basis of expectation leads to the goal or not, the expectation and therefore (indirectly) the behavior is confirmed. In this way, when the situation recurs, there is an increased tendency to strive towards the goal with the same class of behaviors.

Two things that distinguish Tolman's approach are his notions concerning the concepts of stimulus and response. For him, a stimulus is a perception; it is an environmental event that is processed by the organism and thus colored by the organisms past history. Tolman does not think of a response as a collection of muscle twitches or glandular secretions. Rather, learned behavior is composed of performances. Performances are acts. They are classes of behavior that are defined in terms of some end result or goals; they are 'patterns of organism - environment rearrangements'.

Critically evaluating the theory we find that in some respects, Tolman's injection of surplus meaning - and his predilection for stringing together with hyphens the words that label the construct (viz., sign - gestalt - expectation, means - end - readiness) - cast, for some, a bothersome aura about his point of view. Besides,

EXPERIMENTAL PERSPECTIVE

Cognitive Maps and their Operation in Latent learning

Some of the most direct evidence regarding cognitive process comes from a series of experiments that revealed a type of cognitive learning called latent learning. In latent learning, a new behavior is learned but is not demonstrated until reinforcement is provided for displaying it (**Tolman** and **Honzik** 1930).

By experiments done on rats, cognitive theorists pointed out that unrewarded rats had learned the layout of the maze early in their explorations; they never displayed their latent learning until the reinforcement was offered. The rats seemed to develop a **cognitive map** of the maze - a mental representation of the spatial locations and directions.

Humans too, develop cognitive maps of their surroundings, based primarily on particular landmarks (**Garling** 1989). When they first encounter a new environment, their maps tend to rely on specific paths - such as the directions we might give someone unfamiliar with an area. However, as people become more familiar with the area, they develop an overall conception of it that has been called an abstract cognitive map. Using such a map, they are eventually able to take shortcuts as they develop a broad understanding of the area (**Gale et al.** 1990).

Unfortunately, though, our cognitive maps are often riddled with errors, representing simplifications of the actual terrain. We tend to develop maps that ignore curving roads and instead conceive of areas in terms of straight grids of intersecting roadways (**Tversky** 1981). Our cognitive maps, then, are imperfect versions of actual maps.

Despite their inadequacies, the possibility that we develop our cognitive maps through latent learning presents something of a problem for strict operant conditioning theorists. Considering the results of Tolman's maze experiment, it is unclear what the specific reinforcement was that permitted the rats that received no reward to initially learn about the layout of the maze, since there was no obvious reinforcer present. Instead, the results support a cognitive view of learning, in which learning may have resulted in changes in unobservable mental processes.

Tolman consistently wrote with a chuckling lurking somewhere in the background, always called his theory programmatic, and was ready to shift a point of view at a moment's notice.

Leaving aside the negligible criticism, Tolman's theory made a major impact. Tolman knew what he was up to, and the cognitive, purposive aspects of his theory are the parts of it that have survived to influence the theoretical side of the psychology of learning as we know it today. Whereas concepts like 'attention' or 'cognition' were taboo in theoretical camps apart from Tolman's at the time Tolman was developing his theory, they label areas of psychology which, years later, are at the very centre of both theory and research.

Theories of Discriminative Learning

Theories of discriminative learning include the algebraic summation theory and non-continuity theory.

Algebraic Summation Theory of Discriminative Learning

This theory is also known as *the Spencer-Hull theory of discriminative learning*. This theory of discriminative learning makes use of the concept of generalized excitation and inhibition that came initially from the works of **Spencer** (1936, 1937, 1952, 1960), though most of the fundamental notions are close to those of **Hull** (1943, 1952).

Spencer and Hull insisted that gradients of stimulus generalization interact algebraically. Suppose that an animal is trained on a discrimination problem by the reinforcement of a response to one stimulus (S+) and the extinction of the response to a second stimulus (S-), then the excitatory effects associated with S+ will

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Discriminative Learning

Organisms come to discriminate among stimuli when they are trained to respond differentially to them. In an empirical, operational sense, discrimination is the opposite of generalization and we can look upon discriminative learning in a general way as the process of breaking down generalizations.

There are many ways to set up laboratory studies of the process by which organisms come to discriminate among stimuli. In classical conditioning Pavlov's dogs also learned to respond to the sound of a particular tone and not to other tones. This learned ability to distinguish between a conditioned stimulus and similar but irrelevant stimuli is due to discrimination. Thus, if stimuli are sufficiently distinct from one another so that the presence of one evokes a conditioned response but the other does not, we can say that stimulus discrimination has occurred. In stimuli discrimination, an organism learns to differentiate among different stimuli and restricts its responding to one stimulus rather than to others.

Just as in classical conditioning, operant conditioning also involves the phenomena of discrimination. The process by which people learn to discriminate stimuli is known as stimulus control training. In stimulus control training, a behavior is reinforced in the presence of a specific stimulus, but not in its absence. A discriminative stimulus signals the likelihood that reinforcement will follow a response.

generalize to other stimuli, and so will the inhibitory effects associated with S-. Now according to this view, the strength of the tendency to respond to any given stimulus is obtained by *subtracting* the strength of the generalized *inhibition* associated with that stimulus from the strength of the generalized *excitation* associated with that stimulus. The ultimate tendency to respond, in other words, is a *net* tendency to respond.

One of the most interesting capabilities of the Spencer-Hull theory is the way in which it can be used to account for a phenomenon in discriminative learning known as *transposition*. Transposition is the apparent ability of organisms to make *relational* discriminations. The Spencer-Hull theory suggests that the occurrence of transposition depends upon factors that stem from the characteristics of generalization gradients, characteristics that can be determined by extent of training, amount of reinforcement and so on.

In summary, Spencer's and Hull's algebraic summation theory places great emphasis upon the gradual accumulation of habit strength and upon the algebraic summation of gradients of generalization based on reinforcement and extinction.

Non-Continuity Theory of Discriminative Learning

Spencer's and Hull's algebraic summation theory places great emphasis upon the gradual accumulation of habit strength and upon the algebraic summation of gradients of generalization based on reinforcement and extinction. In general, this theory has been contrasted with one which emphasizes on the problem - solving behavior of organisms in discriminative learning. This is generally called a *non-continuity* theory because it implies that learning a discrimination is not a continuous accumulation of positive and negative habit strength, or the like. The essential idea is that organisms try out hypotheses about the discrimination problem they have to solve, now paying attention to one aspect of the problem, now to another, trying out this hunch, then that one, and so on. Eventually, the problem is solved—perhaps all at once—as the result of a more or less strategic attack upon it. Obviously, the strategies that are available depend to a great extent upon the inherent capabilities of the learning organism.

The notion that in problem solving a succession of strategies or hypothesis is adopted has been advanced by many investigators (**Krechevsky** 1932; **Lashley** 1938, 1942; **Lashley** and **Wade** 1946). The non-continuity

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Comparative Evaluation of the Algebraic Summation and Continuity Theory of Discriminative Learning

The theory of discriminative learning makes use of the concept of generalized excitation and inhibition. Spencer and Hull insisted that gradients of stimulus generalization interact algebraically. In summary, Spencer's and Hull's algebraic summation theory places great emphasis upon the gradual accumulation of habit strength and upon the algebraic summation of gradients of generalization based on reinforcement and extinction.

In general, the non-continuity theory has been contrasted with one that emphasizes on the problem-solving behavior of organisms in discriminative learning. This is called a non-continuity theory, because it implies that learning a discrimination is not a continuous accumulation of positive and negative habit strength, or the like. The essential idea is that organisms try out hypotheses about the discrimination problem they have to solve, now paying attention to one aspect of the problem, now to another, trying out this hunch, then that one and so on. Eventually the problem is solved - perhaps all at once - as the result of a more or less strategic attack upon it.

On evaluating the two theories, we can say that the continuity theory is correct in asserting that animals can be trained to have positive responses to certain stimuli without comparing these stimuli with others on the same sensory continuum. On the other hand, there are abundant data to show that animals do not react simply to stimuli, any stimuli that come within range; they are selective in what they attend to. Furthermore, there is good evidence that animals test 'hypotheses' about the nature of a problem and that they can behave in a relational manner if we present them with a problem which, in a more or less obvious way, leads then to respond relationally. Thus, both the theories operate hand in glove as far as the operational mechanism of discrimination is concerned.

theory has never been entirely expressed by one author, and many more points than the simple one about hypotheses have been made. Lashley, for example, has emphasized on the momentary attentional set the animal may have in perceiving a portion of the stimulus field in front of it by the experimenter.

It is impossible to say as yet to what extent the development of learning theory will be determined by the progress in applied learning research connected with behavior therapy, instructional technology, etc. A solution of the basic problems of learning theory seems as little to be hoped for from this source as from a greater formalization of propositions. It is still an open question whether approaches to date, adequately represent and explain human adaptation processes.

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Behavior Modification: An Application of Learning Theory

Behavior modification is a generic term referring to the applied use of behavioral psychology to bring about changes in human behavior by workers in the helping professions - clinical and educational psychologists, social workers, teachers, etc. Based on Skinner's operant conditioning paradigm, its central tenet is that behavior is primarily learned and maintained as a result of an individual's interaction with his environment, which includes other individuals, and is hence susceptible to change, by control over features of that environment. The three-term analysis of behavior (or ABC model) indicates that behavior change can be achieved

by manipulating either the antecedent conditions for behavior, or the consequences following behavior, in line with the law of effect. Simply stated, this means that rewarded behavior will tend to increase in frequency, while behavior followed by punishing consequences will tend to decline.

Using the basic principles of learning theory, behavior - modification techniques have proved to be helpful in a variety of situations. Behavior modification has also helped people to loose weight, give up smoking, and behave more safely.

The techniques used by behavior analysts are varied as the list of processes that modify behavior. These include: reinforcement scheduling, shaping, generalization training, discrimination training and extinction. Participants in behavior-change program do, however, typically follow a series of similar basic steps. These steps are: identifying goals and target behaviors, designing a data - recording system and recording preliminary data, selecting a behavior-change strategy, implementing the program, keeping careful records after the program has been implemented and finally evaluating and altering the ongoing program.

Behavior-change techniques based on these general principles have enjoyed wide success and have proved to be one of the most powerful means of modifying behavior (**Greenwood et al.** 1992). Clearly, it is possible to employ the basic notions of learning theory to improve ours and others lives.

Other Theories

Current theories afford a hardly more unified picture, although the inclusive theories of behavior have been replaced by models with less applied claims to validity. Significantly, these new theories are no longer advertised as 'learning theories'. Apart from the attempts to modify and extend older systematic approaches, theoretical efforts in the learning field are at present characterized by restriction to a systematic treatment of part areas, as, e.g. in 'miniature' models (**Bower** 1962); a tendency to an increased formalization of approaches, whether in the form of probabilistic learning models (**Atkinson** and **Estes** 1963), or as attempts to stimulate learning processes (**Feigenbaum** 1963); and more consideration of up to now neglected or inadequately examined learning mechanisms: examples in this regard are the recent theoretical approaches to the phenomenon of social learning (**Bandura** and **Walters** 1967), but also the more intensive interest in memory processes proper.

VERBAL LEARNING

The study of verbal learning is different from that of what we have seen in conditioning. In the conditioning experiments, the subjects of our study were various animals upon whom experimentation was done. In the study of verbal learning, only human subjects are used as it involves the use of language. The term 'verbal learning' denotes a field of enquiry in which focus of interest lies in the phenomena and the processes by which individuals come, through practice, to link two verbal items together (*paired – associates learning*: In experimental investigation of learning, items (words, nonsense syllables, numbers, etc.) presented in pairs with one as the stimulus item, the other as the response item. The subject's task is to learn to give the appropriate response term when presented with the stimulus item), to learn sequences in which a set of verbal items occurs (*serial learning*: The learning of items in a prescribed order. The serial-order method is frequently utilized in the rote learning of non-sense syllables), to differentiate between verbal items (*verbal discrimination learning*: verbal learning in which one has to make choices or judgments between two alternatives i.e. learn to differentiate between verbal items), or to recall a set of items without regard for the order in which they occurred originally (free *recall*: to recall a set of items without regard for the order in which they occurred originally).

Most of the methods experimental psychologists have used to study verbal learning are associative in nature. Associations are relations, and so this means that the basic technique of learning in the laboratory

is to teach subjects the relation among elements of various sorts. These elements may be words, *nonsense syllables* (a pronounceable combination of letters that do not make meaningful words. They were first devised by Hermann Ebbinghaus), letters, numbers and sometimes whole sentences and connected discourse. The methods of verbal learning in the laboratory are associative in another narrower meaning as well. They originated in a theory of learning that asserted that the basic principle in all learning is association by *contiguity* (the coexistence or proximity, in time or space, of different experiences. The law of contiguity states that when events occur simultaneously or in close proximity, they are then associated, which is a precondition for learning). That means that one element comes to be related to another, simply because they have been perceived together. Therefore, the oldest techniques of learning in the laboratory are simple ways of presenting verbal items to subjects in temporal contiguity.

In order to study the process in verbal learning, investigators have used two principle kinds of variations: the nature of the material given to the subject to learn and the method of presentation and practice.

Materials In The Study of Verbal Learning

1. **Nonsense Syllables**: These were first used by German experimental psychologist **Hermann V. Ebbinghaus** (1885). Ebbinghaus believed that the nature of verbal learning consisted of association by temporal contiguity of ideas. These ideas could later be remembered if one of them could elicit all the other associations that were made in the first place by *rote practice* (memorizing in which little or no understanding of the material is required. Memorizing a list of nonsense syllables illustrates rote learning).

   Ebbinghaus reasoned that the ordinary words that carried the meaning of ideas would be for adult subjects in the laboratory, be associated with countless other words, simply as a result of ordinary experience. He wanted to study how new ideas were acquired and so he argued that he could not use ordinary German words because there would already be too many associations among these words. Learning and retention of material learned in the laboratory would be contaminated by relations learned outside the laboratory. Therefore, Ebbinghaus formed words that he thought would be totally meaningless and devoid of associations by combining all the possible consonant-vowel-consonant (CVC) combinations that did not make real German words. These are referred to as CVC nonsense syllables. Some examples of CVC's are FAH, YER, ZID, KOS, JUC, PAH, WEK, RIF, JOX and YUB.

   Within nonsense syllables, there are two characteristics that make them vary in ease with which they may be learned and associated with one another. One of these is their internal structures and the other is their presumably previously learned relations with other items. All kinds of material used in verbal learning experiments have internal structure. Nonsense syllables certainly have different kinds of internal structures.

   The earliest attempt to assess the learnability of nonsense syllables is the measurement of association value (a property of nonsense syllables and other materials that are themselves meaningless of being, to varying degrees, suggestive of meaningful words or ideas) by Glaze (1928). Glaze showed a large number of nonsense syllables one at a time to subjects and asked them to indicate whether or not each syllable produced an association or not. Glaze's procedure was casual and he used only 15 subjects. He investigated to say that his measurements proved to be reliable and valid predictors of all kinds of measures of the comparative speed of learning and retentive qualities of nonsense syllables. The percentage of subjects reporting an association to a given syllable will predict how many repetitions are required to combine that syllable with other syllables in serial learning. **Archer** (1960) made the most extensive study in this field.

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Association Values and Nonsense Syllables

The concept of association value was first given by **Glaze** (1928). Nonsense syllables are not devoid of meaning. They are most certainly not uniform in the ease with which they may be associated with one another in rote practice. Two characteristics that make them vary in the ease with which they may be learnt and associated with one another are (a) internal structure and (b) previously learned relations with other items. For example: BEK is more structured than XYF since BEK is associated and related with BIC pens.

2. **Meaningful Words**: This term comes from the idea that more associations a given verbal item arouses, the more meaningful is that item. In most measurements of meaningfulness, people are asked to list all the associations they can think of with a word in a given period of time, say one minute. Some examples of meaningful words are DOOR, HOUSE, JOKE, ARMY, SHOE, ECHO, LUCK and DISH.
3. **Relationship Among Items**: One of the most commonly used techniques to establish the pre-existing relations people may have among words that will help them in learning a new task is testing for association. In a *free association* (conditions in a word-association test where no restrictions are put on the nature of the subject's response and the reporting of whatever comes to the mind of the person being analyzed, regardless of how painful, embarrassing or irrelevant it might seem) test, a person is given a stimulus word and asked to reproduce the response to it. The relative frequency with which particular responses are given is taken as a measure of the strength of the association (**Cramer**, 1968 and **Cofer** 1971). One of the largest collections of norms of free association is that published by **Postman** and **Keppel** (1970).

Methods of Research in Verbal Learning

There is a puzzling array of conditions under which subjects have been taught verbal materials in the laboratory. They are as follows:

1. **Free Recall**: The simplest way of testing the effects of subjects studying some set of verbal materials is to ask for free recall. Free recall is a way of saying that subjects can recall the items presented to them in any order they wish. The way in which they actually recall the material depends upon the material. **Murdock** (1962), in an experiment, found that the probability of recall of individual items is a function of their position in the list. This is one of the most important finding as far as the characteristics of immediate free recall is concerned. He found that the items at the end of the list were recalled better (*recency effect*) and those at the beginning of the list next (*primacy effect*). The items in the middle of the list were recalled the least. These results were independent of the list size used. However, variation in terms of serial position is dependent upon the nature of practice (*rehearsal*) (Refer rehearsal in chapter on memory).
2. **Serial Learning**: The earliest experiments on verbal learning were experiments on serial learning. **Ebbinghaus** (1885) used what has come to be known as the method of complete presentation. That is to say, he spread the complete set of materials out before himself, before he began to learn them. He read each word only once at the stroke of a *metronome* (a device for making off short periods of time, usually by means of a pendulum which produces an auditory click at the end of its arc) and tried to

associate it with the next item so that, when given any simple item, he would anticipate the next one. Thus, despite the method of complete representation he learned by serial anticipation.

Serial anticipation produces some interesting and complicated effects in learning that reveal something of the nature of the processes people go through when they try to associate verbal items together. In contemporary experiments, the method of complete representation is seldom used. Instead, the subject sees one word at a time. When the subject sees one particular word exposed, he is to try to guess or anticipate what the next one will be. Thus, each item serves as a stimulus for the recall of the next.

Figure 6.6 shows the typical results from an experiment in serial anticipation. It shows the number of correct responses during practice of a list to mastery as a function of items in the list. The largest numbers of correct responses are made at the beginning of the list, the least just slightly past the middle and the correct responses found at the end of the list are as much as those of the beginning.

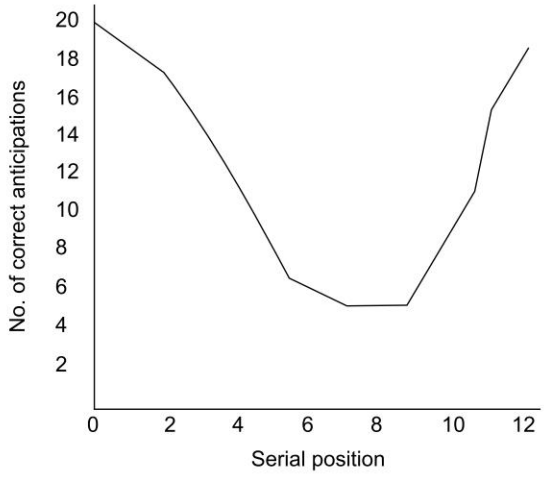

Fig. 6.6 Serial Anticipation

3. **Paired Associate Learning**: This is the most common method of presentation used in the laboratory. In this method, the subject is asked to learn that when he sees or hears one item, he is to respond with another one that is associated with it. This is called the anticipation method in paired associate learning. An alternate method is the study-test or recall method. In this procedure, each trial consists of two parts. In the first part, the pairs are presented and the subject responds by pronouncing or spelling them. In the second part, the stimuli are presented alone one by one, usually in a new order and the subject is asked to recall the responses for each one.

   Irrespective of diversities of procedure and material, we can reach to three generalizations: *Firstly,* pairs with an average meaningfulness or association value are learnt rapidly than those pairs with lower meaningfulness or association value. *Secondly*, learning is a positive function of stimulus meaningfulness or association value, as well as response meaningfulness or association value being, more rapid for higher values of these measures. *Thirdly*, earning seems to be more influenced by response meaningfulness or association value than by stimulus meaningfulness or association value.

   Some examples of stimulus response pairs are MUW – BULL, DIV – LAMP, DAX – COAL, BEM – TIME, RUL – GOLD, KER – NAME, GEN – LOOT, LUR – ROOF and JIT – LION.

4. **Verbal Discrimination Learning**: In this type of procedure, a series of verbal items is presented, usually visually, and the subjects are asked to learn which member of the pair is 'correct', i.e. the one arbitrarily selected by the experimenter as the right one. Little work has been conducted concerning the relation between meaningfulness or association value and verbal discrimination learning. What there is has not indicated an important relationship. **Keppel** (1966) found no significant difference in the number of trials subjects required to learn a list of 12 words and a list of 12 CVC's taken from the range of 34-37 percent association values in Archer's scaling.
5. **Other Methods**: There are of course an endless number of methods of presentation that might be employed in the laboratory. New methods are developed all the time; then, there are a whole battery of methods that have been invented primarily for the study of retention. Among these are the various tests for short-term memory and tests for recognition memory.

Determinants of Verbal Learning

Researches have found a number of factors that play a significant role in the determination of verbal learning. These factors are as follows:

1. **Meaningfulness**: It is of common knowledge now that more the meaningfulness of an item, the more readily and easily it is learnt. **Ebbinghaus** (1885) in his experiment came to the conclusion that as the meaningfulness (m) of the item in the serial list increases, the list requires fewer trials to learn. In free recall experiments, it was found that meaningfulness is positively related to the amount recalled. In paired-associate learning experiments also, it was found that pairs with an average meaningfulness are learnt more rapidly than those pairs with lower meaningfulness values. **Noble** (1952) found that as the

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Two-stage Theory of Verbal Learning

Underwood and Schultz (1960) have followed the lead of other writers in suggesting a two-stage interpretation of verbal learning: *Response Integration Stage* and *Hooking up Stage*. In the *response integration stage*, the subject must identify the response terms with which he is to deal and further in the case of unlikely combinations of letters, that letters go together in a required order. The idea is that some of the subject's learning time must be devoted to learning the composition of responses before these responses can be linked, as in paired associate learning, to their stimuli.

The second stage in learning is the linking of responses to stimuli. This is referred to as the '*hook-up*' or '*associative stage*'. However, the impact of these two stages (response integration and hooking up) might overlap but the postulates of these two stages remain the same - verbal learning seems to be useful because it explains a greater effect of response meaningfulness than stimulus meaningfulness in paired-associate learning. A well-integrated response could be available of association to its stimulus much quicker than a poorly integrated response. In verbal discrimination learning, however, neither item must be produced. Meaningfulness has little effect in this situation. The greater availability of items with high meaningfulness is probably shown in the influence of meaningfulness in free recall and in serial learning.

Underwood and Schultz have suggested that meaningfulness, association values and scaled meaningfulness and other variables such as frequency of occurrence, familiarity, pronounciability, etc. are related to learning scores because they help in indexing response integration of items at the time an experiment in verbal learning started is due to the learner's prior experience with the language. It is however, not possible to classify just what features of this experience are the critical ones so far as the response integration is concerned.

meaningfulness of items increases, lesser time is required for learning. **Underwood** (1964) observed that higher the meaningfulness, more rapid is the learning.

2. **Frequency**: Learning and retention is also influenced by the frequency with which the particular words are encountered. In a study by **Hall** (1954), it was found that the subjects recalled those items better that they frequently heard or saw. In another study, **Underwood** and **Schultz** (1960) found that the frequency with which words have been experienced determines their availability as responses in new associative connections.
3. **Recency**: **Murdock** (1962), in an experiment, found that the probability of recall of individual items is a function of their position in the list when free recall is used. Along with other things, he found that items at the end of the list are recalled better as compared to the ones in the middle of the list. This is due to the recency effect. This occurs if we reason on the basis of the information processing theory, because at the time of recall this information (last item in the list) is available in the sensory register and is recalled immediately from there.

   Another aspect of recency is, if the time interval between presentation and testing is increased, there will be a decline in recall. Less the time interval, better the recall, keeping aside other aspects.

   Another aspect of recency is that of the '*selector mechanism'*. This is a tendency of not making an error by presenting an item that is not present in the list. The suggestion for such a response is that this response is the outcome of recency. The 'selector mechanism' provides a set to respond from a restricted pool of items. This set disappears as the length of time interval between presentation and recall is increased.
4. **Similarity**: There is a close relationship between similarity and generalization. During the course of learning, when the stimulus is attached to a response and thereby learnt in that manner, we at the same time develop a tendency to make the same response to similar stimuli. However, a point to be noted is that if the stimulus items are similar to each other, the learning task gets difficult because of inter-pair generalization. This has been demonstrated in studies done by **Underwood** and **Schultz** (1959). In a study, Hull found that similarity between stimulus and response hinders the association between them, rather than the learning of discrete responses.

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Clustering

Clustering occurs in free recall when words belonging to same conceptual category follow one another in the order of recall more often than they should by chance. **Bousfield** (1953) who discovered the effect, argued that clustering was the result of words making subjects think of the category name and the category name, in turn, making the subjects think of another word from the list they had just heard that belonged to the same category. This process has sometimes been described as *mediation through superordination*. To take a particular example, a subject may remember that cat is on the list; the word cat leads to the mediating concept, animal, and that in turn, helps the subject to remember that dog was on the list. Therefore, in recall dog will be remembered right after cat, even though they were widely separated in the list presented to the subject.

Mediation: Sometimes two things are associated together by showing something else in common. When such association occurs, mediation is said to have taken place. The principle of mediation asserts that association between elements **A** and element **B** occur because they are both associated with **C**. The third term bridges the gap between two terms that otherwise would be unrelated. The principle of mediation was more important when association theory dominated the study of verbal learning. However, there is no denying that mediation takes place and is important in learning.

5. **Imagery and Concreteness**: The role of imagery in learning is an important one. When one learns verbal material, one learns by forming images of it. What is of importance is the image arousing capacity of the verbal material. Words for which images can be formed easily are referred to as *concrete*, and for which images are difficult to form are called *abstract* (**Paivio** 1965, 1971). In an experiment on memory, Paivio found that learning in a paired-associate task showed better recall for pairs when the stimulus word was concrete and also when the response term was concrete, as compared to recall where either the stimulus term or response term was abstract. These findings hold solid ground in case of learning as well as memory, since basically what is being learnt goes into memory.

   Further studies by **Epstein**, **Rock** and **Zuckerman** (1960) found that in learning, the concreteness of the stimulus is more of importance than the concreteness of the response term. In another study by **Paivio, Yuille** and **Mudigan** (1968), the role of concrete stimuli in facilitating verbal learning was highlighted.
6. **Motivation**: Where there is a will, there is always a way. This holds true for verbal learning as well. Studies have shown that motivation plays a significantly important role in verbal learning. Prominent among these studies are those done by **Deese** and **Hulse** (1967), who have on the basis of experimental evidence shown that motivation influences the amount of casual learning. In another study done by D'Amato, the motivational role played by instructions given to the subject before a verbal learning task is highlighted. Amount of learning increases as a result of instructions given before the learning task. These instructions served as an incentive and the subject was thereby motivated to do better. However, not all studies have born positive results on the role played by motivation in verbal learning. In studies done by **Harley** (1965) and **Weiner** (1966), it was found that verbal learning is least influenced by the magnitude of reinforcement.

CONCEPT LEARNING

The dictionary tells us that a concept is a thought or an idea. Firstly, we will deal with the question related with the acquiring of ideas. Our perceptions are meaningful impressions that the world makes upon our senses, while our thoughts are activities that can go on independently of the external impressions of the moment. The learning of both *perceptual* and *cognitive concepts* depends upon the way in which we organize the components to make *unitary concepts*, and that dependence is the most significant aspect of concept learning.

PSYCHOLOGY NUGGET

Important Characteristics of Features

1. Features cannot exist in themselves.
2. Features always exist in more than one state.
3. Features must always exist in different states.
4. Features are practically endless in numbers.
5. Features usually contain other features.
6. Features are plainly organized in a hierarchy.
7. Features are not fixed but are the result of the active operation of human mind.

Concepts and Concept Identification

A concept is a set of features connected by some rule. In order to make sense out of this definition, we must first know what is meant by '*feature*' and '*rule*'. A feature is any aspect of an object or event that can be abstracted from that object or event and be said to be identical to the same feature abstracted from any other object or event. Buffalos in India are black. Black then becomes a feature of the Indian Buffalo. It is also a feature of other objects, for example steam engines or even automobiles. We can define features as precisely or loosely as we choose. Some important characteristics of features are highlighted in the box.

The other part of the definition of concept concerns the nature of rules. A rule is an instruction for doing something. Some rules are *heuristic* (serving to find out or to stimulate investigation) and some are *algorithmic* (a technique of problem solving that involves the specification and tryout of all possible solutions). The heuristic rules are general principles that apply with discretion. Algorithmic rules are precise and they apply automatically and blindly. Both these processes occur in human thinking. Thus, it is now quite clear that there are at least two components in learning new concepts. We must come to identify the features and we must learn how these features are connected by rules. These two components usually go together in the process of learning.

Experimental Materials In The Study of Concept Learning

Artificial Stimulus Material: For concept learning, it is necessary that the subject differentiates between the stimuli given. The stimulus is differentiated on the basis of its different dimensions. Occasionally, investigators of concept identification in laboratory experiments will have subjects learn to identify concepts from ordinary experience. More often, however, investigators invent artificial concepts. These have special properties that enable us to tease apart and control various aspects of the processes in concept learning. In Fig. 6.7, drawn in the box, is some material that might be used in the laboratory experiment on concept identification is shown.

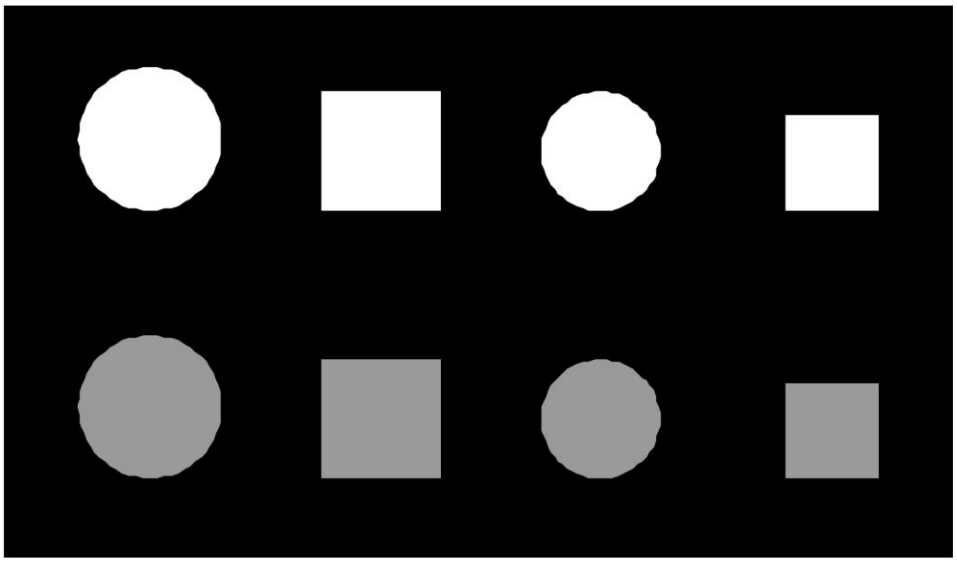

Fig. 6.7 Stimuli that can be Used in a Concept Learning Experiment

Each panel in the figure contains an example of a possible concept. These exemplars have been constructed by making all possible combinations of three binary features. Binary features are ones that can exist in only two possible states. One feature is *shape* and the other is *size*. Finally, all exemplars are of one or two colors, i.e. grey or white. There are eight possible objects or exemplars in this conceptual universe. Thus, two sizes × 2 colors × 2 shapes. This produces 8 stimuli. A given concept from this universe will consist of some subset of all possible combinations. One concept, for example, is defined by the *affirmative rule*; the concept consists of all square things. Exactly half of the objects in this universe will be examples of this concept since half of the objects are square. Another concept might be defined by the *conjunction* of size and shape. One such concept consists of all square things that are small. The subset of objects defined by this particular concept is smaller than the affirmative concept. It consists of only two *exemplars*. Still another concept might be defined by the inclusive *disjunction* of objects that are either gray or round or both. Here, six out of the eight possible objects are exemplars of the concept. There is one important point that all objects can be members of more than one concept. In fact, the number of possible concepts in such a universe is greater than the number of objects. It is seen that for some concepts, some features will be relevant and others will be irrelevant. Relevant attributes are those mentioned in the rule defining the concept, while irrelevant attributes are all the remaining ones in the universe.

Natural Stimulus Material: For the study of concept, the materials of daily life are also used, their figures may be used for this purpose. These articles must be well-acquainted with the subject and they must be natural. This stimulus being well-known to the subject seems to have hard characteristics for it is difficult to differentiate between their dimensions and dimensional values. Their relevant characteristics make the concept of learning easier but their irrelevant characters make concept learning difficult.

A number of psychologists have used words, instead of figures, for their experiments and natural articles for examples: Himalaya, Ganga, Cloud, Sun, Sahara, Strom, Sugar, Volcano, Road, Agra, etc. These words, given in the example, can be differentiated into two blocks—*naturally originated* like Himalayas, volcano, Ganga, etc, and *man-made* or *artificially produced* like sugar, road, Agra, etc.

Concept-Attainment Experiments

There are two general classes of experiments in concept learning. One of these uses a **method of reception** and the other, a **method of selection**. In both kinds of experiments, subjects are exposed to objects or pictures of objects like those given in the box above. The subjects guess which objects are examples of the concept, and from this information they try to form an idea of the objects that form the concept as well as of the rule that defines the concept. The way in which this is done, however, differs between the receptive and the selectional paradigms.

Method of Reception (Response Method): In this method, the subject is presented with each successive object, and he makes some decision as to whether it is an example of the concept or not. He then is told whether his decision is correct or not. The important feature of the receptive paradigm is that the selection of each example presented to the subjects is in the hand of the experimenter. Thus, if the subject has a particular hypothesis about what the concept is which he is to learn, he may not be able to test that hypothesis until a relevant object comes along.

There are several ways of doing a receptive experiment. In the simplest form, the subject learns just one concept, and he may indicate that concept by saying 'yes' or 'plus' for objects that he thinks are examples of the concept and saying 'no' or 'minus' for those objects that he thinks are not examples of the concept. In more complicated cases of the receptive experiment, subjects may have to associate nonsense names with each object. The set of objects will be divided up into a number of mutually

exclusive subsets, each defined by some concept rule. This is a more difficult task because the subject has to learn several concepts instead of just one. Other variations of the receptive paradigm ask subjects to sort objects or otherwise indicate how objects are to be distributed among concepts. These are minor variations; the important property by of the receptive method is that the subject has no control over the order in which he receives exemplars.

Method of Selection (Identification Method): This method, as by name, allows the subject to select which object he will test as an example of the concept on each trial. The best-known experiment using the selective paradigm is shown in Fig. 6.8. In this set of objects, there are four features: shapes, color, number of objects and number of borders. Since each feature exists in three states, there are 3 × 3 × 3 × 3 or 81 objects in all. The subjects in this experiment are told that various combinations of objects would define concepts and it was the task of the subject to find out what the concepts were by choosing various objects as examples of the concept. Of course, a subject's initial choice is presumably a random one and in that respect is not very different from being presented with an initial object by the experimenter. Thereafter, however, the subject can choose his own example in order to test various hypotheses. That is precisely the advantage of the selective paradigm. It enables us to make inferences about what hypothesis the subject have in mind by following the choices they make.

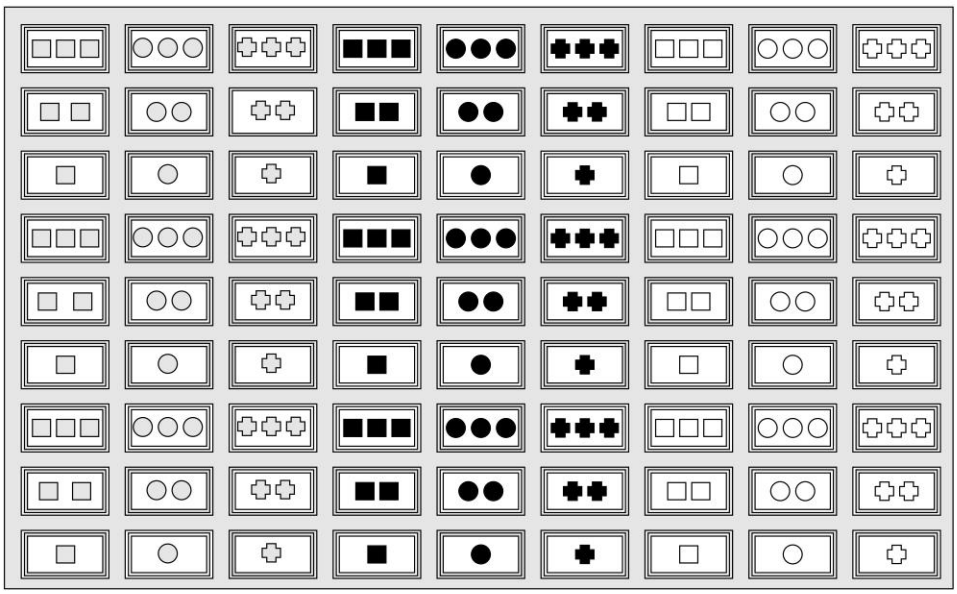

Fig. 6.8 An Experiment Using Selective Paradigm

In summary, we can say that it is in terms of concepts that human beings organize their environment. Concepts are mental categories. They are of two types, i.e. well- defined and ill-defined. The well-defined concepts are artificial and used in sciences and technologies. They are defined as 'a set of features combined by some rule'. There may be some rules of which the conjunctive rule is often made. Such concepts are learned either by the selection method or by the reception method. Learning of such concepts is influenced by the nature of rule, number of relevant and irrelevant features and perceptual properties of the exemplars.

PSYCHOLOGY NUGGET

Perceptual Learning

Perceptual learning refers to an increase in the ability to extract information from the environment as a result of experience or practice with stimulation coming from it. Perceptual learning is a variety of the cognitive learning. It is also involved in determining what the focus of attention is. Perceptual learning indicated that perception can be modifiable or *plasticity of perception*. Gibson gives a number of examples to illustrate this phenomenon. She cites the competence of people who are trained to various occupations to make perceptual distinctions that untrained people cannot. Skill or artistry in many professions is based upon facility in making such subtle distinctions. Distinguishing the calls of birds by trained ornithologist is one of Gibson's examples. Another example of perceptual learning is illustrated by the remarkable feats of blind people. Blind people learn to extract from the environment information that sighted people do not ordinarily use.

PSYCHOLOGY NUGGET

How Do We Learn Everyday Concepts Without Learning Rules?

How do we learn everyday concepts like if we do not learn a set of defining rules? **Rosch** (1977) has suggested that after extensive experiments with members of a category such as birds, we gradually learn what most birds are like. This includes things such as their average size, their most usual coloring, their common behavior patterns and everything else about them that is *birdlike*. It would *not* include such things as having two eyes or warm blood because lots of other kinds of animals have these features too. Thus, we learn what most birds have in common with one another and what most birds have that other kinds of animals do not. This enables us to distinguish between birds and all other animals that are not birds, and also gives us a notion of what a typical bird is like. Our concept of *bird* then is the sum total of what we have learned about birds and about other kinds of animals.

NEUROPHYSIOLOGY OF LEARNING

Psychologists, since long, have assumed that during the learning process some kind of structural change occurs in the central nervous system of the organism. However, now there is clear evidence available regarding what these changes may be and where they occur. It is important to first know about the early work done in this area because they were the foundations upon which the present researches were done and firm conclusions made.

Earlier Researches: The early investigators tried to locate a 'trace', which they hypnotized, had been left by learning. This belief of theirs was based on the fact that since the structure of RNA (ribonucleic acid) molecule is similar to that of the DNA (deoxyribonucleic acid) molecule that encodes genetic information they hypothesized, the RNA molecule might encode memory traces as the genetic molecule does hereditary

EXPERIMENTAL PERSPECTIVE

Early Experiments

Rats were trained to approach a food cup when a click was sounded. The RNA was extracted from their brains and injected into the bellies of untrained rats. The untrained animals thereafter had some tendency to go to the food cup when the click was heard (**Babich**, **Jacobson**, **Bubash** and **Jacobson** 1965).

In a second experiment, one group of rats was trained to respond to a click, another to a light. The RNA from the two groups was injected into untrained rats. On the average, the 'click-injected' rats oriented somewhat more to click than to light and vice versa, though neither group showed a clear tendency to respond to either stimulus. The 'injected memory' took a few hours to take effect and faded gradually in an untrained animal unless reinforced by training (**Jacobson**, **Babich**, **Bubash** and **Jacobson** 1965).

traits. Earlier, studies done on rats in this regards by **Babich**, **Jacobson**, **Bubash** and **Jacobson** (1965) lend support to this hypothesis. Findings from these studies and other studies make us come to the conclusion that there is a high possibility of chemical changes occurring during the process of learning. However, in later researches such evidences could not be given much support (**Gross** and **Carrey** 1965; **Luttges**, **Johnson**, **Buck**, **Holland** and **McGaugh** 1966). Despite the lack of support from other researches during that period, there was one research done by **Plotkinoff** (1966) which provided preliminary evidence suggesting that an increase in the production of RNA may be accompanied by improved performance of a learned task. This finding was doubted with the assumption that the drug magnesium pemoline injected in the rats for increase in the production of RNA is a stimulant and thereby resulted in improved performance.

Brain and Learning: Where Does it Take Place?

Earlier researches (**Forbes** and **Mahan** 1963) done were to answer the question as to whether the spinal cord itself with no help from the brain was sufficient for learning – could learning take place if the connections with the brain were served so that only the spinal cord and peripheral nerves were involved. The resultant

EXPERIMENTAL PERSPECTIVE

Experiment Demonstrating Separate Action of the Two Processes of Memory

Animals were trained to leave a starting box to avoid a mild shock to the feet. Only one trial per day was given and each trial was followed at some interval from a few seconds to several hours with an electric shock through the brain, strong enough to cause a seizure. During such a seizure, many of the nerve cells of the brain are thrown into a temporary chaotic discharge. The development of the habit was not interfered within the least if sufficient time (one hour) separated the trial and the brain shock. When the seizure followed the trial in less than one minute, however, there was very little recall of the avoidance training on subsequent trials. In these latter cases, whatever was learned about avoiding the mild shock during the initial daily trials was evidently prevented from being stored permanently (**Duncan** 1949).

of such studies for conditioning experiments showed that the spinal cord was not capable of carrying out a true conditioned reflex. After such findings, the next question that needed to be answered was whether the sub-cortical areas of the mammalian brain were sufficient for learning. Researches done in this context (**Culler** and **Mettler** 1934) had previously shown that some learning ability was evidenced in animals deprived of all cerebral cortex but responses were slowly acquired and were gross, involving only widespread thrashing types of movements.

Evidence so far had shown that in dogs and presumably in animals above them on the phylogenetic scale, the cerebral cortex was essential for precise learning. These evidences put to question the role of the sub-cortical structures and a more plausible formulation was theorized stating that though cortex plays an important role for fine discrimination of sensory input and minute adjustments of motor output but that the sub-cortical structures provide the switchboard effect which is a minimum requirement of simple CR learning. This however, does not hold true for all species. The pigeon that has little true cortex and the fish that has none at all, can learn to discriminate between visual stimuli and respond rapidly and well. In higher animals and man, with their ample supply of true cortex, it is becoming increasingly clear that a number of sub-cortical structures contribute substantially to the execution of learned acts. There is good evidence that one sub-cortical structure, the *hippocampus*, is crucial for recent memory.

What was the exact role of different parts of the cortex remained to be investigated. **Lashley** (1929, 1950), using instrumental conditioning and ablation techniques, had reached a conclusion which then was unacceptable. He had stated through these research findings that a learned connection was not localized in any one place. In fact, he had demonstrated that a learned response did not depend on any simple cross connection between sensory and motor areas. Latter experiments conducted on monkeys done by **Sperry** (1947) supported this view. By now, it was quite clear that in some manner a large expanse of the cerebral cortex together with its connections to other parts of the brain was involved in the learning of even a very specific response. Further, researches have also shown that some type of sensory and motor learning involves not only the sensory and motor areas, but also areas located elsewhere in the cortex. All this researches done way back in the past had been indicating quite apparently that simple reflex like connections are not adequate to explain the observed facts, and there is not a simple connection existing between a conditioned stimulus and an unconditioned response. The role of the frontal lobe has also been investigated by **Jacobsen** (1936) and experimentations on monkeys have lead him to conclude that there is another part of the brain quite remote from the areas directly serving sensory or motor functions that is vital to the performance of complex learned responses. Investigators, however, differ as to whether the function of the frontal lobe is that of short-term memory storage or preservation of the process that has been initiated (**Warren** and **Akert** 1964). These various findings suggest that the picture of stored memories as individual synaptic connections is too simple. It seems evident that the effects of learning may be transferred from one region to another and may be stored in a number of places.

Learning and Memory

Learning is directly related with memory because learned information is stored in memory and the measurement of learning is achieved by the information retrieval from memory hence it is pertinent to know first as to where memory is stored (*refer chapter on memory for detail*). Investigators speak of an *engram* or *memory trace* (a hypothetical memory trace or a hypothetical trace left in the nervous system as a result of learning. The concept of the engram is employed to account for retention) as that which occurs in the brain when learning has taken place. Interestingly, however, it has been found that engram formation does not ensure long-term engram storage. The process by which information is temporarily held as it is being acquired is evidently quite different from the process by which it is permanently stored in the brain (**Hebb** 1949).

Experimental research has confirmed this 'two-process' theory of memory. The first process, the formation of the engram and its temporary storage, occurs during the learning trials; it lasts only for a brief period, however, and the engram is lost unless the second process occurs, in which the memory trace is permanently stored. The hypothetical process by which the fragile and unsustained 'recent memory' process is converted to long-lasting memory storage is called *consolidation* (the hypothetical continuation of the neurophysiological activities involved in learning after the cessation of practice. The necessity for assuming consolidation of some sort is based on the facts of retroactive inhibition and retrograde amnesia (2) the hypothesis that learning occurs in two phases, an initial short-term phase which, through practice or repetition, is converted into long-term memory). Experiments have also demonstrated the separate action of the two processes and have clearly show that the effect is truly due to prevention of consolidation, and not just to a general disruption of behavior (**Heriat** and **Coleman** 1962; **King** 1965)

EXPERIMENTAL PERSPECTIVE

Experiment Showing Prevention of Consolidation

Two separate studies produced the same results, in each a thirsty rat learned to run through an alley to reach water. Then, on a single trial, a strong shock was administered to his foot, suppressing the alley running behavior. This was followed by a strong shock to the brain. It was reasoned that if the shock to the head interfered with a consolidation process, the rat would not remember the foot shock the next time he was put in the maze, and thus would show no avoidance behavior. If fear of the head shock was a factor, however, the rat would be expected to show pronounced avoidance behavior. No avoidance behavior took place in either study, indicating that memory of the foot shock had not been stored and confirming Duncan's interpretation (**Heriat** and **Coleman** 1962; **King** 1965).

The two-stage memory process also seems needed to explain the clinical phenomenon known as *amnesia* (generally any loss of memory; often applied to situation in which a person forgets his or her own identity and is unable to recognize familiar people and situations and the functional inability to recall the personal past. The inability to recall, in functional amnesia, suggests that the forgetting is motivated, that is, because of severe conflicts of psychological trauma; the individual seeks escape through forgetting. Amnesia may also be caused by cerebral shock, such as may occur in injuries of the head). Before looking into this aspect, we will briefly talk about amnesia and its relation with memory. Studies of patients suffering from amnesia (retrograde amnesia) have highlighted the role of the medial temporal lobe and portions of the thalamus and hypothalamus in the storage and retrieval of memories of past experiences. People suffering from *retrograde amnesia* (loss of memory for events occurring before the onset of amnesia) are largely unable to recall their past life events that constitute the *episodic memory,* but on the other hand they are less impaired on their more general knowledge of the world that constitutes their *semantic memory*. Most amnesics show some loss in both categories. The causes of most amnesia can either by a brain infection such as that incurred in encephalitis, or by alcoholism accompanied by vitamin B1 deficiency and referred to in clinical terms as *Korsakoff's psychosis*. Other causes of amnesia can be an injury to the brain caused by an accidental trauma or incurred in neurosurgery.

The explanation for the memory loss seen in amnesics has been subject to investigation with varied hypothesis. As told before, this loss is only partial and the amnesics can learn new tasks and not remember

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Self-Exciting Circuits

One function of the distributing system of collaterals and interneurons is the prolongation of excitation. This occurs because they are arranged in *self-exciting circuits* of interneurons. In such circuits, when one neuron discharges, the nerve impulse passes down the main axom and also into a collateral branching off from it. This branch may connect with a second neuron causing it to be excited. The axom of the second neuron, in turn, transmits the impulse to the original cell and excites it a second time. This may be repeated many times.

having learnt them (*anterograde amnesia* - failure to recall events occurring after the onset of amnesia). The two hypotheses put forward to account for the facts of amnesia are the consolidation deficit and the retrieval deficit hypothesis. Separate studies on consolidation (**G.E. Muller** and **Pilzecker** 1900; **Russell** and **Nathan** 1946; **McGaugh** and **Herz** 1972; **Milner** 1966) have proposed that a consolidation of memories takes place for some time after an event. This process is thought to strengthen memories of the event, making them more resistant to subsequent disruption. They have, however, only been successful in proving that the same occurs but not what it exactly is. The retrieval hypothesis as advocated by **Warrington** and **Weiskrantz** (1970, 1975) states that if a person cannot remember something, it does not prove that the information has been lost forever. It merely shows that the person cannot retrieve the memory at that moment. If the memory can be retrieved later, the momentary lapse is usually interpreted as a retrieval deficit. This interpretation has found several lines of support. Studies on consolidation prove only that it occurs, not what it is exactly. However, discovering where in the nervous system something occurs and establishing its duration gives us major clues, towards identifying the actual mechanisms. It is possible that consolidation may be a matter of permanent changes in synaptic transmissions, perhaps involving RNA, whereas the immediate memory trace may concern only short-lived electrical phenomena. The *self-exciting circuits* of interneurons may be possible basis for the short-term memory trace. Repeated afferent stimulation also leaves a motoneuron hyperexcitable long after the stimulation has ceased and changes in synaptic events have been observed to last as long as an hour after the end of stimulation.

Recent and Simpler Systems: Important Clues

Other than research that has been done on human cases of amnesia; researchers have shown interested in investigating the process and uncovering the neural basis of learning and memory and looked at three basic learning phenomenon. These include *habituation*—learning not to respond to repeated, inconsequential stimuli; *sensitization*—increase in all responses following the presentation of a potentially threatening stimulus, and *classical conditioning*—as discovered by Pavlov. All these forms of behavioral change have been examined in the laboratory with animal subjects, usually invertebrates such as the marine sea slug. In search for simpler systems in which to investigate learning and memory, neuroscientists have turned to creatures such as the Aplysia in which there are fewer neurons to contend with, and the neurons themselves tend to be larger and easier to manipulate than those of vertebrates. The so-called simple systems have provided important clues to how nervous systems change during learning.

According to **Eric Kandel**, **Schwartz** (1982) and **Carew et al**. (1983), who examined habituation, sensitization and conditioning of one innate response shown by the Aplysia - the gill withdrawal reflex, the main

site of change for these various phenomena appears to be in the presynaptic terminals of the sensory neurons that produce the gill withdrawal reflex. The changes in these terminals appear to follow from changes in the ion channels that allow for either increased or decreased levels of Ca^{2+} to enter the terminals. The amount of neurotransmitter and hence the amplitude and duration of postsynaptic potentials depend on the amount of Ca^{2+} that enters the presynaptic terminals.

The investigation of learning in vertebrates has followed several different paths. One of the most productive research programs is that of **Thompson et al**. 1983; **McCormick** and **Thompson** 1984; **Thompson et al**. 1984. These investigators have found evidence that the dentate–interpositus nucleus of the cerebellum and regions of the nearby brainstem are critical for the classical conditioning of the nictitating membrane in rabbits. The hippocampus is also involved in conditioning situations in which a delay occurs between the presentation of the to–be–conditioned stimulus and the unconditioned stimulus.

Another approach to learning in the vertebrate brain involves a phenomenon known as long-term potentiation (LTP). The LTP is an increase in the size of an evoked potential to a standard stimulus following brief but intense electrical stimulation of an afferent pathway to the neurons producing the evoked potential. Much of this research has been done in the dentate gyrus of the hippocampal formation. **Lynch** and **Baudry** (1984) have proposed that LTP involves the appearance of an increased number of postsynaptic receptors. Although the details of the Kandel hypothesis and that of Lynch and Baudry differ, both focus on the synapse as the site of change in the brain underlying learning and memory.

MEASUREMENT OF LEARNING

Despite the amount of research devoted to the learning process, we do not know exactly what physiological events underlie the behavioral changes that we see. Yet, these changes obviously do occur and they can be observed and measured. If such observations are to be of any worth, however, it is necessary first to define precisely the behavior that will be taken as a criterion of learning – as a dependable sign that learning has occurred – and second to design procedures for measuring different amounts of this criterion behavior.

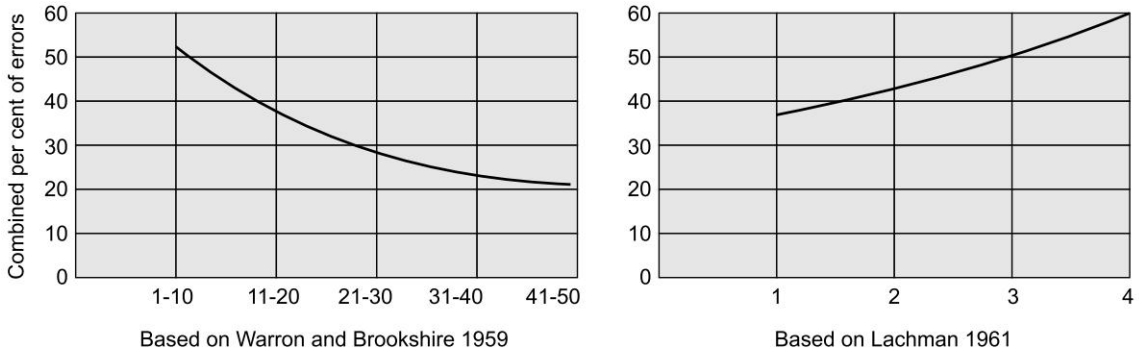
Learning Criteria

As we have seen in the conditioning experiments, it is quite easy to set up a criterion for learning. The criterion in such experiments can be pressing of the lever with a certain frequency or blinking a certain number of times. In experiments related with verbal learning, the criterion of learning is easy to specify. It is simple if the task at hand requires something specific like mastering a list of words and the experimenter after the recall simply counts the number of words reproduced correctly and the number of trials taken to master the same completely. However, things become difficult if one wants to find a dependable and measurable criterion for the result of certain classroom experiments in which students have learned to carry more responsibility, to be more cooperative or to think more critically. Much of the current research in educational settings is concerned with defining and establishing ‘criterion behaviors’ that will give a better indication of such learning outcomes that the traditional paper and pencil tests or recitations have given.

In the laboratory studies of learning, the criterion most often used as indicators of learning are: accuracy of response; speed of response; strength of response; probability of response; effort in response; resistance to extinction and resistance to interference. We will now examine each one of these briefly.

1. **Accuracy of Response**: In laboratory learning experiments, the subject is usually given a task in which his responses can be scored as right or wrong. A record can then be made of either his errors or his correct responses, or both, on each trial. In most learning, many errors are unnecessary movements

are made in the early stages, but along with practice, the errors are seen to drastically reduce or are eliminated. This increased accuracy is taken as an indication that learning is occurring. If errors are plotted, the curve goes down during learning. If correct responses are plotted, it rises. Figure 6.9 shows accuracy as a criterion of learning.



The graph on the left shows the decreasing errors of twenty macaqu monkeys in learning which of two stimulus objects to displace in order to obtain a food reward. The objects were wooden figures, and the choice was between a blue cross and a yellow circle, or between a black square and a red triangle. The graph on the right shows the increase in per cent of correct responses of a group of rats in a discrimination situation over a period of four days.

Fig. 6.9 Accuracy as a Criterion of Learning

It is possible, however, to arrange the conditions of learning in such a manner that no errors will occur. This can be done with human subjects through the use of a technique called *programmed instructions* (a learning process objectified and split up into steps; the individual is expected to become personally active by making an outward response. This determines, at least in part, the time when the next teaching step will begin. The steps either are very short, containing little information and the response expected at any particular place is easy, or the individual receives some comments on his response after a very brief space of time (at least while actually working); this comment determines, at least in part, what the selection and sequence of further steps will be).

2. **Speed of Response**: As errors and unnecessary movements are eliminated, the time required to make the correct responses also decreases. Speed of response, as a criterion of learning, may be measured either by noting the decrease in the amount of time required to perform a response or by recording the increase in the number of responses made in a given amount of time.
3. **Strength of Response**: In classical conditioning, the experimenter often makes a quantitative measurement of some physiological activity such as the number of drops of saliva or the amplitude of the (GSR) *galvanic skin response* (a change in the electrical resistance of the skin; an indicator of arousal; detected by a sensitive galvanometer. In measuring the GSR, a weak electric current may be

impressed on the skin and the resistance of the skin to that current may be measured or the weak current generated by the body may be measured on the surface of the skin. In either case, what is probably being measured is the electrical activity associated with vascular changes in the arterioles and veinules. The GSR has been correlated with emotional states, strains and tension, but in no clear-cut manner, it is best thought of as an index of the level of activation) that occurs in response to the conditioned stimulus. As conditioning advances, the measured strength of the response increases.

4. **Probability of Response**: As learning continues, the probability increases that the learner will make the correct response rather than an unrelated one. This criterion is difficult to measure for only one subject but when a group of subjects is used, probability of a response can be measured according to the percentage of the group making an adequate response on each succeeding trial.
5. **Effort in Response**: When we begin to learn a complex skill, we are often painfully conscious of each detail of the act to be learned and are aware of putting forth a great deal of effort. As learning progresses, we become less aware of the details and feel less effort and strain. A feeling of effort is such a subjective criterion that it is seldom used in learning experimentation, but sometimes it is possible to get objective measures of the decreased energy output as learning proceeds. In some studies, for example, energy cost has been gauged by the amount of carbon dioxide the subject exhales. However, energy cost is not often used as an indicator of learning progress because of the complexity of the apparatus required to make the physiological measurement. Muscle tension is a more frequently used measure of effort, especially in motor learning. Muscle tension increases during the first few trials and then decreases.
6. **Resistance to Extinction**: It was formally reasoned that the better established a learned response was, the more resistant it would be to extinction and hence that resistance to extinction could be used as a measure of the strength of the learned response or habit. It is now recognized, however, that the rate of extinction depends on several other factors in addition to habit strength.

   It sometimes turns out that what is happening during so called 'extinction' is not a breaking down of the original response but a new parallel learning: when the original learning conditions are reinstated (reward present), the original learned response often turns out to be as strong as ever. In such cases, the subject has evidently retained the response in his repertoire but has learned not to make it under conditions of no reward. In some cases, too, the persistence of a conditioned response during extinction trials may be simply the result of an unclear stimulus situation in which the extinction conditions are not perceived as being different from the learning conditions—as when partial reinforcement has been used. When this is the case, resistance to extinction may be more related to the perceptual situation than to the strength of the learned response.
7. **Resistance to Interference**: The better a response has been learned, the less it will suffer when a conflicting response must be learned; and, conversely, the less well it has been learned, the more vulnerable it will be to such interference. But interference may also indicate lack of perceptual clarity. Thus, presence or absence of interference may be simply an indicator of whether the subject is able to distinguish between the old and new stimulus conditions, each of which he associates with an appropriate response. Therefore, interference or resistance to it does not necessarily prove anything about the strength of the learned response and used alone, is not a dependable measure of the degree of previous learning.

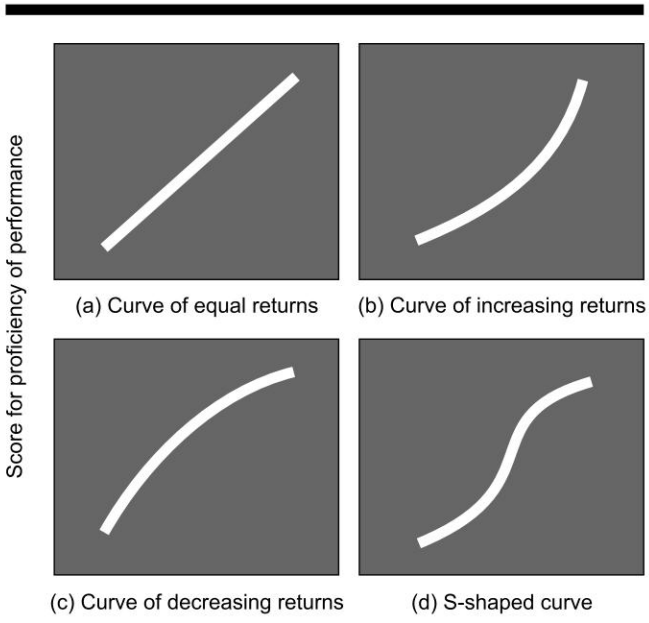
Of the seven methods of measuring the amount of learning that has taken place, the ones most frequently employed are accuracy, speed, strength and probability of response. These are easiest to work with in the laboratory as well as in ordinary life situations.

LEARNING CURVES

Whatever criterion of learning is used, the experimenter gets a clearer picture of how learning has progressed by plotting his data in a learning curve (they are constructed in order to represent learning progress in successive presentations of the learning material or in successive trials. Prerequisites for the construction of a learning curve are constant learning conditions in the individual trials (e.g. the same motivational situation) and a measure for effective learning that can be used throughout all trials. Two variables which are decisive for the type of curve selected are complexity of assignment material and stages of learning. Positively accelerated curves tend to be obtained at an earlier stage of practice and negatively accelerated curves at a later stage. There may be more or less extensive intermediate stretches without any noticeable learning increment. Interpretations of learning curves are problematical since it is not clear to what extent each learning curve is an artifact of a specific evaluation method). As we have seen earlier that one of the major changes that typically accompanies learning of a skill is the improvement in the rate of learning. However, there is always a limit to the degree of skill that one can acquire. It has also been experimentally observed that the rate of learning during practice of a skill does not remain constant at all times in the case of an individual. The rate of learning, as normally measured by performance, can be represented graphically. These graphical representations are referred to as the learning curve. They are graphic devices that show the quantity or quality of a subject's performance after successive units of practice. The unit of practice may be a simple trial, a block of trials or an interval of time. *Unit's of practice are customarily shown along the base line of the graph* (X-axis); *amounts of the criterion behavior, such as percentage of correct responses, amount of time to achieve a goal or a measure in the form of a score in points and so on, are shown along the vertical axis* (Y-axis).

Learning curves display a variety of shapes, depending on the behavior being learned, the criterion employed to measure learning and the amount of learning that was still possible at the start of the experiment. In interpreting learning curves, it is important to note the particular aspect of performance being recorded and the subject's initial proficiency. Usually an experimenter wants to determine not only the general direction of a curve, but also the rate at which performance is changed. Curves showing four different types of learning have been found: *Linear acceleration* (curves of equal returns), *Positive acceleration* (curves of increasing returns), *Negative acceleration* (curves of decreasing returns) and *S-shaped curves*. However, generally only the latter three are talked about when types of learning curves are mentioned. Figure 6.10 shows these typical learning curves.

1. **Linear Acceleration (Curves of equal returns)**: Some learning experiments yield curves showing a linear acceleration. These 'curves' are essentially straight lines; they indicate that each trial has yielded the same amount of improvement. Obviously a linear accelerated curve cannot continue indefinitely, for this would indicate that there was no limit to the effectiveness of practice and no ceiling to learning capacity. Thus, a curve of linear acceleration is seldom obtained over a large number of trials.
2. **Positive Acceleration (Curves of Increasing Returns)**: Sometimes, especially at the beginning of learning, each trial brings more improvement than the ones before it. But this happens only over a short period. Curves of positive acceleration from practice are rare. If the returns actually continue to increase with each trial, the learning curve would soon be shooting almost straight up, a trend that could not go on indefinitely.
3. **Negative Acceleration (Curves of Decreasing Returns)**: Most laboratory studies of learning performance yield curves of negative acceleration. Such a curve indicates that the greatest amount of improvement occurred during the early trials. This diminishing of returns on subsequent trials continues until a point is reached beyond which practice brings no further improvement. The curve then levels off, indicating that the subject's top level of performance has been reached.



Curve (a) shows linear acceleration; Curve (b) shows positive acceleration; Curve (c) shows negative acceleration and Curve (d) shows the S-shaped, which is the combination of the positive and negative acceleration curves.

Fig. 6.10 Typical Learning Curves

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Fluctuations in Learning Curves

Although learning curves show a generally consistent improvement in the subject's performance, there is usually some variability from trial to trial; on some trials performance even becomes slightly worse. Does this mean that learning itself is producing irregularity or even that the subject is 'loosing ground' on some trials? A more likely explanation is that the fluctuations are partly and perhaps wholly the result of such factors as fatigue and fluctuations in attention. Since a learning curve for one person generally shows fluctuates, it is usual to combine the performance of many subjects into one curve, letting the random errors balance each other. A curve obtained with such a combined data is known as a **Vincent curve**.

4. **S-shaped Curves**: The fact that different experimental studies yield curves of different shapes does not necessarily mean that there are different kinds of learning that follow different trends. A more likely explanation is that different curves are found because few experiments show the entire learning

process. In the earlier stages of learning, a completely new and unfamiliar skill, a subject is likely to show positive advancement from practice graphically represented by a positively accelerated curve. This is so because there is sufficient room for practice at that point. If the learning task is one with which the subject is already partially familiar, on the other hand, practice is likely to yield a negatively accelerated curve. This is so because the person who is already on the way to 'perfection' has less distance to cover than the person who is starting at the beginning. There are few laboratory tasks so new to the learner, as not to be able to utilize some previous learning. But if subjects are presented with such a task and if it is of equal difficulty throughout, a record of their progress from beginning to end can be expected to yield an S-shaped curve. This curve incorporates all three of the curves described just before. Inspecting this type of curve in the figure shown you will see that at first, the learning rate increases with each trial showing a positive acceleration. Then, for a time, the rate of learning remains constant showing linear acceleration. Finally, there is a tapering off: less improvement is shown on each successive trials and the curve begins to show a negative acceleration, tending to level off entirely at the end. Such an S-shaped curve probably represents the complete course of learning.

PLATEAUS IN LEARNING

Learning curves for some types of skills frequently have *plateaus* (a period of several trials in the course of learning in which there is no change in the slope of the learning curve, indicating that learning has temporarily come to a halt. Plateaus may be due to fatigue, loss of motivation or the consolidation of one level of skill before the next higher level is undertaken) or flat places. During the period of a plateau, there is no apparent improvement. Whether this indicates an actual arrest in the learning process itself is undetermined. Three possible explanations of plateaus have been suggested.

The first explanation assigns the plateau in a learning curve being caused by loss of interest in the learner. Under conditions of boredom, there may be actual decreases, rather than increases in performance with continued practice. After a short period of no practice or of a different activity, the subject may return to the original task with renewed vigor.

The second explanation assigns a reflection of change in the subject's mode of attack on the problem. A person who is learning to type, for example, may display considerable initial improvement in performance when he goes about typing the standard phrase (The quick brown fox jumps right over the lazy dog) keeping his eyes focused on the keys on the keyboard. But then wanting to increase his efficiency, he begins to try the touch method (typing on the keyboard without looking at it). When he first makes the transition, he may show no apparent improvement or may even appear to loose ground. Finally, however, when he acquires the higher-level habit, he forges ahead again.

The third explanation for a plateau is that it may result from interference. A different skill learned previously can hinder the learning of the new one and sometimes parts of the same task interfere with each other. It is well known, for example, that too much practice in reading aloud will interfere with progress in learning to read silently. The most common source of plateaus due to interference is 'forced feeding'. When the teacher or a textbook introduces new skills or concepts too rapidly, the learner does not have sufficient time to gain a functional mastery of each, the result is a plateau that continues until individual is able to assimilate each new concept (that is why this textbook is so written starting from the very basic concepts and gradually moving higher up linking them together). Figure 6.11 shows the plateau in learning.

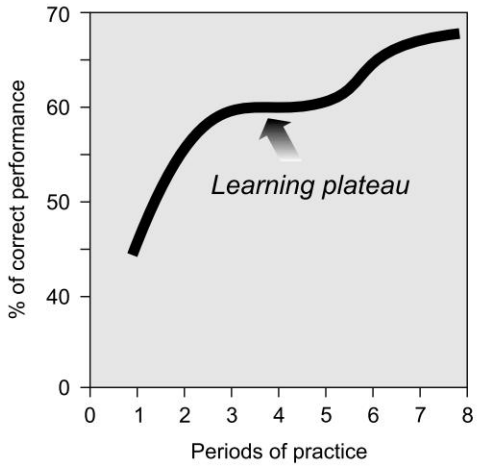

Fig. 6.11 Plateau in Learning

TRANSFER OF TRAINING (LEARNING)

The effects of learning and conditioning are cumulative in time. When an organism learns a list of words or undergoes conditioning, it is more or less permanently modified by his experience. When this organism faces new tasks and new problems, its behavior may be seriously affected by the results of past learning and conditioning. It is only through such cumulative effects of learning that steady intellectual development and growth, progressive refinement of skills and creative thinking are made possible. Sometimes, it is true, past experience also hinder rather than facilitate the acquisition of new skills, but the balance is overwhelmingly towards an advantage for the learner. When past learning effects new learning, it is technically referred to as *transfer of training* or *transfer of learning*. Transfer of learning is one of the most pervasive characteristic of behavior. This is so because it is only through transfer of learning that the continuity and lawful development of habits of ever-growing complexity is guaranteed. Transfer of learning also plays an important role as far as the emergence of consistent personality traits and the organization and integration of knowledge is concerned. Both of these depend upon transfer.

Kinds of Transfer

Transfer of learning affects learning of a new task in three ways.

1. **Positive Transfer:** Positive transfer occurs when skills previously learned help or facilitate the learning of a new skill. Placed in a new learning situation, the learner performs better than he would without the benefit of past training. To explain this type of transfer, we will use a simple example from your life assuming that you know how to ride a two wheeler (scooter/motorcycle). All of us must first learn to ride a bicycle and thereafter only can we ride a two wheeler. Why is it so? The reason is plain and simple. Our initial learning of how to balance on two wheels is done with practice, creating errors (falling down) on a bicycle and with practice our performance gets better and finally we have mastered the skill of balancing. Now, after having mastered this skill on a bicycle when we start learning to ride a two wheeler, the effect

of our previous learning (balancing on two wheels) facilitates our learning. Thus, a positive transfer effect of previous learning can be vividly seen. This type of transfer can be seen in various types of learning.

Since transfer from one task to another depends mainly on the stimulus and response elements in both the earlier task and the new one and thus when the responses expected from the two tasks or learning situations are similar positive transfer takes place. With the increase of similarity between the two responses, the effects of positive transfer also become stronger. Maximum positive transfer occurs when both the previous and present responses are similar or identical. For example, in learning mathematical tables, we begin to learn them we start with the tables of 2 and learn that 2 X 9 = 18 and when we move ahead, we learn the tables of 9 we see that 9 X 2 is also equal to 18. Here, both the responses being identical maximum positive transfer takes place.

2. **Negative Transfer:** Negative transfer, on the other hand, occurs when previous skill learning interferes with the learning of a new skill. It has been experimentally shown that past experiences sometimes slow down the acquisition of a new skill or the solution of a problem. Placed in this new situation, the learner performs poorly than he would without previous learning. To explain this, let me give you an example from my personal life and related with the two wheeler example given above. I had first learnt the bicycle and thereafter, the motorcycle which had a foot break. One day, I borrowed my friend's Kinetic scooter that had hand brakes and I ended up having a minor accident. Now let us review this. Had I learnt the Kinetic first the transfer of training would have been highly positive since both have hand brakes but I learned the motorcycle. Now, after the motorcycle that had foot brakes, I rode the Kinetic which had hand brakes. An accident was bound to happen since a negative transfer took place because of previous learning of position of the breaks. This type of transfer can also be seen in various types of learning.

   We have seen that negative transfer usually takes place when the stimuli in the previously learned task and the new task are the same or comparable from one task to the other, but the responses required are dissimilar. Thus, negative transfer occurs when similar stimuli require different responses. To cite an example, RAM in the computer vocabulary is an abbreviation of Random Access Memory is pronounced as 'RAAM' but RAM is also the Hindi name of a person and pronounced as it is spelt. Obviously, all Indians know the name of RAM since childhood and when they are exposed to the computer terminology RAM, a negative transfer may occur. The effects of negative transfer in the pronunciations of many English language words has lead to great jokes being created about them – BUT and PUT (try pronouncing then in the same manner and you will experience the negative transfer). Thus, learning English as a second language for many Indians becomes quite difficult because of such types of negative transfers.

3. **Zero Transfer**: This type of transfer occurs when the learning of a new task is neither aided nor hindered by past learning. For example, let us suppose you are studying three subjects in your graduation. These subjects are Economics, Psychology and English Literature. Now let us see what kinds of transfers are possible between these three subjects. At face value, you will think that there is no relationship between Psychology and English Literature, but it is not so. For at least a hundred years, the discoveries and hypotheses of psychologists have been enriching the study of English literature, either as a way of understanding the mind of the artist or of the characters they create. Studying psychology with English literature gives one the chance to 'apply' the insights which the scientific study of individual and group psychology provides to a range of powerful and enigmatic works of literature, from the plays of Shakespeare, through the Gothic and Romantic projections of the late 18th-century, to the short stories and novels of British and American Women Writers writing in a post-Freudian universe. Both subjects require the close analysis of texts (spoken, written, uttered) and the discipline of clear report and essay-writing. Thus, now you will believe that a positive transfer takes place. Between Psychology and Economics, most of us will think that since statistics is a common paper in these two subjects a positive transfer will take place but it is not so. You will be surprised that a negative transfer takes place since

the statistical methods and analysis applied differ minutely in Economics and behavioral sciences. It is this minute difference which creates hindrance and a negative transfer occurs. The transfer between Economics and English Literature apparently appears to be zero.

It is very important to know that the effects of transfer are measured by various measuring devices and their sensitivity is of prime importance. It can be possible that one method of measurement shows zero transfer while another more sensitive one shows either positive or negative transfer. Also in many situations, transfer from learning of one task to learning of another may involve both positive and negative transfers. In such a case, ultimately, what type of transfer takes place will depend on the net effect of the two types (Table 6.2). Another important point about transfer is that the general methods of work and rules involved in learning two tasks, even if the stimuli and responses are different, may be carried over from one situation to another facilitating positive transfer. This occurs mainly due to the phenomenon of *learning to learn* (acquiring skill at learning tasks through practice at learning. Some psychologists believe that learning to learn can account for behavior formerly classified under insight learning). There may be similarities in the types of learning rather than in the task or in the subject matter and, therefore, positive transfer may result from learning to learn.

TABLE 6.2 Stimulus–response Relationship and Kind of Transfer

Stimulus–Response Relationship	Amount and Kind of Transfer
1. Identical stimuli and identical responses.	Maximum positive transfer.
2. Similar stimuli and identical responses.	Positive transfer.
3. Identical stimuli and similar responses.	Positive transfer.
4. Different stimuli and similar responses.	Small amount of positive transfer.
5. Different stimuli and different responses.	Little or zero transfer.
6. Similar stimuli and different responses.	Negative transfer.
7. Identical stimuli and different responses.	Negative transfer.

EXPERIMENTAL PERSPECTIVE

Simple Experiment to Study Transfer of Learning

A simple experiment can help one practically learn about the type, amount and effect of transfer. For the conduction of this experiment, two groups will be required. The first group will be the *experimental group* (one subject will also do) upon which we will literally experiment. The other will be the *control group* (one subject will also do) that will serve as our criterion group. Both the groups (subject/s) must be equated with respect to chronological age, motivation and relative unfamiliarity with the task to be done. The design to be followed by each group is as stated in the table below.

Groups	Phase 1	Phase 2	Recall Task	No. of Trials/Errors/Time
Experimental Group	Learn Task A	Learn Task B	Recall Task B	Result measured as per pre-defined criterion of learning.
Control Group	Unrelated Task	Learn Task B	Recall Task B	Result measured as per pre-defined criterion of learning.

As per the above design, the subject/s in the experimental group are asked to do Task A till cent percent learning is achieved as measured by recall/performance on standard pre-defined criterion. Meanwhile, the control group subject/s is asked to do any other activity not related with Task B. After this, both the groups are asked to learn Task B. Now if the experimental group needs less trials, commits fewer errors or takes little time to accomplish learning (measured through some pre-defined criterion) as compared with the control group, it can be concluded that a positive transfer has taken place. If the reverse results are achieved, then a negative transfer has taken place. If both match equally on the learning criterion for Task B, then zero transfer has taken place. (**This experiment and the psychological processes involved will be explained in detail in the chapter on memory and forgetting under retroactive and proactive inhibition**).

CROSS-EDUCATION (BILATERAL TRANSFER)

So far, we have been talking of various types of transfer taking place from past learning situations to new learning situations on the basis of similarity and differences between the stimulus and response. Now, we will discuss a different type of transfer that takes place between the parts of our body. This type of transfer is technically referred to as *bilateral transfer*. This transfer is termed as bilateral since the transfer takes place between symmetrically located parts of our body, i.e. eye to eye, hand to hand and from foot to foot. When this cross-education is as such, then it is referred to as bilateral transfer. This type of transfer may be the most common type of cross-education but it is not the only kind. There may be transfer from hand to foot or even from one skin area to another, non-symmetrical one.

PSYCHOLOGY NUGGET

Bilateral Transfer in Mirror Drawing

We can experimentally demonstrate the phenomenon of bilateral transfer in a laboratory using the mirror drawing apparatus. This apparatus is in the shape of a laptop computer in which the screen serves as a mirror and in the keyboard area there is a board on which a sheet with a star pattern can be tacked in such a manner that its reflection can be seen in the mirror. A hand shield is used to prevent the subject from looking directly at the star pattern. The subject is asked to slip his hand under the shield and place the point of his pencil on the starting point. The starting point is directly opposite the subject—nearest to the mirror. The subject on signal and as per instructions has to start tracing the star pattern, looking at its reflection in the mirror and keeping as well as he can within the lines in the patters. The experimenter notes the starting and the finish time. This way, at least ten to fifteen trials are taken. After the trials have been taken the experimenter asks the subject to do the same using the other hand. On computing, the time and errors (when the line touches the borders its counted as an error) and as per hypothesis, we will find that firstly with practice the time and errors have decreased and secondly fewer number of trials were required and less errors committed when the other hand is used. The results can be shown graphically through a learning curve. These results indicate two things. First, it shows the effect of practice and second bilateral transfer of this practice. (An electronic version of the mirror drawing apparatus with a stylus is also available and used in laboratories which have an error reading digital meter and a star shaped pattern).

Note: This experiment can have different types of designs.

Neurology of Bilateral Transfer

How bilateral transfer is possible can be explained on the basis of the neurology. It seems almost certain that the locus of any practice effect is the cerebral hemispheres and practice leaves behind some change in the neural structure or condition. In the case of bilateral transfer, the operating mechanisms have in part a different cerebral localization, since the right side of the body is connected most directly with the left hemisphere and the left with the right hemisphere. If in case any of the motor mechanism is destroyed, the other bilateral motor mechanism takes up its task though it is a bit difficult in the beginning but with practice it improves. Transfer shows that either hand is available for the use of the same high-level cerebral mechanism.

DETERMINANTS OF LEARNING—FACTORS INFLUENCING LEARNING

There are many factors that contribute to the efficiency in learning and the acquisition of new skills. Among these many, one such factor is *knowledge of results*. When a learner gets feedback about his performance, his efficiency increases. In cases of motor and verbal learning, feedback will help the learner in knowing where he has gone wrong and what all adjustments have to be made on his part for better output. Feedback is also helpful in enabling the learner to direct his actions for the purpose of eliminating errors thus increasing precision leading to better performance on successive trials. Knowledge of results acts as reinforcement and motivates the learner to perform better.

Learning efficiency is also determined by the way *practice periods* are distributed. The length of the practice sessions and the distribution of rest periods affect, to a great extent, the learning process. Research has shown that in the case of motor learning, practice was more effective when it included brief and judiciously distributed rest periods. This method leads to more rapid learning than continuous or massed practice does. The practice periods also should not be of very long durations since it may create physical or mental fatigue, leading to drop in performance levels. The periods must not be too short also or else they will tend to break up the task into very small, meaningless parts.

The *way in which the material of a task is learnt* also determines learning efficiency. It has been found that for fast learners the *whole learning method* (learning in which the material is practiced in its entirety) leads to better learning. This finding holds true mostly when the material to be learnt is not too long. Short or highly meaningful material is easily learned and memorized as a whole. When one uses the part method for learning, the continuity and meaning of the material often gets lost. This aspect leads us to another factor that is *meaningful* and *relevance* of the material to be learned. The rate of learning tends to be more rapid if the material to be learned is meaningful and relevant (*for conceptual details refer to information processing theory in memory chapter*). The more meaningful the material, the fewer the trials or practice session needed for learning.

Interest is another factor that influences the learning efficiency. An individual will learn more quickly if he is interested to do so. Related with this factor is the *attitude* of the learner. A positive attitude will give positive gains in learning. Another related and dominating factor influencing learning is motivation. Learning is also influenced by the *motivation* of the learner. Motivation is the driving force directing activity towards the attainment of specified goals (for conceptual details on motivation refer chapter on motivation). If a learner is goal-oriented, his performance for the attainment of the goal will surely be efficient.

In short, we can conclude that the important factors determining and influencing learning are knowledge of results, practice periods, learning method, meaningfulness and relevance on the one hand, and on the other hand related factors of interest, attitude and motivation that together play a very decisive role.

KEY TERMS

Acquisition
Response
Instrumental conditioning
S-R theories
Retention
Imitation
Reward training
Learning curves
Stimulus
Classical conditioning
Discrimination training

EVALUATE YOURSELF

Multiple Choice Questions

1. The fundamental properties of learning is that it
(a) Modifies some stimulus-response relations
(b) Promotes physical maturation
(c) Requires perceptual skills
(d) Modifies human behavior

2. An animal learns by trial and error when
(a) There is a strong motivation
(b) The goal is clear
(c) The problem cannot be solved easily
(d) All the above conditions are fulfilled

3. In which of the following respects, classical and operant conditioning do not differ?
(a) In classical conditioning, the animal is passive, whereas in operant conditioning the animal is active.
(b) The conditioned behavior in classical conditioning is called respondent behavior, whereas that in operant conditioning is called operant behavior.
(c) In classical training, the reinforced behavior is similar to the behavior normally elicited by the reinforcing stimulus whereas in operant training, it is not.
(d) By classical conditioning, a subject can be made to alter his autonomic and muscular responses, whereas by operant conditioning this is not possible.

4. Reinforcement can be
(a) Negative only
(b) Positive only
(c) Both negative and positive
(d) None of the above

5. Mirror drawing is an example of
(a) Sensory skill
(b) Sensory motor skill
(c) Motor skill
(d) Visual skill

6. Which of the following statements is not true regarding transfer of learning?
(a) The direction of transfer depends upon the degree of response similarity and the amount of transfer depends upon the degree of stimulus similarity.
(b) The direction and amount of transfer depends on stimulus similarity.
(c) The direction and amount of transfer depends on response similarity.
(d) The direction of transfer depends upon the degree of stimulus similarity and the amount of transfer depends upon the degree of response similarity.

7. Periods of dead-level performance in the learning curves are called
(a) Plateaus
(b) Hillocks
(c) Mountains
(d) Valleys

8. Verbal discrimination learning involves
(a) Making a choice between two alternatives
(b) Linking two verbal stimuli together
(c) LLearning in a prescribed order
(d) Learning without discriminating

9. Which of the following is not a characteristic of 'features' in concept learning?
(a) Features always exist in more than one state.
(b) Features are practically endless in numbers.
(c) Features are plainly organized in a hierarchy.
(d) Features can exist in themselves.

10. Transfer of learning refers to
    (a) When information is passed down to another person
    (b) When information travels from one place to another
    (c) When past learning effects new learning
    (d) When new learning replaces old learning

Descriptive Questions

1. Define learning and highlight its major aspects.
2. Outline the principle forms of learning.
3. Which laws were given by Thorndike? Discuss each one of them briefly.
4. In which procedure, used for studying learning, a discrete response is attached to a more or less discrete response? Support your answer with experimental evidence.
5. What is meant by the term 'reinforcement'? Discuss its various types and schedules used in conditioning experiments.
6. Pavlovian conditioning is passive in comparison to instrumental conditioning. Discuss this statement.
7. What does the cognitive approach to learning mean? Discuss.
8. How is behavior modification an application of learning theory?
9. Outline the various methods of research in verbal learning.
10. What are learning curves? Discuss their various types showing them graphically.

Critical Thinking Questions

1. During which stage of the human lifecycle maximum learning happens? Why?
2. Can you think of a framework by which you can explain "placebo" effect of drugs on human?
3. When one says person A has a steeper learning curve than person B, what does it convey?
4. Can you think of a framework to explain 'mirror writing' skills of *Leonardo da Vinci.*
5. Can you think of a situation when a person 'delearns'? Can you also think of a situation when one 'unlearns'?

PRACTICAL EXERCISES

1. Divide the class into two groups. Ask them to take side on 'kinesthetic learning is better than auditory or visual learning'.
2. Ask your students to visit a zoo or an aquarium. Ask them to find out if they could find any evidence of conditioning among animals/birds/fish during their trip.
3. Recite a short poem or a prose (must be unfamiliar). Ask the students what they learnt on that day and ask them to note them on a piece of paper and collect them. Then ask the students to recollect the poem/prose after 15 days and collect their notes. Share the findings of 'reminiscence effect' with the class.

Answers to Multiple Choice Questions

1. (a) **2.** (d) **3.** (d) **4.** (c) **5.** (b) **6.** (a) **7.** (a) **8.** (a) **9.** (d) **10.** (c)

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Chapter 7

Memory and Forgetting

Chapter Objectives

After reading this chapter, you will learn:

- Memory as a system of the mind and various taxonomies that evolved to describe memory in different frameworks.
- That recall, recognition and relearning are three basic types of memory tasks.
- The various theories of memory around two models—information processing theory and declarative theory.
- About sensory memory and its various characteristics and the famous Sperling's experiments and findings.
- The empirical findings of short-term memory (STM) and the mechanism of forgetting in STM.
- The concept of working memory and the working memory model.
- About organization and process of long-term memory (LTM) and the various types of LTM organization.
- About the similarities and critical differences among STM, working memory and LTM.
- What forgetting really is, the theories of forgetting and what motivated forgetting is.
- How to improve memory.

Memory is an organism's unwritten record of some past event. The experimental study of memory deals with the composition of memories, their interaction and the processes that occur over a period of time and produce forgetting as measured on retention tests.

Remembering and forgetting are the most common experiences that function daily in our life. Some things are remembered much better and longer than others. Remembering is the process that makes available to the individual something he has learnt earlier. *The learnt material retained by the individual is referred to as his memory*.

The various acts of remembering vary from one another in certain aspects, but they have some elements in common. In each case, the present experience or the current behavior of an individual is determined by something that has happened in the past. Before anything can be remembered, it must be learnt. Information comes in through the sensory channels and is stored in the brain for a short time. Under *favorable conditions,* some part of the information stored in this *short-term store* can be transferred to a *long-term store* from which it can be *retrieve*d and translated into behavior. Thus, it can be said that memory consists of *learning*, *retaining* and *recalling* or *recognizing*.

How this exactly happens will become clear after a detailed discussion on the various types of memory and the process of interaction between them. However, before we discuss the various memory types and their interaction, a debate on whether there exists several levels of memories or not is essential.

MEMORY SYSTEMS AND THEIR TAXONOMIES

The earliest theories of memory treated it as a unitary system. The main interests of study were about how learning occurred and the rules underlying association. Association can be defined as the linkage of information with other information, making the experience or retrieval of one piece increase the likelihood of retrieval of associated pieces.

Another early distinction was between recall and recognition. Recall is the ability to retrieve an item that was previously learned when given an appropriate cue (*cued recall*) or spontaneously (*free recall*). Recognition is the ability to successfully acknowledge that a certain item has or has not appeared in previous experience.

William James introduced a dichotomy between primary (short-term, STM) and secondary (long-term, LTM) memory, which also represents the start of analyzing memory as a non-unitary system (**James** 1890). He described primary memory as that which is held only for a moment in our conscious mind and secondary memory as unconscious but permanent information.

Empirical evidence for the short-term and long-term account emerged with experiments such as the ones performed by **Brown** (1958) and **Peterson** and **Peterson** (1959), where even small amounts of information given to test subjects was rapidly forgotten when active rehearsal was prevented. Even more convincing was neuropsychological evidence of brain lesions causing impaired LTM but preserved STM (**Scoville** and **Milner** 1957) and impaired STM with preserved LTM (**Shallice** and **Warrington** 1970).

The evidence pointed to the existence of at least two memory systems: one with durable long-term storage, unlimited capacity, a slow rate of acquisition and a tendency to encode items according to meaning and another with rapid dissipation and rapid acquisition, a limited capacity and encoding sensitive to phonetic similarity and other surface characteristics (**Waugh** and **Norman** 1965; **Baddeley** 1966b, a). Information from the first short-term system was assumed to be consolidated into a more permanent and robust form in the long-term system.

Sperling (1960) also showed that there appeared to exist a very short-term perceptual memory, an iconic sensory store. These sensory stores were sensitive to similar sounding or looking stimuli and had a very limited capacity and memory span. The **Atkinson** and **Shiffrin** (1971) multi-store memory model expanded this into a model where input entered the short-term sensory store, where it was available for entering into short-term memory. From short-term memory, information was transferred to long-term memory through repetition, and could be retrieved into working memory if needed to generate response output. However, as shown by **Craik** and **Watkins** (1973), memory encoding is not directly related to the time the information is kept in the working memory. Instead, the level of processing, how much information is processed and associated, might affect encoding by creating a richer and more durable memory trace (**Craik** and **Lockhart** 1972; **Baddeley** 1999).

As more studies accumulated, more elaborate models of the information flow between sensory buffers, working memory and long-term memory were developed (**Baddeley** and **Hitch** 1974; **Baddeley** 2000). As in the multi-store model, sensory information is first received in sensory stores (the visuo-spatial scratch pad and the phonological loop). Working memory consists of these stores and a central executive function regulating information flow and usage, which also connects to long-term memory and other cognitive functions. Later, the model has been extended with an episodic buffer, a limited capacity system that temporarily binds together information from the other stores in a multimodal code, which the central executive functions can manipulate (**Baddeley** 2000).

Beside the fractioning of short-term memory, long-term memory was also found to exhibit different subcomponents. Cohen and Squire introduced the distinction between declarative (explicit) and non-declarative (implicit or procedural) memory (**Cohen** and **Squire** 1980; **Squire et al**. 1993). Declarative memory was defined by conscious recollection: memory content such as facts and events that can be recalled to consciousness. Non-declarative memory causes behavioral changes (such as the acquisition of skills, habituation or priming) but the memory content remains inaccessible (**Zola-Morgan** and **Squire** 1993). As expressed by **Tulving** (1999), a declarative memory act results in a product that can be held in mind, while nondeclarative/procedural memory acts do not. Studies in amnesic patients revealed intact learning abilities for motor skills, classical conditioning and priming despite the lack of conscious recollection of the learning events (**Cohen** and **Squire** 1980). Over time, declarative memory has become increasingly defined as a brain systems construct rather than tied directly to consciousness.

Another division within declarative memory was suggested by **Tulving** (1972), between episodic memory and semantic memory. Episodic memories are memories of past experienced events. They are particular, covering a specific learning experience with strong autobiographical aspects (although the exact time of the learning experience in relation to personal history may be hard or impossible to recall). Semantic memory represents world-knowledge. Semantic memories contain meaning and relationships between objects, people, places and concepts often without a recallable source or autobiographical content. The relationship between episodic and semantic memory has been debated (**Graham et al**. 2000). One suggestion has been that semantic memory is the result of the merging of many episodic memories based on their commonalities rather than their individual character (**McClelland** 1994; **Baddeley** 1999). However, some evidence suggests that semantic knowledge can be acquired as one-shot learning and during impaired episodic memory (**Nadel** and **Moscovitch** 1998).

The richness of types of memory in literature suggested the need for taxonomies. **Schachter** and **Tulving** (1994) defined memory systems based on their psychological characteristics. A memory system is a system that is necessary for tasks from a large class of tasks that have the same functional features, such as working memory tasks or skill learning. Each memory system exhibits unique functional properties, and can be distinguished from another through dissociations such as different effects of lesions.

The definition of memory systems given by Schachter and Tulving in terms of observable psychological effects led to a memory taxonomy with five major systems and eleven 'subsystems': procedural memory (motor skills, cognitive skills, simple conditioning, simple associative conditioning), perceptual representation (visual word form, auditory word form, structural description), semantic memory (spatial, relational), primary memory (visual, auditory) and episodic memory.

Squire and **Zola-Morgan** (1991) proposed another taxonomy, only slightly overlapping with the Schachter-Tulving taxonomy. They divided memory into declarative and procedural memory, with declarative memory divided into episodic and semantic memory and procedural memory divided into skills, priming, simple classical conditioning and other categories.

These two taxonomies are based on psychological data, only using brain data as confirming evidence. There is no consensus on how many memory systems exist or along what cognitive dimensions to organize

them (**Eichenbaum** and **Cohen** 2001). Psychologically identifiable memory systems are linked to biological memory systems in some way; the challenge to cognitive neuropsychology is to determine the exact relationships between the behavioral/functional macroscopic description in terms of cognition and the microscopic description in terms of synapses, neurons, networks, brain structure and brain functions.

We will now proceed and discuss in detail the memory systems described above to get a better understanding. However, before we discuss them it is essential to know about the tasks through which memory can be studied experimentally, as well as the various theories of memory.

PSYCHOLOGY NUGGET

Cortical Dynamics of Memory

Memory networks are formed in the cerebral cortex by associative processes, following Hebbian principles of synaptic modulation. Sensory and motor memory networks are made of elementary representations in cell assemblies of primary sensory and motor cortex (phyletic memory). Higher-order individual memories, e.g. episodic, semantic and conceptual, are represented in hierarchically organized neuronal networks of the cortex of association. Perceptual memories are organized in posterior (post-rolandic) cortex, motor (executive) memories in the cortex of the frontal lobe. Memory networks overlap and interact profusely with one another, such that a cellular assembly can be part of many memories or networks. Working memory essentially consists in the temporary activation of a memory network, as needed for the execution of successive acts in a temporal structure of behavior. That activation of the network is maintained by recurrent excitation through reentrant circuits. The recurrent reentry may occur within local circuits as well as between separate cortical areas. In either case, recurrence binds together the associated components of the network and thus of the memory it represents. (**Joaquin M. Fuster** 2000).

TYPES OF MEMORY TASKS

Psychologists study human memory by observing people perform memory tasks. Three important types of memory tasks are recall, recognition and relearning.

Recall

Recall is the process of remembering learned associations without the benefit of extra cues. Thus, recall is the mental revival of past experiences. Recall, however, is not a very reliable index of retention, for often, an item that cannot be recalled at a given moment is still retained and is recalled sometime later.

The act of recalling is a response to a stimulus. When acquisition or learning takes place, a stimulus and response occur together and get associated. At the time of recall, the stimulus tends to evoke the same response with which it was associated previously.

Recognition

Recognition is easier and is often a more sensitive measure of retention than recall. Recognition is the ability to look at several things and select the one that the individual has seen or learned before. Recognition is better than recall as an index of retention.

Remembering something that one has learned by the recognition method often requires less effort on the part of the individual than remembering by recall. Memory by recognition can last for many years in the life of an individual.

The major difference between recall and recognition is that in the case of recognition the object or the name of the object is in front of the individual for perception while in the case of recall it is not. In recall, the individual has to search in his memory for the object. Recall is an active process. Recognition is, at least apparently, more passive than recall.

Relearning

This is also known as the *saving method*. Relearning is the process by which something previously learned is later learned again. In relearning, an individual usually learns faster than he did the first time.

The saving method or relearning method can be thus stated:

$$\text{Original trials} - \text{Relearning trials}.$$

The percentage saving can be found out by the formula:

$$\frac{\text{Original trials} - \text{Relearning trials}}{\text{Original trials}} \times 100$$

Experimental studies have demonstrated that the amount of retention over the largest period of time is likely to be the greatest when the method of relearning is used. Why this is so will become clear further ahead in this chapter.

THEORIES ABOUT MEMORY

Theory of General Memory Functions

According to this theory, three distinct processes of memory have been identified:

(a) *Encoding process*: Encoding is the process of receiving sensory input and transforming it into a code, which can be stored.
(b) *Storage process*: Storage is the process of actually putting coded information into the memory.
(c) *Retrieval process*: Retrieval is the process of gaining access to stored coded information when it is needed.

Information Processing Theories

If we draw an analogy between a human being and a digital computer, we see that they act in somewhat similar ways as far as information processing is concerned—they take in information; process it in steps or stages and then produce an output. Models of memory based on this idea are called information-processing theories.

When man is viewed as a processor of information (**Miller** 1956; **Broadbent** 1958), it seems necessary to postulate holding mechanisms or memory stores at various points in the system. For example, based on his *dichotic listening* studies, **Broadbent** (1958) proposed that information must be held transiently before entering the limited capacity-processing channel. Items could be held over the short term by recycling them, after perception, through the same transient storage system. From there, information could be transferred into and retained in a more permanent long-term store.

Information Processing Theory Model by Richard Atkinson–Shiffrin (1968)

The information processing theory given by **Richard Atkinson** and **Shiffrin** (1968) best explains the stages of memory in an interlinked manner. This theory is based on the idea that humans are like digital computers that take in items of information; processes them in steps, or stages; and then produce an output. Figure 7.1 shows the information processing theory model given by Atkinson and Shiffrin.

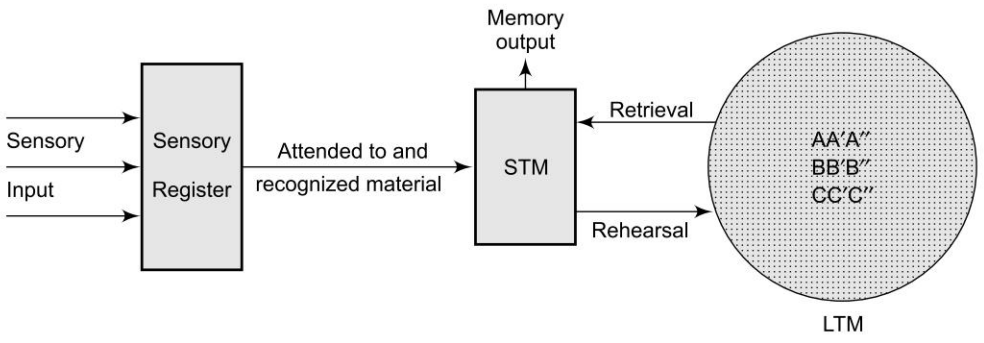

Fig. 7.1 Information Processing Theory Model by Atkinson and Shiffrin

Sensory Register: The information that one receives from the outer environment can be held for a very brief duration in the sensory channels (vision, hearing, touch, etc.). This storage function of the sensory channels is referred to as the sensory register. Most of the information that is briefly held in the sensory register is lost. This is due to simple decay. However, if one has paid attention to the information and has recognized some of it, then this attended information is passed on to the STM for further processing. So here the role of selective attention is highlighted—our ability to pay attention to only some aspects of the world around us while largely ignoring others (**Johnston**, **McCann**, and **Remington** 1995; **Posner** and **Peterson** 1990). **Lloyd et al.** (1984) have estimated that 0.05% of the contents of sensory memory gets as far as STM.

Short-Term Memory: Short-term memory holds information received from the sensory register for up to about 30 seconds, although the length of the retention depends on a number of factors. To demonstrate this process practically and to ascertain a few factors responsible for this storage of information in STM, we will take the help of an example. Take a list of twenty nouns and just go through them. After doing so, recall them in any order as you please (*free recall*). Now carefully compare the original list of nouns and the one reproduced by you. If conducive conditions for the experimental task existed then you will note that in the list, the words in the beginning of the original list were reproduced better and also the words at the end of the original list were reproduced better. This is due to the *primary effect* and the *recency effect*. The primary effect is because the items in the beginning of the original list could be rehearsed and went into LTM (**Rundus** and **Atkinson** 1970). The recency effect is because these nouns were stored first in the sensory register and on recall and they were immediately available through STM. Preventing rehearsal, as the theory predicts, it eliminates the recency effect but not the primacy effect (**Eysenck** 1993).

The storage capacity of STM is very limited. It has a capacity of 7 ± 2 *chunks* (**Miller** 1956). However, later studies suggested that the limit in capacity is more typically only three or four units (**Broadbent** 1975; **Cowan** 2001). Since the storage capacity of STM is very small as is the duration, it is important that an item

of information be kept in the centre of attention. The process of rehearsal can do this. The amount of rehearsal given to an item is important in the transfer of information from STM to LTM. However, rehearsal as such is not the final criterion for the transfer of information from STM to LTM. The way rehearsal is done is of prime importance. One can just go over and over what is to be remembered, the process known as *maintenance rehearsal*, yet not succeed in transferring information to LTM. What is important is to give the material organization and meaning as one is rehearsing it. This is an active rehearsal process known as *elaborative rehearsal* and chances of success are likely high.

Long-Term Memory: The information that is stored in LTM is that which has been rehearsed. This information is stored in a highly organized manner. Since this storage is organized, it becomes essential to give organization and meaning to the material being rehearsed for the purpose of transfer from STM to LTM. This organization of information in LTM can be seen in the *Tip of the Tongue* (TOT) phenomenon. Let us take a comical example. A teacher asked a student in a chemistry class what the chemical formula H_2SO_4 stood for. The student stammered while trying to reply but could not reply. The teacher asked if the student knew the answer or not. To this, the student replied 'yes, it is at the tip of my tongue.' The teacher joked and asked the student to spit it out at once since it was Sulphuric Acid. Jokes aside, it is quite clear from the example that the student was trying to search for the required information in the organized store and was on the verge of retrieving the required information. The TOT phenomenon will be discussed in detail when we talk about LTM in elaborate detail, further in this chapter.

According to this model and other models, it can now be said and accepted that memory can be classified into three levels of storage: sensory stores, short-term memory (STM) and long-term memory (LTM).

Levels of Processing Theory

Craik and **Lockhart** (1972) gave this theory. They have argued that the data offered as evidence for the existence of multiple storage systems can be explained just as well in terms of the levels of processing. Their idea is based on the widely accepted notion that perception involves the rapid analysis of stimuli at a number of levels or stages (**Selfridge** and **Neisser** 1960). Preliminary stages analyse stimuli into sensory features such as lines, angles, frequencies and amplitudes. Later stages use the results of preliminary analyses to match stimuli against stored representation (pattern recognition) and to extract meaning from messages. After a stimulus has been recognized it may still undergo further processing, e.g., by triggering association or images based on the subject's past experience. The idea that processing involves a series or hierarchy of stages means that the stimuli may be processed to different 'levels' or 'depths', depending on factors such as the nature of the stimuli and the amount of time available for processing.

Craik and Lockhart further say that one of the results of perceptual analysis is the *memory trace*, (the hypothetical structural alteration in brain cells following learning) and that trace persistence is a function of depth of analysis, with deeper levels resulting in traces that are more durable. The basic determinant of how long information will be retained is the depth to which it has been processed. However, stimuli can also be retained, at a given level of processing, by rehearsal. This mechanism is called *primary memory*.

In short, we can say that according to this theory, incoming information can be worked on at different levels of analysis. The deeper the analysis goes, the better the memory and that processing strategies are an important factor in memory.

Evaluation of Levels of Processing Theory

The levels of processing approach were influential when it was first formulated and researchers in the field welcomed its emphasis on mental processes rather than on rigid structures. However, it soon became clear

EXPERIMENTAL PERSPECTIVE

Neural Evidence: Some Recent Researches

In the recent past, researches have been conducted using positron emission tomography and functional magnetic resonance imaging techniques and have shown that there is a correlation between higher levels of processing with more brain activity and activity in different parts of the brain than lower levels. In a study done by **Kapur**, **S**; **Craik**, **E.; Tulving**, **A.A.; Houle**, **S,;** and **Brown, G.M.** (1994), they found that in a lexical analysis task their subjects showed activity in the left inferior prefrontal cortex only when identifying whether the word represented a living or nonliving object, and not when identifying whether or not the word contained an 'a'. In another study done by **Fletcher**, **P.C**; **Shallice T**; **Dolan R.J** (1998), in an auditory analysis task they found that their subjects showed increased activation in the left inferior prefrontal cortex when subjects performed increasingly semantic word manipulations. **Friederici, A.D**; **Opitz. B**; and **Yves von Cramon**. **D** (2000) found that synaptic aspects of word recognition correlated with the left frontal operculum and the cortex lining the junction of the inferior frontal and inferior precentral sulcus. **Kelley**, **W.M**; **Macrae C.N**; **Wyland C.L**; **Caglar. S**; **Inati. S**; and **Heatherton T.F** (2002) that the self-reference effect also has neural correlates with a region of the medial prefrontal cortex, which was activated in an experiment where subjects analysed the relevance of data to themselves. Studies done by **Vaidya**, **C.J**; **Zhao M**; **Desmond J.E**; **Gabrieli J.D.E** (2002) explain the specificity of processing on a neurological basis and show brain activity in the same location when a visual memory is encoded and retrieved, and lexical memory in a different location.

that the model was too simplistic and that it was descriptive rather than explanatory. A major problem is circularity, i.e. there is no independent definition of depth. The model predicts that deep processing will lead to better retention - researchers then conclude that because retention is better after certain orienting tasks, they must, by definition, involve deep processing.

Other researchers have questioned the idea that depth of processing alone is responsible for retention. **Tyler et al**. (1979), for example, gave participants two sets of anagrams to solve. Some were easy like DOCTRO and others were more difficult such as OCDRTO. In a subsequent, unexpected, recall task, participants remembered more of the difficult than the easy anagrams, in spite of processing levels being the same. Tyler and colleagues suggested that retention was influenced by the amount of processing effort, rather than depth.

Craik and **Lockhart** (1986) themselves have since suggested that factors such as elaboration and distinctiveness are also important in determining the rate of retention; this idea has been supported by research. For example, **Hunt** and **Elliott** (1980) found that people recalled words with distinctive sequences of tall and short letters better than words with less distinctive arrangements of letters. **Palmere et al**. (1983) concluded through an experimental study done by them that the effects of processing on retention are not as simple as first proposed by the levels of processing model.

In conclusion, we can say that the levels-of-processing model is not as widely accepted as the multi-store model. **Eysenck** and **Keane** (1995) complain that it is simplistic and descriptive rather than explanatory, while **Baddeley** (1990) points out that depth of processing is often defined circularly in terms of the amount of information retained. Some experimental evidence has been found to contradict it. On the other hand, **Parkin** (1987) claims that the model has been important in establishing that processing strategies are an important factor in memory.

Episodic Trace Model of Declarative Memory

It is believed that there are two long-term memory systems - *implicit* and *declarative*. Implicit memory is the memory underlying cognitive, perceptual and motor skills. Declarative memory is associated with cognitive

EXPERIMENTAL PERSPECTIVE

A Daytime Nap Containing Solely Non-REM Sleep Enhances Declarative But Not Procedural Memory

The specialized role that sleep-specific brain physiology plays in memory processing is being rapidly clarified with a greater understanding of the dynamic, complex and exquisitely orchestrated brain state that emerges during sleep. Behaviorally, the facilitative role of non-REM (NREM) sleep (primarily slow wave sleep) for declarative but not procedural memory performance in humans has been demonstrated in a number of nocturnal sleep studies. However, subjects in these studies were tested after periods of sleep that contained REM sleep in addition to NREM sleep, and comparison wake groups were subjected to mild sleep deprivation. To add some clarity to the findings of these nocturnal studies, **Matthew A. Tucker, Yasutaka Hirota, Erin J. Wamsley, Hiuyan Lau, Annie Chaklader** and **William Fishbein** (2006), assessed performance on declarative and procedural memory tasks following a daytime training-retest interval containing either a short nap that included NREM without REM sleep, or wakefulness. Consistent with previous findings, we show that after a comparatively brief sleep episode, subjects that take a nap improve more on a declarative memory task than subjects that stay awake, but that improvement on a procedural memory task is the same regardless of whether subjects take a nap or remain awake. Slow wave sleep was the only sleep parameter to correlate positively with declarative memory improvement. These findings, with reference to the general benefits of napping and within the broader context of a growing literature, suggest a role for NREM-specific physiology for the processing of declarative memory.

abilities not directly attributable to unconscious skills or habits. Here, our concern is to discuss how declarative memory might work. The *episodic trace model* helps us in understanding it.

According to this view, memories are stored as electrochemical traces. The concept of a *memory trace* was put forth by **Donald Hebb** way back in 1949. He argued that memories must somehow be fixed within the nerve pathway of the brain. He believed that synapses in the brain were altered by the continuous flow of electrical impulses and that when the impulses died down the change in the synapses remained, creating a network of neurons that stored specific memories. He argued that activating one or two of the neurons in the network could trigger others, thereby bringing stored memories back to mind. Researchers today are beginning to find solid evidence for Hebb's assertion.

Today, most episodic trace models assume that memories are laid down electrochemically in the brain as entire 'images' containing information about the item, its association and the context in which it was acquired (**Raaijmakers** and **Shiffrin** 1992).

In short, this model of human memory depicts memories as being laid down as entire images that contain information about the item, its associations, and the context in which it was acquired. These 'images' are assumed to be represented in the brain as electrochemical traces.

Network Model of Declarative Memory

The network model assumes that memories are not laid down in 'clusters' or 'images' in a parallel fashion, but rather are *all* tied together in a complex interlinked net, i.e. all memories are joined to create a network. They are not seen as individual images laid down one next to the other. **Donald Hebb** had also thought of such a probability but did not stress much upon it.

One of the most popular network models describing how meaning is represented in the memory is based on *propositions* (**Anderson** 1983; **Raaijmakers** and **Shiffrin** 1992). The word proposition is borrowed from

EXPERIMENTAL PERSPECTIVE

Sleep in Children Enhances Preferentially Emotional Declarative but not Procedural Memories

Although the consolidation of several memory systems is enhanced by sleep in adults, recent studies suggest that sleep supports declarative memory but not procedural memory in children. In a study done by **Alexander Prehn-Kristensen, Robert Göder, Stefania Chirobeja, Inka Breßmann, Roman Ferstl** and **Lioba Baving** (2009), the influence of sleep on emotional declarative memory (recognition task) and procedural memory (mirror tracing task) in 20 healthy children (10–13 years of age) was examined. After sleep, children showed an improvement in declarative memory. Separate analysis with respect to the emotional stimulus content revealed that sleep enhances the recognition of emotional stimuli ($p > 0.001$) rather than neutral stimuli ($p = 0.084$). In the procedural task, however, no sleep-enhanced memory improvement was observed. The results indicate that sleep in children, comparable to adults, enhances predominantly emotional declarative memory; however, in contrast to adults, it has no effect on the consolidation of procedural memory.

logic theory. A proposition is *'the smallest unit about which it makes sense to make the judgment true or false'*.

Storing something according to what it *means*, rather than how it is stated or by how it looks, requires a propositional representation rather than a visual or verbal representation. *Propositional network theory* argues that if we wish to recall how something looked or was stated, we must first locate (recall) its meaning and from there reconstruct our own sensory or verbal representation.

If the LTM is filled with many propositions, that is bits of simple meaning, then there must be a way in which the bits can interact. In a propositional network, each proposition is represented by a circle that is connected to the components of the proposition by arrows. The components are called '*nodes'*, and the arrows connecting the nodes are called '*links'*. Each arrow is labelled to indicate what kind of link it is. Perhaps, this argument approximates the biochemical organization of this memory.

Memories seem to be linked in different ways. Some nodes are very close and strongly linked to other nodes. So if one thing is remembered, the possibility of remembering other things is there. Some nodes may be far away from others or poorly linked, in case of which there is no assistance in remembering different thinks.

Phenomena of Multiple Personality Explained On The Basis of The Network Model of Memory: In this type of mental disorder, individuals appear to develop more than one personality. These personalities rarely appear simultaneously; instead, they seem to vie for consciousness. Often, one personality is totally unaware of another. No one is sure what causes multiple personality, but some interesting possibilities are under investigation.

One such possibility involves propositional network theory. Interestingly, researchers have found that about 98 percent of people with multiple personality were abused as children (**Chance** 1986). It may be that these individuals, through fear and anxiety, repressed and isolated their childhood experiences. As a result, their memories may have developed in a fragmented way, with whole sections of memory cordoned off from other sections, linked together poorly or not at all. If this is the case, when a particular node or memory is activated, a person with multiple personality disorder may be trapped within a limited fraction of her memory, with each fraction holding different and limited 'knowledge' about herself. Such limited and enclosed areas of memory might easily seem to be separate and with distinct personalities.

Of course, no one knows the real cause for sure, or even if this disorder is a distinct one, but this hypothesis is interesting. If it is correct, future researches will view multiple personality more as a 'fragmented personality', a developmental failure to integrate memory, than one that is truly multiple.

Critical Evaluation of the Models of Declarative Memory

Declarative memory is associated with cognitive abilities not directly attributable to unconscious skills or habits. The *episodic trace model* helps in showing how declarative memory might work. This model depicts memories as being laid down as entire images that contain information about the item, its association and the context in which it was acquired. These 'images' are assumed to be represented in the brain as electrochemical traces. The *network model*, on the other hand, holds that sensory information and words are transformed into propositions or other discernible entities in order to be stored in the memory in such a way that they are interconnected, forming memory intersections like ropes in a net.

Evidence suggests that memories may be laid out in an interconnected three-dimensional arrangement corresponding with the biology of the brain (**Franklin** and **Tversky** 1990). Their research implies the existence of a mental representation connected and linked in a way that is similar to the real personal space around us.

Some researchers point out that episodic trace model is better able to explain certain findings. For instance, the network model would lead us to believe that *apple-pear* would be easier combination to remember than *apple-engine* simply because the two fruits are more likely to be paired in real life. However, *apple-engine* is often more memorable because it is a unique pairing. The episodic trace model indicates that such an odd pairing would cause *apple* and *engine* to be laid down parallel to one another in a 'memory image' that would include the recollection that one was studying about this at an earlier time.

All this is quite puzzling and some researchers have tried to blend the episodic trace model and the network model into a single hybrid model that contains the best aspects of both views (**Squire**, **Knowlton** and **Musen** 1993).

SENSORY MEMORY

When a stimulus acts upon the nervous system and is terminated suddenly, some information continues to be available for a brief period of time. Stimuli like a click or flash elicit electrical activity in both the receptor and the sensory projection area of the brain, which persists briefly after the termination of the stimulus itself. At a more behavioral level, such phenomena as visual after-effects are well known.

Based upon a number of experimental studies (**Cattell** 1885; **Sperling** 1963), Sperling concluded that there exists a visual storage system which decays rapidly, but from which the subject can extract information as long as it is available. This storage system is referred to as the **visual sensory** or **iconic memory**. Evidence for an auditory sensory memory or **echoic memory** has also been obtained with a variety of different experimental procedures. An essential difference of both these types of memory as compared with the STM is that they are not subject to the severe capacity limitation of STM, and that information is rapidly lost. This rate of loss is different for visual and auditory memory - it being more for visual memory.

Distinguishing Characteristics of Sensory Memory

The processes that produce perception and recognition take time. The data from the senses must be 'matched up' with our knowledge of the world. If sensory experience terminated before there processes were completed, we would be unable to identify what was 'out there'. Some amount of time, however brief, is necessary to

allow for the processing of incoming information. Sensory memory guarantees a minimum processing time by temporarily preserving the stimulation.

The distinguishing characteristics of sensory memory are as follows:

1. First, its content is solely a record of the sensory effects of the stimulus. The information preserved in sensory memory is no more or less than a representation of the physical characteristics of the stimulus. Sensory memory holds a representation prior to those structures and processes that make up our knowledge of the world.
2. A second characteristic of sensory memory is its relatively large capacity. We take in much more information in a single glance than we could ever use. From this initial stimulation, only some small portion produces any lasting effect on latter memory or thought.
3. Thirdly, sensory memory has a brief duration. Under most conditions, visual sensory memory persists for much less than a second.

In summary, sensory memory represents a persistence of the stimulus in the nervous system for some time after its objective termination. Its function is to preserve this information long enough for further processing by, later, more limited mechanisms. Sensory memory thus differs from other forms of storage in its content, capacity and duration.

Visual Sensory Memory or Iconic Memory

In scanning a visual scene or reading, the eyes fixate for a fraction of a second and then move to fixate on a new location. Normally, the eyes change fixations three or five times per second. The latency of eye movement, the time it takes the eyes to move to a new fixation, is approximately 200 m/sec.

The question that arises is how much can one see in a glance. To answer this question, we have to take into account the frequency and latency of eye movements along with the known fact that visual information must be taken in or 'extracted from the environment' in a succession of rapid but discrete fixations. An important limitation to the operation to our system of visual intake, therefore, is the amount of information we can derive from a single glance. Some of the most important techniques used to study these questions were originated by **George Sperling** (1960, 63, 67).

Sperling's Research

Sperling wanted to measure what he called the '*span of apprehension'*, the number of items a person could remember from a single brief exposure. To do this, he presented observers with a matrix of printed letters such as:

T	D	R
S	R	N
F	Z	G

This presentation was made with the help of a *tachistoscope* illuminated by a single 50-m.sec flash of light. This duration was chosen since it is much shorter than the average duration of a fixation and too brief for the occurrence of any eye movements during the single presentation.

Sperling found that if the number of letters presented were less than four, observers could easily report the whole matrix without error. With more than four letters, performance was no better. In fact never could the observers report more than four or five letters correctly irrespective of the number presented - there appeared to be an *upper limen* on the amount of information that could be obtained from a single glance. However, observers did report of seeing more letters than recalled by them but could not remember them.

This suggested to Sperling that the apparent limit on the span of apprehension in fact may occur at a stage of processing after the visual analysis of the stimulus has been completed. That is, the visual characteristics of the stimulus may have been taken in and stored, but the process of classifying and identifying these stimuli has not yet been completed before this representation was lost. This suggestion involved a clear hypothesis about the locus of the limitations on performance for this particulars task.

To test this hypothesis instead of using the previous procedure called whole report, Sperling used the partial report procedure in which the observer was free to recall whatever he remembered rather than trying to recall the entire presentation. Using this technique, Sperling could measure how much information was actually present immediately after the display went off, and for the brief instant before that visual information decayed. The technique Sperling used was to sample the information present in this hypothetical 'visual memory'. Using this technique, Sperling could tap the content of the visual trace without using the time-consuming process of total recall.

The results of Sperling's research taken together helped him to infer that there is a sensory representation of the stimulus, which is stored for a very brief period of time but has a much larger capacity than the later parts of the system. The short life of this sensory memory and the limited capacity of later stages explain why we can see more than we can say.

Sperling first called this visual sensory memory or 'visual image' which is indeed a very confusing term. To remedy the confusion, **Neisser** (1967) coined a new name and called it the *iconic memory*.

Auditory Sensory Memory or Echoic Memory

Neisser (1967) has called a sensory memory for audition echoic memory. In anything, the need for an echoic memory is more acute than the need for an iconic memory. The reason a sensory store is more necessary for audition than for vision comes from inherent properties of these two modalities: Whereas meaningful visual patterns occur all at once, spread out in space, meaningful auditory patterns occur piecemeal, spread out in time. For an auditory event to be perceived as a unit, the early portion of that event must be held while the later portions unfold.

Evidence for an Echoic Memory

The main issue facing psychologists working in the area of memory has not been proving that echoic memory exists, but rather getting evidence for its existence. They have largely used the following three approaches for the required evidence:

1. **Recognition Method**: If material is unattended or uncategorizable, most theorists hold that it resides briefly in the auditory system and then is lost. When a segment of information of this sort is repeated, the subject can verify for us that the information has been stored and retained without the subject having to identify it. The subject can simply indicate that repetition has occurred; the time between original exposure and accurate detection of repetition gives an estimate of how long the information has been retained. Some of the famous studies using this method were those of **Guttman** and **Julesz** (1963) and **Treisman** (1964).
2. **Sampling Method**: If a person receives some piece of linguistic information and does not categorize it right away, then we should be able to gather evidence for pre-categorical storage by probing for the information at some later point in time. Sampling is a technique by which we can assess how much of the uncategorized information remains available to the subject. This type of technique is only valid for information that has not been identified or categorized. Some of the famous studies done using this method were those by **Moray**, **Bates** and **Barnett** (1965); **Norman** (1969); **Eriksen** and **Johnson** (1964) and **Darwin**, **Turvey** and **Crowder** (1972).

3. **Masking Method**: A large body of research has been directed at the problem of echoic storage through methodologies involving one or other type of masking. In masking studies, some distracting event follows stimulus presentation with the result that performance is poorer than without that event. Generally also, if the distracting event is delayed there comes a point when performance is just as good as without masking. Some famous studies done using this method were those by **Massaro** (1972); **Elliot** (1962); **Dallett** (1965) and **Crowder** and **Morton** (1969); **Morton**, **Crowder** and **Prussin** (1971); **Crowder** (1972).

Properties of Echoic Storage

Modality Effect: If subjects are given the memory-span lists under identical conditions of presentation, except that the mode of presentation is visual in one case and auditory in the other case, then there is an advantage for auditory presentation that occurs only on the last part of the serial-position functions. The comparison between visual and auditory presentation is probably best made between two visual-presentations conditions wherein in the first one, the subject is told to read the items silently to himself during presentation, and in the second he is asked to read them aloud. **Conrad** and **Hull** (1968) have reported the results from such a comparison in a simple experiment. They found that the auditory presentation has a large advantage, which is strictly restricted to the last part of the list, really to the last item. They claimed that the advantage of auditory over visual presentation was due to the presence of echoic memory and that this advantage could be removed if a spoken word, called as '*stimulus suffix'*, was presented after the last memory item, in time with the prevailing rate of presentation, thus equating performance with visual presentation. An essential part of this argument is that echoic memory is larger than iconic memory.

Echoic Memory and Speech

The statement that 'short-term memory has a larger capacity for auditory information than for visual information except when stop consonants are concerned, in which case the two capacities are equal' generated

PSYCHOLOGY IN EVERYDAY LIFE

Sounds Closely Linked with their Auditory Context are More Likely to be Remembered

Everyday experience tells us that some types of auditory sensory information are retained for long periods of time. For example, we are able to recognize friends by their voice alone or identify the source of familiar noises even years after we last heard the sounds. It is thus somewhat surprising that the results of most studies of auditory sensory memory show that acoustic details, such as the pitch of a tone, fade from memory in 10–15 s. The three questions that arise are what type of acoustic information can be retained for a longer term, secondly what circumstances allow or help the formation of durable memory records for acoustic details, and finally how such memory records can be accessed. A study done by **István Winkler** and **Nelson Cowan** (2005), discusses the results of experiments that used a model of auditory recognition, the auditory memory reactivation paradigm. The results obtained with this paradigm suggest that the brain stores features of individual sounds embedded within representations of acoustic regularities that have been detected for the sound patterns and sequences in which the sounds appeared. Thus, sounds closely linked with their auditory context are more likely to be remembered. The representations of acoustic regularities are automatically activated by matching sounds, enabling object recognition.

the interest of **Crowder** (1975); **Darwin** and **Baddeley** (1974) to review the same. There are a number of quite different techniques that have been used to study the perception of speech in which differences between vowels and consonants have been reliably obtained. In each of these divergent interactions, stop consonants show striking different results from vowels or other speech classes. The immediate memory differences therefore fall into place alongside numerous results from speech perception. It can be said that echoic memory difference between vowels and consonants is the major cause of perception difference.

The evidence for sensory memory is the persistence of images after a stimulus has gone. Virtually all research here has been into visual (**Sperling** 1960; **Reeves** and **Sperling** 1986) and auditory sensory memory (**Baddeley** 1995), that hold information for upto a second and upto ten seconds, respectively. However, it is theorized that there are sensory memories for the other sensory modalities too.

SHORT-TERM MEMORY

Short-term memory is a theoretically neutral term used to describe experimental situation or tasks requiring retention for upto a minute or so. Historically, the study of long-term memory preceded that of STM.

To understand short-term memory, let us take the help of a very common happening in our life. You probably have had the experience of being introduced to a stranger, exchanging a few sentences, and then saying as you part, 'very nice to have met you ...'. The person's name cannot be remembered though you heard it only a few minutes before. In another case, you even forget the number you have just dialed in case you have to dial it again. These two cases differ, operationally, of course, in two important ways. The first case concerns retention after relatively short intervals and after relatively low degree of original learning. These features characterize procedures for the study of STM. The reason for the short retention interval, usually measured in seconds or a few minutes, is obvious. The low degree of learning is necessary because better original learning may facilitate subsequent retention to such a degree that no loss may be measurable over the short-term interval.

Short-Term Retention: Methods of Study of STM (Research on the Memory Span)

One of the oldest measures of mental ability is the digit span task. A string of unrelated digits is read to a subject, who must then repeat them back in the same order. The span for the normal adult is approximately seven; performance in excess of seven does not necessarily indicate high intelligence, but a score below five may be an evidence of feeble-mindedness (**Horrocks** 1964).

Miller (1956) described another measure in an article entitled 'The magical number seven, plus or minus two: some units on our capacity for processing information'. He proposed that immediate memory was limited to 7±2 chunks, where a chunk is a unit reflecting the organization imposed on the stimulus material by the subject himself. Unfortunately, there is no mathematical formula available for calculating the number of chunks in a message; indeed, since chunking is subjective, the number might differ from person to person. However, there is not much reason to dispute Miller's insight that the amount retained is a function of how material is organized. Later on, in an autobiographical essay **Miller** (1989) indicated that he was never very serious about the number seven; it was a rhetorical device that he used to tie together the otherwise unrelated strands of his research for a talk. Although it is true that memory span is approximately seven items in adults, there is no guarantee that each item is a separate entity. Perhaps the most important point of **Miller's** (1956)

article was that multiple items can be combined into a larger, meaningful unit. Later studies suggested that the limit in capacity is more typically only three or four units (**Broadbent** 1975; **Cowan** 2001). That conclusion was based on an attempt to take into account strategies that often increase the efficiency of use of a limited capacity or that allow the maintenance of additional information separate from that limited capacity.

Sub-Span Memory: Distraction Technique

Let us consider the following question: Should a subject be able to remember a *consonant trigram* (e.g. XJD) for, say 18 seconds? Since, as proposed by **Miller** (1956), the memory span is 7±2, the answer should be obviously 'yes'. However, for **Peterson** and **Peterson** (1959), the logical answer needed experimental verification. Though there is no doubt that subjects would show perfect retention, provided they were free to rehearse the item. Taking this aspect into consideration, Peterson and Peterson included in the task a technique unique in the sense that it permitted assessment of retention of a single item outside the usual content of an entire list of items. The technique included a distraction task to eliminate or at least reduce the subject's opportunity to rehearse.

In the experimental task, the subject was shown a green light and thereafter was presented with a consonant trigram. A three digit number, say 295, followed this presentation. The subject had been instructed previously to start counting backwards in threes soon after the three-digit number is presented (e.g. 295, 292, 289…) with each tick of a *metronome* set at one tick per second and was required to do so till a red light was shown. Then they were required to recall the given consonant trigram presented on that trial. In this way, 48 consonant trigrams were presented one by one and subjects were tested over 6 retention intervals i.e. 3, 6, 9, 12, 15, and 18 seconds. The results are shown graphically in Fig. 7.2. The graph obtained shows that 50 per cent forgetting occurred after 6 seconds and 90 per cent after 18 seconds.

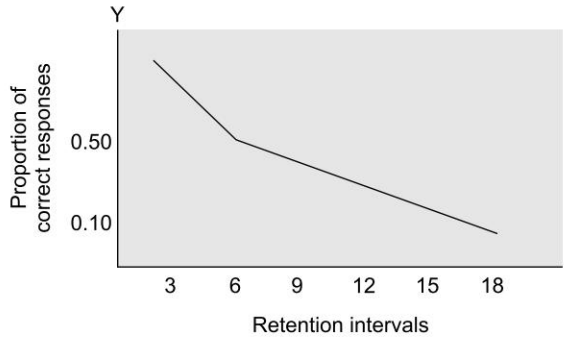

Fig. 7.2 Results of the Experiment Done by Peterson and Peterson

The relation between percentage of correct recall and retention, as found in this study, was that when rehearsal is not permitted, recall of a sub-span number of letters decreases drastically within 18 seconds. Subsequent work by **Murdock** (1961) has established the generality of this finding. It is also important to mention that Peterson and Peterson suspected that their data indicated that verbal information was subject to rapid decay when rehearsal was prevented.

However, subsequently, skeptics argued that the memory loss occurred because the temporal distinctiveness of the current letter trigram diminished as the filled delay increased. In particular, this delay effect was said to occur because of the increase across test delays in the proactive interference from previous trials. On the first few trials, the delay does not matter (**Keppel** and **Underwood** 1962) and no detrimental effect of delay is observed if delays of 3, 6, 9, 12, 15, and 18 seconds are tested in separate trial blocks (**Turvey et al**. 1970; **Greene** 1996).

Yet, there may be a true decay effect at shorter test intervals. **Baddeley** and **Scott** (1971) set up a trailer in a shopping mall so that they could test a large number of participants for one trial each, so as to avoid proactive interference. They found an effect of the test delay within the first 5 s, but not at longer delays. Still, it seems that the concept of decay is not yet on very firm ground and warrants further study. It may be that decay actually reflects not a gradual degradation of the quality of the short-term memory trace, but a sudden collapse at a point that varies from trial to trial. With a control for temporal distinctiveness, **Cowan et al**. (1997a) found what could be a sudden collapse in the representation of memory for a tone with delays of between 5 and 10 s.

Probe Technique

Keppel et al. used this technique. This is quite similar to the distraction technique method but in this, the interpolated activity is the same or similar to the stimulus being presented to the subject for learning.

The material for the experimental task consisted of three types of list—one list of meaningful words, the other of nonsense words and a third a mixture of the two. The experimental procedure involved was presenting a part of any one of the list to the subject. Thereafter, a part of any remaining list (other than the one already presented) was presented to the subject. After this, the subject was asked to rest for a specified time. After the rest interval was over, the subject was presented a word from the list presented at the very beginning to him and was asked to recall the remaining part of the list presented.

The results obtained showed that there is a rapid reduction of retention in STM. Results also indicated that if learning attempts were increased, the retention in STM also increased. In addition, the effect of *retroactive* and *proactive interference* was found in STM. The probe technique is shown with the help of a flow chart for ease and clarity of understanding in Fig. 7.3.

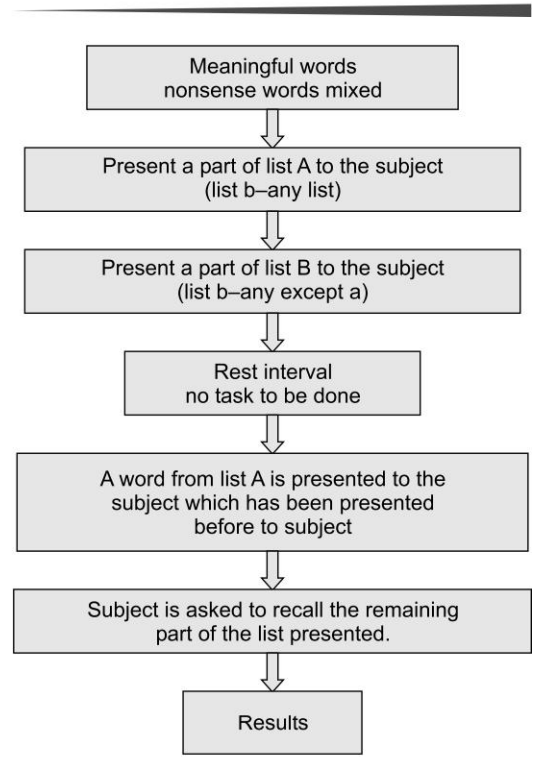

Fig. 7.3 Flow Chart Showing the Probe Technique Procedure

Characteristics of Short-Term Memory

Two variables that seem to have the greatest influence on STM are degree of original learning and characteristics

of other materials that are learned by the subject under the same circumstances. These variables also have an impact on LTM.

Degree of Learning in STM

While studying about STM, we must keep in mind that the most common methodological error in retention studies is the failure to equate the terminal level of original learning. Keeping this in mind will help us in eradicating this error when we experimentally study about retention in STM as well as LTM.

The influence of degree of learning on STM has been shown in three ways. The most clear-cut demonstration of this effect has appeared in experiments by **Hellyer** (1962). Hellyer's procedures were similar to Peterson and Peterson's including the same kind of verbal materials and retesting of subjects in a number of conditions. All he did more was that he let the subject repeat the verbal units (1, 2, 4 and 8 times) aloud. The results as shown in Fig. 7.4 show that more the repetitions, the better the retention i.e. less the loss over a given retention interval. In Peterson and Peterson's study, the subjects were allowed no repetitions and there was more interference. Hence, forgetting was more.

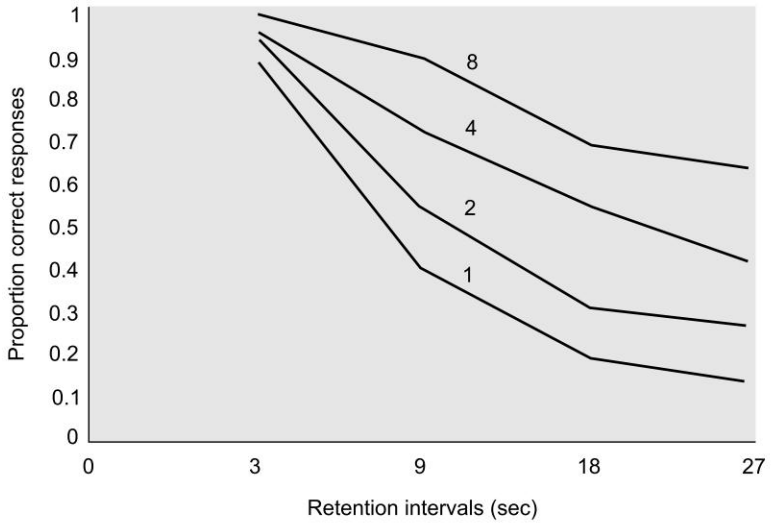

Fig. 7.4 Graph Showing that More the Repetitions, the Better the Retention

The other way in which degree of learning has been varied in STM is that retention in STM is directly related to the degree of learning if it is improved by increasing the duration time of exposure. That is, if the exposure time of presented stimulus is increased, retention will be better.

A final way by which the degree of learning can be said to increase is by increased rehearsal during the retention interval, which if interfered by backward counting and allowed minimal rehearsal is adversely effected. Hence, more the rehearsal the better the learning and thus, better the retention.

Effects of Prior and Subsequent Interference on Retention in STM

The procedure of **Peterson** and **Peterson** (1959) included a test for retention of each individual item before presentation of the next. Since the interpolated experience involves a different class of materials which does not involve learning, it causes an interference in the actual learning but Peterson and Peterson summed it as such that their subjects learned 48 different items, learning before the presentation of any item might have caused the forgetting. This source is termed as *proactive interference*. In the same manner, retention is influenced by learning that is done after the actual learning. This is termed as *retroactive interference*.

However, it must be mentioned that both types of interference may either have a positive or negative effect on the retention depending on factors such as similarity between original and interpolated activities; amount of strength of original and interpolated learning and temporal points of interpolation.

Mechanism of Forgetting in Short-Term Memory

It is important to find out if loss of information is governed by the same principles for STM as for LTM. The difference in rate of forgetting seems so drastic as to suggest that different principles must operate in the two domains.

There are two views on this issue. One view holds that there are several different storage systems in the human memory, including primary and secondary memory. **Hebb** (1949) argued that the physiological basis of memory is dual in nature. According to his theory (discussed briefly earlier also), there are two phases in the establishment of the physiological substrate for memory. The first of these phases is dynamic. It consists of a network of activity in a group of nerve cells that recurrently excite one another. This phase, Hebb asserts, is responsible for a memory trace (*a memory trace is a hypothetical pathway through which information is carried to the brain*. It is a sort of a neural record of the material leaned which is carried to the brain) of very short duration. Hebb attributes long-term or permanent memory to structural changes in these nerve networks, which is the result of repeated elicitation of the active phase. The most straightforward interpretation of Hebb's theory is that forgetting in primary memory is due to passive decay. Since structural changes are permanent, it would be plausible to conclude that forgetting in secondary memory is due to a principle like competition at recall (**McGeoch** 1932). In other words, *decay* and *interference* would both be required to explain forgetting. Many theorists have modeled their theories after Hebb's analysis.

The idea that there are two stages in the memory is not necessarily linked to the idea that decay and interference are the mechanisms of forgetting. In primary memory, at least two principles of forgetting have been proposed in addition to decay. One is *displacement* (**Waugh** and **Norman** 1965), i.e. an item is retained in the primary memory until it is displaced or bumped out by a subsequent item. Another is *acid-bath interference* (**Posner** and **Konick** 1966),i.e. forgetting in primary memory is an interaction of both decay and interference. The interaction may be conceived of as analogous to an acid bath.

Melton (1963) and others have tried to show that the principles of interference theory, long used in the analysis of LTM, are also applicable to STM. Sensory memory may be outside this explanation scheme. Many theorists are willing to conclude that decay operates in this domain. However, the problem of interference appears debatable in light of the findings of **Lewandowsky et al**. (2004). They presented lists of letters to be recalled and varied how long the participant was supposed to take to recall each item in the list. In some conditions, they added articulatory suppression to prevent rehearsal. Despite that suppression, they observed no difference in performance with the time between items in the response varying between 400 and 1600 ms (or between conditions in which the word 'super' was pronounced one, two or three times between consecutive items in the response). They found no evidence of memory decay. A limitation of this finding,

EXPERIMENTAL PERSPECTIVE

In Search of Decay in Verbal Short-Term Memory

Is forgetting in the short term due to decay with the mere passage of time, or interference from other memoranda, or both? Past research on short-term memory has revealed some evidence for decay and a plethora of evidence showing that short-term memory is worsened by interference. However, none of these studies has directly contrasted decay and interference in short-term memory in a task that rules out the use of rehearsal processes. **Marc G. Berman, John Jonides,** and **Richard L. Lewis** (2009), used a novel paradigm to address this problem directly by interrogating the operation of decay and interference in short-term memory without rehearsal confounds. The results of these studies indicate that short-term memories are subject to very small decay effects with the mere passage of time but that interference plays a much larger role in their degradation. The authors discuss the implications of these results for existing models of memory decay and interference.

though, is that covert verbal rehearsal may not be the only type of rehearsal that participants can use. Perhaps there are types that are not prevented by articulatory suppression.

Evaluation of Mechanism of STM Forgetting

In **Reitman's** (1974) experiment, though decay seemed to be the cause of forgetting in STM it, however, cannot be considered the sole mechanism. **Keppel** and **Underwood** (1962) and **Loess** (1964) showed that forgetting rate depends on the number of prior trials, as interference theory would predict. We may tentatively conclude that decay and either interference or displacement operate in STM.

EXPERIMENTAL PERSPECTIVE

Interference-Based Forgetting in Verbal Short-Term Memory

Stephan Lewandowsky, **Sonja M. Geiger** and **Klaus Oberauer** (2008) presented four experiments that tested predictions of SOB (Serial Order in a Box), an interference-based theory of short-term memory. Central to SOB is the concept of novelty-sensitive encoding that holds that items are encoded to the extent that they differ from already-encoded information. On the additional assumption that distractors are encoded into memory in the same manner as list items, the theory predicts differential effects of interfering activity based on the similarity structure of distractors. Consistent with predictions, three experiments showed that overt articulation of distractors in between recalls of list items did not affect forgetting when the same distractor was repeated multiple times, whereas forgetting was observed if several different distractors were articulated within the same time span. A fourth experiment showed that the absence of forgetting with repeated articulations of the same item was not due to compensatory attentional refreshing of memory traces. The data support the notion that forgetting from short-term memory arises from interference and are difficult to reconcile with temporal decay.

It seems difficult to choose between the notions of displacement and interference. The main problem with the displacement notion is that it suggests that items are displaced randomly. However, it is known that similar effects operate in STM. **Wickelgren** (1965) showed that greater retroactive interference for phonologically similar interpolated items is there as compared to phonologically dissimilar items. Thus, displacement of items from STM is not random, but is dependent on similarity.

In short, none of the mechanisms of forgetting alone explains all short-term forgetting. Interference is not entirely satisfactory and displacement is uncomfortably vague. However, evidence has shown that not all classical interference phenomena operate in STM (**Baddeley** and **Dale** 1966; **Peterson** and **Gentilic** 1965; **Wickelgren** 1967; **Lewandowsky et al**. 2004). This evidence supports the dual-process point of view.

WORKING MEMORY

The term 'working memory' refers to a brain system that provides temporary storage and manipulation of the information necessary for such complex cognitive tasks as language comprehension, learning and reasoning. This definition has evolved from the concept of a unitary short-term memory system. Working memory has been found to require the simultaneous storage and processing of information. It can be divided into the following three subcomponents: (i) *the central executive* which is assumed to be an attentional-controlling system and is important in skills such as chess playing and is particularly susceptible to the effects of Alzheimer's disease; and two slave systems, namely (ii) *the visuo-spatial sketch pad* which manipulates visual images and (iii) *the phonological loop* that stores and rehearses speech-based information and is necessary for the acquisition of both native and second-language vocabulary.

Working memory is not completely distinct from short-term memory. It is a term used by **Miller et al**. (1960) to refer to the *memory as it is used to plan and carry out behavior*. One relies on the working memory to retain the partial results while solving a mathematical problem without using a paper and pen, to combine the premises in a lengthy rhetorical argument or to cook a meal without making the unfortunate mistake of adding the same ingredient twice. In fact, working memory also affects good writing.

After **Baddeley** and **Hitch** (1974) demonstrated that a single module could not account for all kinds of temporary memory, the term 'working memory' became more dominant in the field. Their thinking led to an influential model (**Baddeley** 1986) in which *verbal-phonological* and *visual-spatial* representations were held separately, and were managed and manipulated with the help of attention-related processes called *central executive*. In their 1974 paper, this central executive possibly had its own memory that crossed domains of representation. By 1986, this general memory had been eliminated from the model, but it was added by **Baddeley** (2000) again in the form of an *episodic buffer*. It seemed necessary to explain short-term memory of features that did not match the other stores (particularly semantic information in memory) and to explain cross-domain associations in working memory, such as the retention of links between names and faces. Because of the work of **Baddeley et al**. (1975), *working memory is generally viewed as the combination of multiple components working together*. Some even include in that bundle the heavy contribution of long-term memory, which reduces the working memory load by organizing and grouping information in working memory into a smaller number of units (**Miller** 1956; **Ericsson** and **Kintsch** 1995). For example, the letter series IASIPSIFS can be remembered more easily as a series of acronyms for three civil services of India: the Indian Administrative Services (IAS), the Indian Police Services (IPS) and the Indian Foreign Services (IFS). However, this factor was not emphasized in the well-known model of **Baddeley** (1986).

The working memory model will be discussed in detail later. The revised model (**Baddeley** 2000) as illustrated in Fig. 7.5 explains the functions and process of the components.

WORKING MEMORY MODEL

The working memory model or the multi-component model was the outcome of criticism levelled upon the multi-store model for being too simplistic and assuming that STM and LTM act as unitary stores. This outlook did not go well with **Baddeley** and **Hitch** (1974) to whom it seemed much more likely that both memory systems are divided into separate components that have different functions. They became the first people to explore the notion of a multi-component, short-term store. To examine their hypothesis, they conducted a study to find out if a person can perform two tasks simultaneously in a successful manner if the task does not involve the use of one (same) component alone. Thus, if two tasks made use of separate components, then both can be performed successfully at the same time.

To test their hypothesis, Baddeley and Hitch gave their subjects a digit string of common sequence (e.g. 1, 2, 3, 4, 5, 6, 7, …) and asked them to repeat it aloud over and over again. Simultaneously, the subjects were asked to perform a verbal reasoning task which involved making judgments against given statements (e.g. B is followed by A – true or false). Most of the subjects did both the tasks successfully at the same time. Baddeley and Hitch attributed this outcome to the use of two components of working memory for each task separately (one component for one task). The recitation of digits in sequence involves phonological loop with little or no involvement of the central executive while verbal reasoning tasks which required greater cognition effort was handled by the central executive.

Another important finding in this experimental study was that when the subjects were asked to recite the digits in reverse order (e.g. 7,6,5,4,3,2,1) and simultaneously perform the verbal reasoning task, their performance on the verbal reasoning task declined. This result suggested that since reciting the number string in the reverse order also involved the use of the central executive and hence it was not left with enough cognitive resources to allocate for both tasks simultaneously. Thus, this experiment lends support to the presence of multi-components within the working memory.

Braddeley and Hitch came to the conclusion that short-term memory is a flexible and complex system which consists of a central control mechanism assisted by a number of slave systems. The model has been modified slightly in the light of some recent experimental studies done by **Baddeley** (1986, 2000) and is shown in Fig. 7.5, detailing out the functions of the system.

1. Central Executive

Central executive is the most important component in the model and is responsible for monitoring and coordinating the operation of the slave systems. It is flexible in that it can process information from any modality and also has some storage capacity, although this is very limited. It seems to play a major role in attention, planning and in synthesizing information, not only from the slave systems but also from LTM.

Baddeley (1996) has identified the following functions of the central executive component: Switching of retrieval plans, timesharing in dual-task studies, selective attention, temporary activation of long-term memory. These functions have been supported by **Smith** and **Jonides** (1999) including sub-task planning and coding representations.

To study the central executive, Baddeley used tasks with random generation of letters or digits. The theory says that close attention is needed to avoid producing non-random sequences. **Baddeley** (1996) found that randomness decreases as digit memory load is increased. Randomness is also reduced by an alternation task suggesting that rapid switching of retrieval plans is a CE function. However, **Towse** (1998) argues that random generation is not a pure central executive function.

Evidence in Support of the Central Executive: There is a lot of biological evidence for and against the central executive. **Baddeley** (1996) found that when patients suffering from Alzheimer disease are given

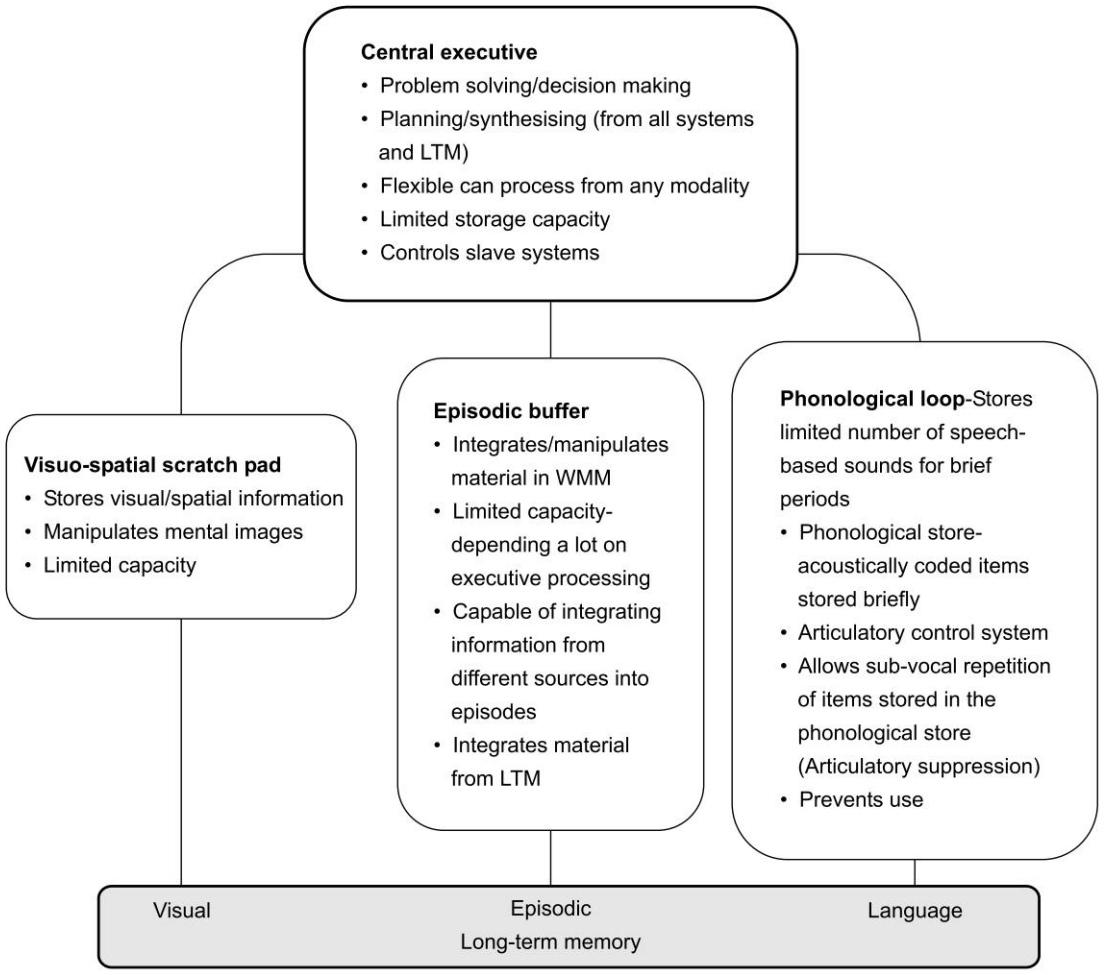

Fig. 7.5 Baddeley's (2000) Revised Working Memory Model

two simultaneous tasks to perform, there is a marked reduction in their performance as compared to normal people. He attributes this reduction to the reduced functioning of the central executive in the Alzheimer patients and indicates it as evidence for the central executive function of distributing attention between two tasks. In another study using fMRI done by **D'Esposito et al.** (1995), found that the dorsolateral prefrontal cortex is activated during dual-task conditions. Conducting the *stroop test,* which requires central executive functions of attention and inhibition, on some patients with frontal cortex damage thus assumed as central executive deficit, failed to show any problems (**Ahola et al** 1996). **Andres** and **van der Linden** (2002) looked at patients with frontal lobe damage and concluded that not all central executive processes are exclusively sustained by the frontal cortex. Evidence suggests that there are some common brain areas but there are also differences from task to task (**Collette** and **van der Linden** 2002).

2. Episodic Buffer

Episodic buffer is assumed to be a limited-capacity temporary storage system that is capable of storing information in a multi-dimensional code from a variety of sources and integrating the same. It thus provides a temporary interface between the slave systems (the phonological loop and the visuo-spatial sketchpad) and long-term memory. It is assumed to be controlled by the central executive, which is capable of retrieving information from the store in the form of conscious awareness, of reflecting on that information and, where necessary, manipulating and modifying it and binding it from a number of sources into coherent episodes. Such episodes are assumed to be retrievable consciously. The buffer is episodic in the sense that it holds episodes whereby information is integrated across space and potentially extended across time. In this respect, it resembles Tulving's concept of episodic memory. It differs, however, in that it is assumed to be a temporary store that can be preserved in densely amnesic patients with grossly impaired episodic long-term memory. It is, though, assumed to play an important role in feeding information into and retrieving information from episodic long-term memory. The buffer serves as a modeling space that is separate from long-term memory, but which forms an important stage in long-term episodic learning. Shaded areas in the model of working memory, incorporating the episodic buffer as shown in Fig. 7.5, represent 'crystallized' cognitive systems capable of accumulating long-term knowledge, and unshaded areas represent 'fluid' capacities (such as attention and temporary storage), themselves unchanged by learning.

In more simple words the main characteristics of the buffer as outlined by **Baddeley** and **Wilson** (2002) are that it has a limited capacity, integrates information from a range of sources into a single complex structure or episode, acts as an intermediary between the subsystems, combining them into a unitary multi-dimensional representation and active binding, which is highly demanding of the central executive. It is designed to fill a gap in the model, because none of the three components (phonological loop, visuo-spatial sketchpad, or central executive) can be regarded as general storage that can combine several kinds of information.

Evidence In Support of The Episodic Buffer: Many studies have been done which provide evidence for the existence of the episodic buffer. Chincotta et al. (1999) have pointed out that without the episodic buffer many findings are hard to account for. Baddeley et al. (1987) found that the immediate memory span for unrelated words is about 5 words; however the immediate span for sentences is about 15 words and this finding becomes hard to account for without the episodic buffer. Baddeley and Wilson (2002) argued that high levels of immediate prose recall depend upon the capacity of the episodic buffer and an efficient central executive. As predicted by this model, patients with impaired long-term memory still have good immediate prose recall, and this recall is better if the amnesic patient has good executive functioning, compared to those with more severe executive deficits. Baddeley (2001) believed that there is unlikely to be a single location of the episodic buffer in the brain. A fMRI study by Prabhakaran et al. (2000) compared the retention of verbal and spatial information held in an integrated or unintegrated form. The results showed greater right frontal activation for integrated information, with unintegrated retention showing more posterior activation of areas previously implicated in verbal and spatial working memory. Thus Prabhakaran et al. saw episodic buffer activation within the frontal lobes and concluded that 'The present fMRI results provide evidence for another buffer, namely, one that allows for temporary retention of integrated information'.

The proposal of the episodic buffer clearly does represent a change within the working memory framework, whether conceived as a new component, or as a fractionation of the older version of the central executive. By emphasizing the importance of coordination, and confronting the need to relate working memory and long-term memory, it suggests a closer link between our earlier multi-component approach and other models that have emphasized the more complex executive aspects of working memory. The revised framework differs from many current models of working memory in its continued emphasis on a multi-component nature, and in its rejection of the suggestion that working memory simply represents the activated portions of long-term

memory (**Cowan, N.** 1999). It also rejects the related view that the slave systems merely represent activations within the processes of visual and verbal perception and production **(Jones, D.M**. 1993 and **Allport, D.A**. 1984). Although working memory is intimately linked both to long-term memory and to perceptual and motor function, it is regarded as a separable system involving its own dedicated storage processes.

3. Phonological Loop

Phonological loop, also called the *phonetic loop* or the *articulatory loop*, is that part of working memory that rehearses verbal information. The phonological loop stores a limited number of sounds for brief periods and can be thought of as an inner ear. It is now thought to be made up of two components (**Gathercole and Baddeley 1993**). One component is the *phonological store*, which allows acoustically coded items to be stored for a brief period. This is a *short-term phonological store* with auditory memory traces that are subject to rapid decay. It can hold traces of acoustic or speech based material. Material in this short-term store lasts about two seconds unless it is maintained through the use of the second subcomponent, articulatory subvocal rehearsal. Prevention of articulatory rehearsal results in very rapid forgetting (decay). The other component is the *articulatory control system*, or *articulatory rehearsal component,* which, allows subvocal repetition of the items stored in the phonological store and thus can revive memory traces.

According to **Baddeley** (1986, 1990), the phonological loop consists of: (1) A passive phonological store concerned with speech perception (2) An articulatory process linked to speech production. Baddeley suggests that auditory presentation of words has direct access to the phonological store, but visual presentation only has indirect access via subvocal articulation. Support from research with patients with brain damage , **Shallice** and **Butterworth** (1977); **Vallar** and **Baddeley** (1984).

Any auditory verbal information is assumed to enter automatically into the phonological store. Visually presented language can be transformed into phonological code by silent articulation and thereby be encoded into the phonological store. This transformation is facilitated by the *articulatory control process*. The phonological store acts as an 'inner ear', remembering speech sounds in their temporal order, whilst the articulatory process acts as an 'inner voice' and repeats the series of words (or other speech elements) on a loop to prevent them from decaying. The phonological loop may play a key role in the acquisition of vocabulary, particularly in the early childhood years. **(Baddeley A, Gathercole S** and **Papagno C** 1998). It may also be vital for learning a second language.

Evidence In Support of The Phonological Loop: A robust finding in working memory research is that to recall a set of phonologically similar words is much more difficult than to recall a set of phonologically dissimilar words, which is the well-known *phonological-similarity effect* (**Conrad** and **Hull** 1964). This finding points out that the capacity of information retention in our working memory store more or less depends on the phonological nature of the information to be memorized. The more similar (phonologically) the item to be memorized, the more difficult it is to retain in the working memory store. This phonological similarity effect is good evidence for the role of the phonological loop in short-term memory tasks. **Larsen et al**. (2000) found that serial recall was 25% worse if a list of words was phonologically similar.

Another support for the phonological loop comes from t*he word-length effect*. The word length effect is the finding that short items are remembered better than long items on immediate serial recall tests. **Baddeley et al**. (1975) describes the ability to reproduce a sequence of words better with short rather than long words. This suggests that the capacity of the phonological loop is determined by the temporal duration and that memory span is determined by the rate of rehearsal. These findings have sometimes not been replicated. There is evidence that the word-length effect depends on the phonological loop (**Baddeley et al.** 1975, 2002).

The effect of articulatory suppression also lends support to the existence of the phonological loop. Memory for verbal material is impaired when people are asked to say something irrelevant aloud. This is assumed to block the articulatory rehearsal process, thereby leaving memory traces in the phonological loop to decay (**Baddeley, A.D. et al**. 1975).

Another research done by **Murray, D.J**. (1968), related with the transfer of information between codes, supports the existence of the phonological loop. When items are presented visually, adults usually name and sub-vocally rehearse them, so the information is transferred from a visual to an auditory code. When this articulation is suppressed, then it prevents the transfer of information and in this case the above mentioned effect of phonological similarity is erased for visually presented items.

There is also neuropsychological evidence in support of the phonological loop. **Waters, G.F. et al.** (1992), have pointed out that defective phonological store explains the behavior of patients with a specific deficit in phonological short-term memory. Aphasic patients with dyspraxia are unable to set up the speech motor codes necessary for articulation, caused by a deficiency of the articulatory rehearsal process. While on the other hand, patients with dysarthria, whose speech problems are secondary, show a normal capacity for rehearsal. This suggests that it is the subvocal rehearsing that is crucial (**Baddeley, A.D.** and **Wilson, B.A.** 1985).

In conclusion, we can say that Baddeley's theory accounts reasonably well for the word-length effect and the effects of articulatory suppression. **Baddeley et al**. (1998) and **Papagno et al**. (1991) suggest that the phonological loop may be more important in learning new words than familiar ones. **Baddeley** (1998) found evidence that subvocal rehearsal is not needed for vocabulary learning as young children (who do not use subvocal rehearsal) still show a link between phonological memory and vocabulary learning.

4. Visuo-Spatial Scratch Pad

Visuo-spatial scratch pad stores visual and spatial information and can be thought of as an inner eye. Like the phonological loop, it has limited capacity, but the limits of the two systems are independent. In other words, it is possible, for example, to rehearse a set of digits in the phonological loop while simultaneously making decisions about the spatial layout of a set of letters in the visuo-spatial scratchpad. It is used in the temporary storage and manipulation of spatial and visual information. This is evident from the studies done by **Baddeley et al**. (1975) and **Baddeley** and **Lieberman** (1980) which suggest that the processing of visualiable messages relies mainly on spatial coding.

Logie (1995) argues for two components of visuo-spatial working memory: (1)The *visual cache* that is supposed to stores form and color information; and (2) the *inner scribe* that deals with spatial and movement information and body movements; rehearses and transfers information in the visual cache to the central executive. **Logie** (1995) has described the theoretical relation between the visual cache and inner scribe components of the 'visuo-spatial sketchpad' as passive and active, respectively. According to him, the visual cache is a passive storage component that is subject to decay and interference by new visual information. The inner scribe is an active rehearsal component that stores spatial codes and prevents both visual and spatial codes from decaying.

Support for Logie's theory comes from comparisons of learning techniques and interference tasks (**Quinn** and **McConnell** 1996). In another study done by **Klauer, K. C**. **and Zhao, Z**. (2004), they found that there is less interference between visual and spatial tasks than between two visual tasks or two spatial tasks. Studies done on patients with brain injury have shown that brain damage can influence one of the components without influencing the other (**Beschin et al.** 1997).. **Smith, E. E**. and **Jonides, J**. (1997), conducted a PET study which showed differences in brain activation during different visual and spatial working memory tasks (**Sala et al**. 2003). Their results indicate that working memory tasks with visual objects mostly activate areas in the left hemisphere, whereas tasks with spatial information activate more areas in the right hemisphere.

Other studies that support Logie's theory are **Brandimonte et al**. (1992) which describes the link between the visuo-spatial sketchpad and Kosslyn's spatial medium.

Evidence in Support of the Visuo-Spatial Scratch-Pad: In conclusion, we can say that in its recent formulation, the visuo-spatial scratch-pad is strongly associated with the visual input. It stores visual features, spatial configurations, visual images or the results of visual construction tasks (**Logie** 2003; **Logie** and **Pearson** 1997; **Quinn** and **McConnell** 1999). Support for the strong relationship between the visual input domain and the visuo-spatial scratch pad is seen in the finding that visual imagery's main tasks are impaired by additional visual input, even if the additional material is irrelevant and should be ignored by the participants. (**Logie** 1986; **Logie** and **Marchetti** 1991; **Quinn** and **McConnell** 1999). It seems that irrelevant visual material overwrites the information held in the store, in a way similar to the irrelevant speech effect observed within the phonological loop (**Salamé** and **Baddeley** 1982). According to this position, the visuo-spatial scratch pad holds only visual information; hence, spatial information from auditory input cannot be directly represented within this mechanism.

An Overall Evaluation of the Working Memory Model

There are several advantages of the working memory system over Atkinson and Shiffrin's short-term store. Working memory involves both active processing and transient storage of information. It is involved in all the complex tasks and explains the partial short-term memory deficits sometimes caused by brain damage. It incorporates verbal rehearsal as an optional process which is more realistic that the enormous significance within the multi-store model. For **Gilhooly** (1996), the working-memory model also has practical applications which extend beyond its theoretical importance. There is also considerable body of empirical research which seems to support the existence of the two slave systems (**Baddeley et al**. 1975). However, The visuo-spatial store has not been investigated in the same depth as the phonological store, but there is experimental evidence which supports its existence (**Baddeley et al**. 1973). However, the role of the central executive remains unclear. It is hard to measure limited capacity. Precise constraints of central executive function are unknown (**Richardson** 1984; **Hampson** and **Morris** 1996). **Eysenck** (1986) feels that the idea of a single central executive is as inappropriate as that of a unitary STM. It is probable that the central executive consists of several components or that there are two or more central executives. More research is needed into the relationship between the episodic buffer, the other components of the system and long-term memory. As a consequence, working memory is a net of active components distributed over several part-systems, some of which are modality specific, others shared across modalities (**Ruchkin et al**. 2003).

PSYCHOLOGY NUGGET

Operating Your Working Memory

Baddeley (1997) has suggested that you can get a good feel for the operation of working memory by the following task. Try to work out how many windows there are in your home. If you are like most people, you will have formed a mental image of your home and counted the windows either by imagining the outside of the house or by walking through the house room by room. The image will be set up and manipulated in your visuo-spatial scratch pad and the tally of windows will be held in the phonological loop as you count them subvocally. The whole operation will be supervised by the central executive, which will allocate the tasks and recognize when the final total has been reached.

However to conclude, we can say that this model has proved influential and is still being developed and expanded. According to **Baddeley** (cited in **Groeger** 1994),

"*I talk about it (the central executive) as if it is a single unitary system; it probably is a system, but I do not know how unitary it is. It is almost certainly the case that what one will end up with is a number of interrelated executive processes, and indeed it may be possible ... to do away with the central executive as an entity. I don't really have a strong view about whether you have a system with a dictator at the top, or an oligarchy or a syndicalist system, but it is important to recognize that there does appear to be some form of overall executive control*."

EXPERIMENTAL PERSPECTIVE

Working Memory and General Intelligence: Role of Short-Term Storage

A study done by **Roberto Colom, Carmen Flores-Mendoza, M. Ángeles Quiroga** and **Jesús Privado** (2005) examined the relationships among short-term memory (STM), working memory (WM) and general intelligence (*g*). Two independent samples of participants performed several verbal, quantitative and spatial STM and WM tasks, as well as a broad set of tests measuring psychometric intelligence. The constructs are carefully sampled to include heterogeneous tasks and tests to control the effect of unwanted variance. The results have several points of interest. First, there is a strong correlation between STM and WM. Second, WM is a slightly better predictor of *g* than STM. Third, when the correlation between STM and WM is statistically controlled, the unique predictive power of WM is small, which suggests that the short-term storage component of the WM system largely drives the relationship between WM and *g*.

EXPERIMENTAL PERSPECTIVE

Distinction Between Short-Term Memory and Working Memory (A Research Article)

Different investigators have used different definitions when talking about the distinction between short-term memory and working memory. This has only mounted to confusion and it becomes difficult to clearly distinguish between these two types of memories. The term *working memory* was used by **Miller et al**. (1960) to refer to temporary memory from a functional standpoint. If we take this into account, then there is no clear distinction between short-term and working memory. However, **Baddeley** and **Hitch** (1974) were fairly consistent with this definition but overlaid some descriptions on the terms that distinguished them. They agreed with the views of **Atkinson** and **Shiffrin** (1968) of short-term memory as the unitary holding place. In due course of their researches, they realized that the evidence actually was consistent with a multi-component system that could not be reduced to a unitary short-term store, they used the term working memory to describe that entire system. **Cowan** (1988), on the other hand, maintained a multi-component view but without a commitment to precisely their components; instead, the basic subdivisions of working memory were said to be the short-term storage components and central executive processes that manipulate stored information. By Cowan's account, **Baddeley's** (1986) phonological loop and visuospatial sketchpad would be viewed as just two of the many aspects of activated memory that are susceptible to interference to a degree that depends upon the similarity between features of the activated and interfering information sources. **Baddeley's** (2000) episodic buffer is possibly the same as the information saved in Cowan's focus of attention, or at least is a closely similar concept.

There has been some shift in the definition or description of working memory along with a shift in the explanation of why the newer working memory tasks correlate with intelligence and aptitude measures so much more highly than simple, traditional, short-term memory tasks such as serial recall do. **Daneman** and **Carpenter** (1980) had assumed that what is critical is to use working memory tasks that include both storage and processing components, so as to engage all of the parts of working memory as described, for example, by **Baddeley** and **Hitch** (1974). Instead, **Engle et al**. (1999) and **Kane et al**. (2001) proposed that what is critical is whether the working memory task is challenging in terms of the control of attention or not. For example, **Kane et al**. found that working memory span storage-and-processing tasks correlates well with the ability to inhibit the natural tendency to look toward a suddenly appearing stimulus and instead to look the other way, the anti-saccade task. Similarly, **Conway et al**. (2001) found that individuals scoring high on storage-and-processing tests of working memory notice their names in a channel to be ignored in dichotic listening less often than low-span individuals; the high-span individuals apparently are better able to make their primary task performance less vulnerable to distraction, but this comes at the expense of being a bit oblivious to irrelevant aspects of their surroundings. In response to such research, Engle and colleagues sometimes used the term working memory to refer only to the processes related to controlling attention. By doing so, their definition of working memory seems at odds with previous definitions but that new definition allows the simple statement that working memory correlates highly with aptitudes, whereas short-term memory (redefined to include only the non-attention-related aspects of memory storage) does not correlate so highly with aptitudes.

Cowan et al. (2006b), while adhering to the more traditional definition of working memory, made an assertion about working memory similar to that of Engle and colleagues, but a bit more complex. They proposed, on the basis of some developmental and correlational evidence, that multiple functions of attention are relevant to individual differences in aptitudes. The control of attention is relevant, but there is an independent contribution from the number of items that can be held in attention, or its scope. According to this view, what may be necessary for a working memory procedure to correlate well with cognitive aptitudes is that the task must prevent covert verbal rehearsal so that the participant must rely on more attention-demanding processing and/or storage to carry out the task. **Cowan et al**. (2005) found that the task can be much simpler than the storage-and-processing procedures. For example, in a version of the running memory span test, digits are presented very quickly and the series stops at an unpredictable point, after which the participant is to recall as many items as possible from the end of the list. Rehearsal is impossible and, when the list ends, information presumably must be retrieved from activated sensory or phonological features into the focus of attention. This type of task correlated with aptitudes, as did several other measures of the scope of attention (**Cowan et al**. 2005, 2006b). In children too young to use covert verbal rehearsal (unlike older children and adults), even a simple digit span task served as an excellent correlate with aptitudes.

Other research verifies this idea that a working memory test will correlate well with cognitive aptitudes to the extent that it requires that attention be used for storage and/or processing. **Gavens** and **Barrouillet** (2004) carried out a developmental study in which they controlled the difficulty and duration of a processing task that came between items to be recalled. There still was a developmental difference in span, which they attributed to the development of a basic capacity, which could reflect a developmental increase in the scope of attention (cf. **Cowan et al**., 2005). **Lépine et al**. (2005) showed that what was important for a storage-and-processing type of span task to correlate well with aptitudes is for the processing component of the task (in this case, reading letters aloud) to occur quickly enough to prevent various types of rehearsal to sneak in between (**Conlin** et al., 2005).

Several papers have pitted storage and processing (perhaps the scope versus control of attention?) against one another to see which is more important in accounting for individual differences. **Vogel et al**. (2005) used a visual array task modified for use with a component of event-related potentials that indicates storage in visual working memory, termed contralateral delay activity (CDA). This activity was found to depend not only on the number of relevant objects in the display (e.g., red bars at varying angles to be remembered), but sometimes also on the number of irrelevant objects to be ignored (e.g., blue bars). For high-span individuals, the CDA for two relevant objects was found to be similar whether or not there also were two irrelevant objects in the display. However, for low-span individuals, the CDA for two relevant objects combined with two irrelevant objects was similar to the CDA for displays with four relevant objects alone, as if the irrelevant objects could not be excluded from working memory. One limitation of the study is that the separation of participants into high versus low span was based on the CDA also, and the task used to measure the CDA inevitably required selective attention (to one half of the display) on every trial, whether or not it included objects of an irrelevant color.

Gold et al. (2006) investigated similar issues in a behavioral design, and testing the difference between schizophrenic patients and normal control participants. Each trial started with a cue to attend to one part of the display at the expense of another (e.g.,

bars of one relevant color but not another, irrelevant color). The probe display was a set that was cued for relevance on most trials (in some experiments, 75%) whereas, occasionally, the probe display was a set that was not cued. This allowed a separate measure of the control of attention (the advantage for cued items over uncued items) and the storage capacity of working memory (the mean number of items recalled from each array, adding across cued and uncued sets). Unlike the initial expectations, the clear result was that the difference between groups was in the capacity, not in the control of attention. It would be interesting to know whether the same type of result could be obtained for high versus low span normal individuals, or whether that comparison instead would show a control-of-attention difference between these groups as **Vogel et al**. (2005) must predict. **Friedman et al**. (2006) found that not all central executive functions correlated with aptitudes; updating working memory did, but inhibition and shifting of attention did not. On the other hand, recall that **Cowan et al**. (2006b) did find was that a control-of-attention task was related to aptitudes.

In sum, the question of whether short-term memory and working memory are different may be a matter of semantics. There are clearly differences between simple serial recall tasks that do not correlate very well with aptitude tests in adults, and other tasks requiring memory and processing, or memory without the possibility of rehearsal, that correlate much better with aptitudes. Whether to use the term working memory for the latter set of tasks, or whether to reserve that term for the entire system of short-term memory preservation and manipulation, is a matter of taste. The more important, substantive question may be why some tasks correlate with aptitude much better than others.

(*This distinction between short-term memory and working memory is an edited and modified extract from Nelson Cowan (2008): 'What are the differences between long-term, short-term, and working memory?', Progress in Brain Research, Vol. 169.*)

LONG-TERM MEMORY

Organization and Process

The human long-term memory is not an untidy jumble of unrelated information; we keep our memory store in order. We organize, categorize and classify information in a number of ways. Our LTM is a bit like a library with a good cross-indexing system. Figure 7.6 shows how science books in a library are organized, categorized and classified.

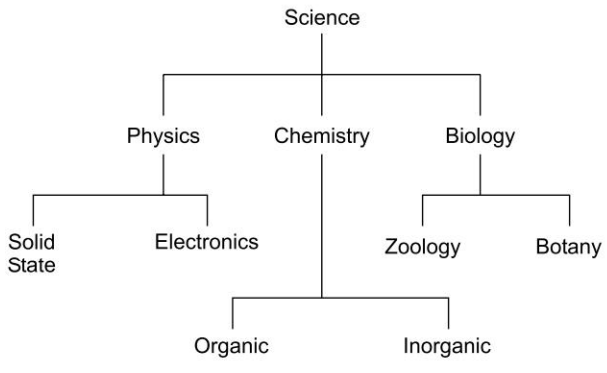

Fig. 7.6 How Science Books are Organized in a Library

Just saying that information in LTM is organized is not sufficient. There has to be evidence for the same. One way to study the organization of information in LTM is to see what happens when we search through our library of experience to retrieve a memory. Suppose you are trying to retrieve a person's name but you cannot quite remember it. The name is on the 'tip of your tongue', but you just cannot recall it. If we look at this tip of the tongue phenomenon (mentioned earlier) in greater detail, we find evidence for the organization of LTM.

Brown and **McNeill** (1966) conducted an experiment to show that information in LTM is organized. They read aloud definitions of unfamiliar words to subjects. Thereafter the subjects were asked to hit the target word on representation of definition.

It was found that the subjects tended to retrieve words from their LTM that sounded like the target word; started with the same letter as the target word; contained the same number of syllabus as the target word or had a meaning similar to that of the target word. These results give evident proof that information in LTM is organized.

Types of LTM Organization

Working at the University of Toronto in the early 1970s, psychologist **Endel Tulving** introduced a distinction between two basic forms of *declarative memory* that he named *episodic* and *semantic*.

Semantic Memory

Much of what is in our memory (LTM) consists of knowledge about what words mean, about the way they are related to one another and about the rules for using them in communication and thinking. It is this kind of memory, that makes our use of language possible. This type of memory is known as semantic memory. Semantic means psychological effects of language. This type of memory is considered to be very stable and there is little forgetting.

The information that is stored in semantic memory is in a highly organized manner. **Collins** and **Quillian** (1969) have indicated that information is stored in logical hierarchies that go from general categories to specific ones. An illustrated example is shown in Fig. 7.7.

Episodic Memory

What was never will be, but what was will ever remain, deep in memory. Episodic memory consists of long-term memories of specific things that happened to us at particular times and places (**Tulving** 1972). In simple words, 'our remembrances of things in the past' make up our episodic memory.

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. Episodic memory, because of it being less highly organized, seems more susceptible to being forgotten than semantic memory does. Episodic memory is related to semantic memory by virtue of information through semantic memory, i.e. in reproducing episodes we take the help of information stored in semantic memory (language). In life, episodic and semantic memories interact and to some degree overlap. In fact, memory for the events of our own lives, called *autobiographical memory*, is a complex mixture of episodic and semantic memories.

Episodic memory is typically subdivided into two further categories: *recollection* and *familiarity*. Recollection refers to memories of a past event that include specific associations and contextual details, whereas familiarity refers to the sense that we experienced an event at some point in the past, even though no specific associations or contextual details come to mind. An example of familiarity without recollection is seeing a person's face and knowing that we have seen that person before, but being unable to remember any specific previous encounter or information about the person, such as their name. Again, these distinctions are

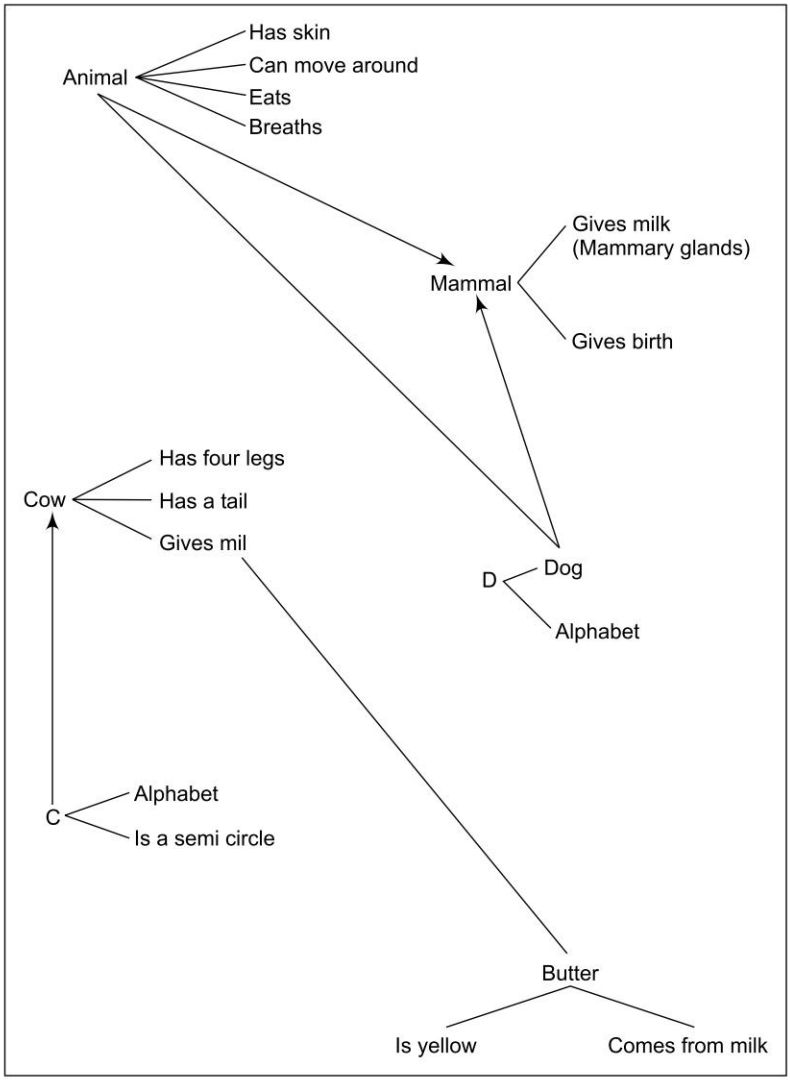

Fig. 7.7 Logical Hierarchies in Semantic Memory (Abraham, A. 1991)

somewhat fuzzy, and it has been argued that familiarity is more closely related to semantic memory or even to priming than it is to episodic memory. Taxonomy of declarative memory functions is shown in Fig. 7.8.

Procedural Memory

Procedural memory can be defined as a type of long-term memory and more specifically a type of implicit memory (Fig. 7.9). It deals with how to perform different actions and skills. Essentially, it is the memory of how to do certain things. Riding a bike, tying a shoelace and washing dishes are all tasks that require

EXPERIMENTAL PERSPECTIVE

Dynamic Switching Between Semantic and Episodic Memory Systems

It has been suggested that episodic and semantic long-term memory systems interact during retrieval. **Kristiina Kompus, Carl-Johan Olsson, Anne Larsson** and **Lars Nyberg** (2009) examined the flexibility of memory retrieval in an associative task taxing memories of different strength, assumed to differentially engage episodic and semantic memory. Healthy volunteers were pre-trained on a set of 36 face–name pairs over a 6-week period. Another set of 36 items was shown only once during the same time period. About 3 months after the training period, all items were presented in a randomly intermixed order in an event-related fMRI study of face–name memory. Once presented items differentially activated anterior cingulate cortex and a right prefrontal region that previously have been associated with episodic retrieval mode. High-familiar items were associated with stronger activation of posterior cortices and a left frontal region. These findings fit a model of memory retrieval by which early processes determine, on a trial-by-trial basis, if the task can be solved by the default semantic system. If not, there is a dynamic shift to cognitive control processes that guide retrieval from episodic memory.

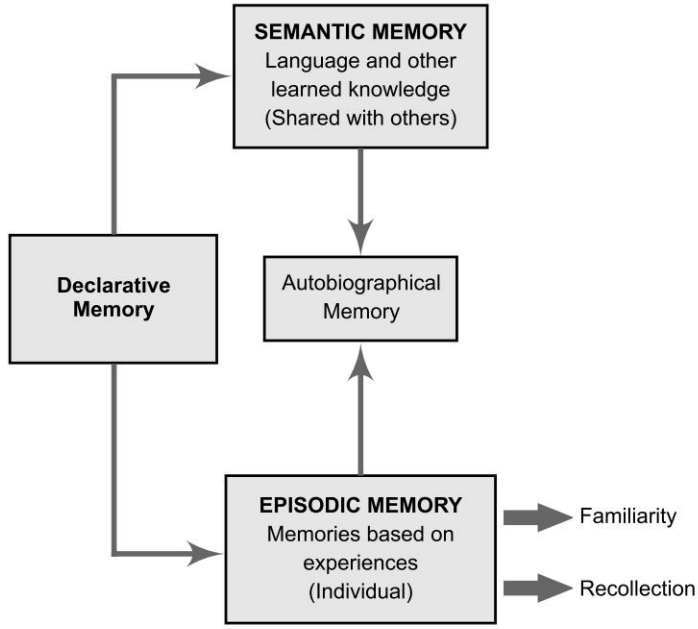

Fig. 7.8 A Taxonomy of Declarative Memory Functions

procedural memory. Procedural memories start to form very early in life as you begin to learn how to walk, talk, eat and play. These memories become so ingrained that they are almost automatic. When we learn a behavior or an emotional response, it becomes part of our procedural memory. Once it has been 'programmed'

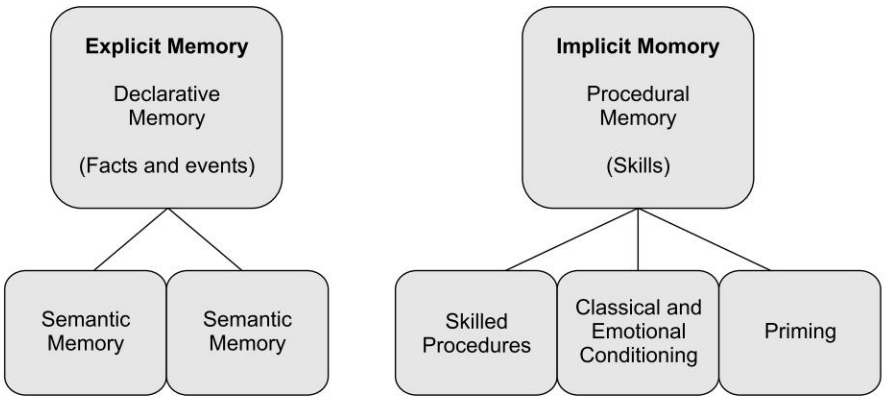

Fig. 7.9 Types of Long-Term Memory

EXPERIMENTAL PERSPECTIVE

Is Procedural Memory Relatively Spared From Age Effects?

Numerous types of age-related deficits in the nervous system have been well documented. While a distinction between general types of memories that are susceptible to compromise with advanced age has been fairly well agreed upon, it is often difficult to determine exactly which specific processes are detrimentally influenced. In this study, **James D. Churchill, Jessica J. Stanis, Cyrus Press, Michael Kushelev** and **William T. Greenough** (2003), used a paradigm that enabled them to distinguish between effects associated with gross motor deficits and those due to learning and memory of a motor skill, per se. In terms of both latency and errors, senescent animals were, on average, impaired in their ability to traverse an elevated obstacle course, compared to younger animals. Yet, if gross motor abilities are accounted for, a fraction of these deficits is readily explained. Moreover, if individual baseline performance differences are normalized, no memory differences are evident across age groups. These observations suggest that memory for a procedural task is not impaired with advanced age.

into the procedural memory system, we do not need to decide how to respond to a specific situation because it has now become automatic, after all. This kind of memory is called 'procedural' because it pre-determines how we will react in a given situation. Once established in the nervous system, it is non-conscious and automatic. Thus, procedural memory is the type of implicit memory that enables us to carry out commonly learned tasks without consciously thinking about them. It is our 'how to' knowledge. Even what we think of as 'natural' tasks, such as walking, require procedural memory.

However, while it is easy to demonstrate actions related with procedural memory, explaining how and where you learned them can be much more difficult. In addition, even though we can do such tasks easily, it is often hard to verbalize exactly how we do them. Procedural memory likely uses a different part of the brain than episodic memory—with brain injuries; you can lose one ability without losing the other. That is why a person who has experienced amnesia and forgets much about his or her personal life often retains procedural memory: how to use a fork or drive a car, for example.

Procedural memory has also at times been referred to as motor memory. This is because of the fact that muscles memorize a particular motion so that you know how to perform a certain action (**Matlin** 1998). Another example is using the computer keyboard. At first, you may need to look to find each letter, but with practice, you just type without thinking of the location of each letter. You have internalized the information into your procedural memory. When performing something with procedural memory, one is not consciously aware of exactly how he or she is performing. They are also not aware of the individual movement and/or how to combine the movements. Becoming aware of these things can disrupt a well-learned skill (**Benjamin**, **Hopkins** and **Nation** 1994).

Some schools of thought believe that procedural memories form a person's character. The basis of this way of thinking is that by learning certain behaviors or emotional responses, they become automatic responses to specific situations. This can be positive in the case of good habits, but it can also mean that negative behaviors are very resistant to change. From this point of view, it takes significant conscious effort to practice and relearn a new positive behavior until the negative one has been replaced.

Difference Between Declarative and Procedural Memory

Declarative memory is memory for repeatedly encountered facts and data such as who is the president, what the square root of 25 is, and where you were born. *Procedural memory*, by contrast, is specifically memory for sequences of events, processes and routines. Deciding which letter of the alphabet has three vertical strokes (M) involves declarative memory. Remembering how to tie your shoes, ride a bike, or shoot a lay-up on a basketball court requires procedural memory.

Evidence for a basic distinction between declarative knowledge and procedural knowledge comes from the effects of brain damage and electric shock. In the 21st Century, ECS (electroconvulsive shock) procedures are refined to the point where 'shock treatments' do not produce measurable effects on memory, largely because of drugs that are administered before treatment and have a protective effect on brain tissue. However, in earlier decades, the treatment was cruder and memory loss after ECS was common. Patients receiving electroconvulsive shock treatments (ECS) often showed amnesia for factual information presented to them in

PSYCHOLOGY NUGGET

Neural Mechanism of Declarative Memory Consolidation and Retrieval

Zi-Jian Cai (1990), in a research paper proposes a new theory addressing the neural mechanism of declarative memory consolidation and retrieval. The premise of the theory is that the cortex is responsible for the storage of declarative memory while the medial temporal lobe is responsible for the consolidation and retrieval of declarative memory. The theory suggests that the medial temporal lobe can only accomplish its functions related to memory by hierarchically and cooperatively regulating the descending limbic system, including the hypothalamus, epithalamus, septum, mammillary bodies and the bed nucleus of the stria terminalis. These descending limbic structures, together with the amygdala, further send efferents to the four ascending NA, 5-HT, DA and ACh systems. It is these four ascending extrathalamic regulatory systems that provide the feedback neural pathways to the cortex and regulate the processes of memory consolidation and retrieval in the cortex. Therefore, the coupling of these descending limbic structures to the ascending NA, 5-HT, DA and ACh systems completes the neural circuits responsible for the consolidation and retrieval of new declarative memories. This neural mechanism of declarative memory consolidation and retrieval is universal to all species in higher mammals.

the preceding days. They showed no similar loss of memory for procedural skills that they practiced before the shock.

Procedural learning appears to be affected by damage to particular areas of the brain, such as the *cerebellum* and *basal ganglia*. By examining people with brain injuries, researchers have demonstrated procedural and declarative memory formation that appear to be controlled by different parts of the brain. Studies have also shown that these memory systems can function independently of each other.

An example of the way in which procedural and declarative systems function independently is the case of a brain-injured patient who is consistently trained to learn a specific task, and can recall the details of his or her training, but fails to improve at the task. This is an example of a damaged procedural memory but a functioning declarative memory. On the other hand, a patient with a functioning procedural memory but a damaged declarative memory would not recall the task training, but would display improved performance of the particular task.

Flashbulb Memories

Neisser (1978) questioned the results of psychological research on memory, as the findings do not enhance our understanding of memory as it occurs in everyday life (**Neisser** 1978). In fact, empirical research and naturalistic studies on memory demonstrate the powerful impact that social factors can have on encoding, retrieval and maintenance of memory contents (**Edwards** and **Middelton** 1988; **Hyman** 1994; **Keenan**, **MacWhinney** and **Mayhew** 1977; **Stephenson**, **Kniveton** and **Wagner** 1991; **Loftus** and **Palmer** 1974; **Wegener** 1987). This raises the question of whether it is appropriate to treat memory as an individual faculty rather than a social faculty (**Bartlett** 1932; **Edwards** and **Middelton** 1986). A particularly intriguing phenomenon in this context is that of flashbulb memories (**Brown** and **Kulik** 1977).

The term *flashbulb memory was* first used to describe memories that seemed to be especially intense and permanent. These are vivid, long-lasting memories of when you first heard surprising and emotionally arousing news (**Brown** and **Kulik** 1977, **Matlin** 1998, **Benjamin**, **Hopkins** and **Nation** 1994.) A *flashbulb memory* is the experience of remembering vividly a certain event and the incidents surrounding it even after a long time has passed. Events that are shocking or otherwise highly significant are often remembered in this way. Even dramatic events in which one is not personally involved is remembered. Flashbulb memories seem to be very detailed and they often focus primarily on how one reacted to the event.

EXPERIMENTAL PERSPECTIVE

Do you Need a 'Flash' to form a Flashbulb Memory?

On January 16, 1991, students encoded an "ordinary event" as part of a demonstration on flashbulb memories and completed a questionnaire modeled after Christianson (1989). By coincidence, the bombing of Iraq began the same day. A similar questionnaire asking about memory for the bombing was given to students two days later. In April 1991 and January 1992, both questionnaires were again completed, allowing comparisons of the students' memories for the two events. Although few differences appeared in the accuracy of the two memories over the intervals, confidence levels for the memories surrounding the bombing were significantly higher. Furthermore, retention and confidence did not differ from April 1991 to January 1992. These findings argue against any special-mechanism hypothesis in the genesis of flashbulb memories but suggest that one thing that makes flashbulb memories unique is the undue confidence with which these memories are held.
(**Charles A. Weaver III**, 1993)

Flashbulb memories seem more vivid because of the high levels of surprise, emotion and perceived importance. Arousal, pleasant or unpleasant, does tend to improve memory (**Bradley**, **Greenwald**, **Petry** and **Lang** 1992; **Benjamin**, **Hopkins** and **Nation** 1994.). Almost like a highlighter, the brain marks the event as important or memorable. It is also possible that these memories are more likely to be discussed in conversation (repetition) or relived in the mind (rehearsal). These things will strengthen the encoding of the information.

PSYCHOLOGY IN EVERYDAY LIFE

What is Most Commonly Remembered by People in Flashbulb Memories?

In a research, **Roger Brown** and **James Kulik** (**Matlin** 1998) found six things that people most commonly remember in flashbulb memories:

1. Who told them the news?
2. What were they doing when they were interrupted with the news?
3. Where were they when they heard the news?
4. How did they feel upon hearing the news?
5. What were others' emotional reactions to the news?
6. What happened afterwards (the aftermath)?

There are several theories about how people form such memories. According to the '**now print'** theory, a mechanism starts up in the brain when something especially significant, shocking or noteworthy is at hand. The entire event is captured and then 'printed', much like a photograph. The 'print' is then stored, like a photograph in an album, for long periods, perhaps for a lifetime. One important aspect is that the entire event

PSYCHOLOGY NUGGET

Flashbulb Memories, Event Memories, and the Factors that Influence their Retention

More than 3,000 individuals from seven US cities reported on their memories of learning of the terrorist attacks of September 11, as well as details about the attack, 1 week, 11 months, and/or 35 months after the assault. Some studies of flashbulb memories examining long-term retention show decline in the rate of forgetting after a year, whereas others demonstrate accelerated forgetting. This article indicates that (a) the rate of forgetting for flashbulb memories and event memory (memory for details about the event itself) slows after a year, (b) the strong emotional reactions elicited by flashbulb events are remembered poorly, worse than non-emotional features such as where and from whom one learned of the attack, and (c) the content of flashbulb and event memories stabilizes after a year. The results are discussed in terms of community memory practices. (**William Hirst et al**., 2009)

is registered, not just the main subject, hence even very insignificant features are remembered. It is periodically reinforced, because such an important event is bound to be remembered and discussed many times throughout the years.

The 'now print' theory implies, among other things, that flashbulb memories are accurate, that they are created at the time of an event, and that they are remembered better because of their highly emotional content. It has become clear, however, that such memories are not always accurate (**Harsch** and **Neisser** 1989). All these implications have been questioned. First, they are not always accurate. This inaccuracy may be because of faulty encoding. Moreover, even if an event is encoded accurately, it may undergo periodic revisions, just like other LTM's. As a result, the flashbulb memory may undergo *reconstruction* and become less accurate over the years until it bears little or no resemblance to what actually occurred.

However, more recent researches suggest that even though flashbulb memories are not as accurate or permanent as the photographic metaphor suggests (**Neisser** and **Harsh** 1990, 1992; **Larson** 1992; **Brewer** 1992; **Weaver** 1993), their forgetting curve is far less affected by time than in the case for other types of memories investigated in the basic memory research (**Bohannon** and **Symons** 1992; **Christianson** 1989; **McCloskey**, **Wible** and **Cohen** 1988; **Pillemer** 1984).

Encoding and Storing in Long-Term Memory

The importance of encoding for LTM is highlighted by encoding failures. In a study known as *Penny Recognition Study,* **Nickerson** and **Adam** (1979) found that most of the subjects when shown the 'heads' side of many coins, put together, failed to identify the right one (different types of distorted pictures of pennies 'head' side were presented together along with the actual picture of the penny). Their results indicate that unless attention is paid, information is not likely to be stored in the long-term memory.

EXPERIMENTAL PERSPECTIVE

What Are The Important Visual Features For Coin Discrimination?

Though previous research has shown that memory for the surface detail of coins is poor. One explanation might be that gross features, such as size, color and edging, are more important than surface detail when discriminating among coins and hence are more memorable. In a 2×4 within-groups experiment, conducted by **John M. Horner** and **Stephen P. Comstock** (2005), 33 participants visually identified coins in 128 coin pairs with surface detail present or obscured, and possibly one of three gross features also eliminated. While the presence of surface detail maintained very high accuracy, when only surface detail was eliminated and the other gross features were still present, participants' accuracy remained high. If surface detail and any gross feature were eliminated concomitantly, accuracy fell significantly. These findings indicate that both surface detail and gross features provide important information for coin discrimination in the real world, and that the gross features of a coin are not more important for visual discrimination than surface detail.

As evident from the above study, encoding for long-term storage requires special attention or strategies of some sort; just being exposed to something is usually not sufficient for long-term storage. Try to test it out yourselves. Try to remember what all is printed on a ten rupees note and write it down. You may find that you have not reproduced all that is written on the rupee. It is so because you never bothered to pay special attention to this information, only the purchasing power of the rupee was of value to you.

Role of Organization

One strategy in remembering things well is to organize or arrange the input so that it fits into the existing LTM categories, or is grouped in some logical manner, or is arranged in some other way that makes 'sense'.

Bower et al. (1969) found that memory for words arranged in logical hierarchies was much better than memory of the same words learned without inherent organization. This can be attributed to the fact that since information is organized in LTM encoding and storing becomes simple and easy when the material being learnt is given meaning and organization. As mentioned before, elaborative rehearsal has an advantage over maintenance rehearsal as far as transfer of information from STM to LTM is concerned. This is because while doing rehearsal of the elaborative type, we are giving meaning and organization to the material being learnt.

However, it must be pointed out that not always the material being learnt is being presented to us in an organized manner. We have to do our own organizational encoding most of the time. This process is known as *subjective organization*. **Tulving** (1962), in a study, demonstrated this effect. He gave subjects a list of unrelated words and thereafter they were required to reproduce the same in any order (*free recall*). He found that certain stereotyped patterns of recall emerged as learning and recall trials of the list was repeated: pairs of words were recalled together as well as short string of words were recalled together which were not arranged in the original list. These results give evidence to the fact that the subjects were doing their own organization.

Role of Imagery

An important aspect of LTM is the form in which the incoming information is being encoded. Another important aspect is whether the information is being encoded by forming images of it.

Paivio (1965, 1971), in an experiment to obtain a rough measure of image-arousing capabilities of words, asked people to rate the difficulties they had in forming visual images, on a scale from 'very easy' to 'very difficult'. Those words for which visual images could be formed very easily were called *concrete* and those for which visual images could not be formed easily or not at all were termed *abstract*. For example, chair is a concrete word and truth is an abstract word. After this was accomplished the effects of imagery on learning and memory were studied.

Using the *paired-associate technique,* Paivio presented to the subjects concrete words and abstract words paired in various ways (C-A, A-C, C-C, A-A). After the presentation, the subjects were given the stimulus word and asked to recall the response (associated word) with it. The results (Fig. 7.10) obtained show that

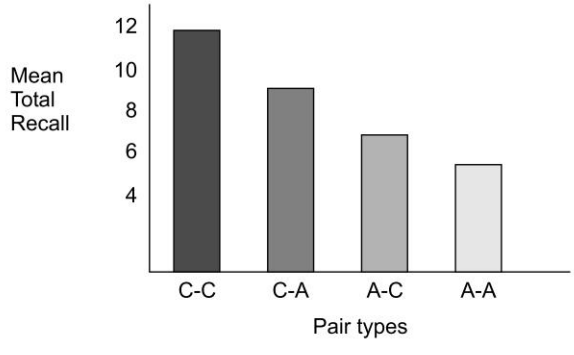

Fig. 7.10 Graph Showing Results of Paivio's Experiment

when a concrete word was used as a stimulus, recall was better (C-C Vs A-C and C-A Vs A-A). It was also found that the imagery evoked by the responses terms also led to a good recall (C-C Vs C-A and A-C Vs A-A). The greatest effect of imagery on recall was found when the stimulus term evoked concrete images (C-C and C-A).

The best way to explain this finding is by drawing an analogy in a hypothetical way. We hang our clothes on a hook or a hanger. In both cases, there is an intermediate assistance to provide this hanging. In the same manner, when a concrete stimulus is used it provides a *conceptual peg* on which responses can be hung.

Constructive Processes

While discussing the theory of general memory functions, it had been mentioned that three distinct processes of memory are there: encoding, storage and retrieval. If these processes are not accurately implemented, memory may be faulty for the related information or not an accurate representation of what was learned. One of the reasons of an inaccurate memory may be that during encoding the to-be-remembered information is modified. These modifications are termed as *constructive processes*. **Frederick Bartlett** (1932) was the first psychologist to describe remembering as `*constructive*'. He meant that ordinary recall is almost never the exact reproduction of something old, of stored stimuli or responses in their original forms. Instead, it is typically the production of something new, appropriate to the present situation. Bartlett's famous studies of story recall illustrate this point.

In a study done by **Frederick Bartlett** (1932), he asked subjects to read aloud a rather bizarre folktale and after a few days, they were asked to recall the same. Their reproduction, when evaluated, showed that the story was shortened and simplified as well as details were omitted and gist was left out. These results show that the subjects were using inferences in their encoding of the story. This is what the constructive process is.

In another study done by **Bransford et al.** (1972), a statement was read out to the subjects. 'The driver of the car was seen drinking before he was involved in an accident'. Thereafter, they were asked the question 'What caused the accident'. It was found that most of the answers were 'Drinking caused the accident'. This indicates that one tends to remember what was inferred at the time of encoding and storage.

Retrieval from Long-Term Memory

After the information has been encoded and stored in LTM, when required it must be retrieved. Here, *retrieval cues* and *reconstructive processes* play an important role.

Retrieval Cues

When one is trying to find the required information from the organized LTM store, he is being aided by retrieval cues or reminders, which direct the memory search to the appropriate part of the LTM library. Many studies have shown the importance of retrieval cues that one encodes at the time of learning (encoding). As we have seen earlier during our discussion on rehearsal that retrieval is quite good when conditions favor rich and elaborate encoding. Perhaps the rich context into which an item of information is embedded provides a number of readily available retrieval cues.

When we are learning, we often do our own organization of the material. This is termed as *subjective organization*. Thus, when we are doing over own organization, we can add a cue to the material being learnt so that at the time of retrieval we can retrieve the required information with the help of the cue. For example, water in Malayalam is called '*Vellam*'. Now during learning, one can have the cue 'well' attached to the word since water is drawn from the well. On retrieval, one has to think of the word well and the actual word will retrieve along with it.

Reconstructive Processes in Retrieval

We have seen earlier that during the encoding stage of LTM constructive processes operate modifying the to-be-remembered information. As opposed to this, modification of already stored input also takes place. This is termed as *reconstructive processes*.

To show the role of reconstructive processes **Loftus** and **Palmer** (1974) conducted an experiment. They took a group of subjects and showed them a short film of an automobile accident. After this, the subjects were divided into two groups. Each group was given a questionnaire to fill. The critical question in the questionnaire for group one was 'about how fast were the cars going when they smashed into each other'. The critical question in the questionnaire given to group two was 'about how fast were the cars going when they hit each other'. After the subjects of each group had filled up the questionnaire, they were asked to disperse and report after a week. After a week when they reported, they were asked a number of questions. The critical question asked was 'Did you see any broken glasses'? There were no broken glasses in the film they had been shown a week back.

The responses of the subjects of group one who had been given the 'smashed' question were positive i.e. they said they had seen broken glasses. The responses of the subjects of group two were largely negative.

These results lend support to the fact that reconstructive processes operate and can influence retrieval. A point, however, must be mentioned that it is difficult to say whether the modifications that have occurred were due to the constructive process at the time of encoding or due to the reconstructive process at a later stage. However, be it whenever, modifications do occur as evident by studies. The reconstruction principle is of utmost importance in the present context because it means that any particular memory is only partly derived from trace information encoded at the time of the event (**Kihlstrom** 1994, 1998).

EXPERIMENTAL PERSPECTIVE

Similarities and Differences Between Working Memory and Long-Term Memory

Two experiments conducted by **Nathan S. Rose, Joel Myerson, Henry L. Roediger III** and **Sandra Hale** (2010) compared the effects of depth of processing on working memory (WM) and long-term memory (LTM) using a levels-of-processing (LOP) span task, a newly developed WM span procedure that involves processing to-be-remembered words based on their visual, phonological or semantic characteristics. Depth of processing had minimal effect on WM tests, yet subsequent memory for the same items on delayed tests showed the typical benefits of semantic processing. Although the difference in LOP effects demonstrates a dissociation between WM and LTM, they also found that the retrieval practice provided by recalling words on the WM task benefited long-term retention, especially for words initially recalled from supraspan lists. The latter result is consistent with the hypothesis that WM span tasks involve retrieval from secondary memory, but the LOP dissociation suggests the processes engaged by WM and LTM tests may differ. Therefore, similarities and differences between WM and LTM depend on the extent to which retrieval from secondary memory is involved and whether there is a match (or mismatch) between initial processing and subsequent retrieval, consistent with transfer-appropriate-processing theory.

Distinction Between STM and LTM

After discussing STM and LTM, let us now briefly talk about the distinguishing features between the two. The features being outlined have been mentioned earlier under different headings. Here, we will try to bring them together in a comparative discussion.

It is essential to state at the onset that the distinction between STM and LTM is one of convenience and is difficult to defend for two reasons. First, STM and LTM are governed in similar ways by the same variables. Second, if the subject's attention is suitably controlled, memory for a given item does not decline as the retention interval increases from one to thirty-two seconds. What causes it to do so is not the passage of time as such but rather the amount of non-specific interference, or the number of shifts, which follow the initial registration of an event (**Waugh** and **Norman** 1968). Taking this into view, we will proceed further.

The distinction between STM and LTM was made by **Melton** in 1962. STM was defined as retention over intervals of up to five minutes while LTM referred to retention over longer intervals. Other investigators have drawn the line at intervals as brief as ten seconds; most however, have assumed that STM spans a maximum interval of thirty seconds to three minutes.

Short-term memory has a capacity of about five items if there are no competing resource demands, somewhat less if attention is divided between short-term maintenance of information and other processes (**Sperling** 1960,1963,1967).

If maintenance rehearsal is not permitted, information is lost from STM at a rate approximated by an exponential function, which starts at 100 percent and decays to its asymptote (straight line that continually approaches a curve, but never meets it) in 20-30 seconds. The asymptote of the curve represents LTM. **James** (1890) referred to STM as primary memory and distinguished it from secondary memory. Primary memory contains information that has never left consciousness; once an item leaves primary memory/ consciousness, it recedes into a passive unconscious state from which it can be returned to consciousness only by a process of retrieval, which may or may not be successful.

Techniques to separate behaviorally the STM and LTM components of retention involve interference with the short-term components of recall. As we have seen while discussing the information-processing theory, if subjects are presented with a list of words to study, their recall will show *recency effect* in that the last four or five words will be recalled better than the words in the middle of the list. This recency effect is obtained only, however, if recall follows immediately upon the presentation of the list, when subjects typically produce the last words of the list first, presumably from their still active short-term buffer. If a thirty-second period filled with some rehearsal-preventing task such as backwards counting intervenes before subjects are allowed to start recalling, the recency effect is wiped out, presumably because the contents of the short-term buffer have been lost. Studies such as this have traditionally been considered to indicate separate, distinct short-term and long-term memory stores. However, recent research has shown that not all of the recency effect normally observed can be ascribed to STM effects, some of it being due to special learning strategies adopted by the subjects in such memory experiments.

Statistical techniques are also used to separate short and long-term retention components. They are based on the assumption that total recall of any serial position in a list of words is composed of two independent components, the STM and LTM contributions: $R = (S + L) - (S \cdot L)$ where R, S and L are the probabilities of recall, short-term and long-term memory, respectively. It is assumed that the value of L is the same for all the items of a list (except for those showing a *primary effect*) and is equal to the observed recall (R) for the items in the middle of a list (where there is no recall from STM). Hence, both R and L can be estimated empirically and values for S can be computed.

In many ways, there is a continuity between the short-term and long-term stores and a more active metaphor would be to describe the short-term store as the momentarily active portion of LTM: consciousness is only able to illuminate a small section of memory at a time, as a tiny flashlight might produce a circle of light in a huge dark room. So long as an item is caught in this light, it is active and accessible to conscious experience, but as soon as the light is needed elsewhere, it is lost and special retrieval procedures are needed to find it again.

EXPERIMENTAL PERSPECTIVE

Division of Working and Long-Term Memory and Relationship With Intelligence

The study done by **Nash Unsworth** (2010) examined the extent to which working (WM) and long-term memory (LTM) reflect the same, related or completely different constructs and how they relate to other cognitive ability constructs. Participants performed various WM, recall, recognition, general fluid (gF) and general crystallized intelligence (gC) measures. Confirmatory factor analyses suggested that the memory measures could be grouped into three separate yet correlated factors (WM, recall, and recognition) and that these factors were strongly related to gF, but were related less so with gC. Furthermore, it was found that the common variance from the three memory factors could be accounted for by a higher-order memory factor which was strongly related to gF, but less so with gC. Finally, structural equation modeling suggested that both the variance common to the WM tasks and the variance common to all the memory tasks accounted for a unique variance in gF. These results are interpreted within an embedded process model of memory and suggest that WM and LTM tasks measure both shared and unique processes, which are important for intelligence.

FORGETTING

Forgetting is the difference between what one has learned and what he has retained. Technically, forgetting is referred to as the loss of information in the retention stage. In certain cases, forgetting may be considered as *negative retention*, which may be temporary or permanent. Information is not forgotten if it has never been learned in the first place and it is not considered forgotten if it is just inaccessible to retrieval although it may be available in the memory. In most cases, details of memory fade rapidly. It is also observed that some forget soon while others have a good memory. Forgetting may be slow or fast, depending upon the individual, the situation and the nature of the information or task learned. We can say that forgetting may be due to inadequate or incorrect encoding or information may be degraded during storage, or storage capacity might be too small to hold all the desired information or retrieval may fail because the search takes place in the wrong part. The rate of forgetting, or the speed with which the material once learned is forgotten, differs from individual to individual. How much and how rapidly a person forgets or whether forgetting takes place at a constant rate or whether one forgets more rapidly at first or later were difficult questions to answer prior to the first significant scientific study of forgetting done by the German psychologist **Hermann Ebbinghaus** (1885). Ebbinghaus learned lists of nonsense syllables and then, using the *relearning method*, tested himself after various time intervals in order to measure the amount of material remembered. (The number of successive trials a subject takes to reach a specified level of proficiency may be compared with the number of trials he later needs to attain the same level. This yields a measure of retention by what is called the relearning method.) **Rubin and Wenzel** (1996) found evidence to support Ebbinghaus from group data, but suggest that autobiographical memory does not fit the model. **Baddeley** (1997) found that the forgetting rate was unusually slow for continuous motor skills e.g. riding a bike. Most studies look at explicit memory and findings with implicit memory have been inconsistent.

Curve of Forgetting

As we can see in Fig. 7.11 forgetting began almost immediately after learning. About 44 percent was forgotten in twenty minutes after the original learning had taken place, about 56 per cent in one hour and 66 per cent

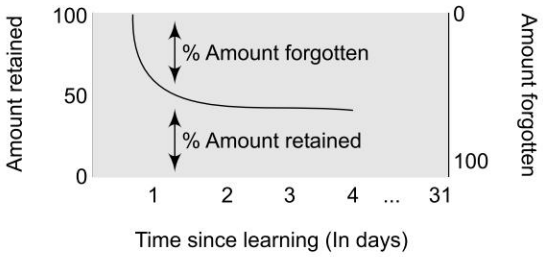

Fig. 7.11 Curve of Forgetting

EXPERIMENTAL PERSPECTIVE

Evaluating Forgetting Curves Psychologically

Richard S. Bogartz (1990) presented a theoretical treatment of forgetting which uses scaled variables, providing a new definition of independence of rate of forgetting from initial level of learning, and an appropriate statistical test of that independence based on functional measurement methodology. It is shown that **Loftus's** (1985a) horizontal interaction method leads to conclusions that are at odds with existing theory, and his conclusion that forgetting is slower for higher degrees of original learning is weakened thereby although it is consistent with his method. **Slamecka** and **McElree's** (1983) approach is rejected, but their conclusion that forgetting rate does not depend on original learning is supported.

in one day. Thereafter, the rate of forgetting declined rather sharply. The importance of this study lies not so much in the observation about the amount of forgetting but in the form of the curve of forgetting obtained. It needs to be commented that since Ebbinghaus used *nonsense syllables* (any of numerous letter combinations without meaning. Generally, they are meaningless sets of two consonants with a vowel switched in between) for this study his findings and, therefore, cannot be generalized to other learning situations. Thus, one cannot make a general statement about the amount and rate of forgetting. One needs to take into account the kind of material learned, the individual differences, the operating conditions and the methods used to test retention.

Now, let us look at how forgetting occur? Why does forgetting take place? There seems to be no one correct and appropriate answer to these questions. Many variables are involved in forgetting and not all have been explained properly. However, efforts here will be to try to discuss the theories of forgetting and gain an insight into the reasons underlying forgetting.

Theories of Forgetting Disuse or Decay Theory

The simplest theory of forgetting is that of disuse or decay. The idea is that learning is the result of practice or use, while during retention intervals, when the information in question is not used, forgetting occurs; therefore, disuse causes forgetting. Such a theory implies physiological basis. It is assumed that learning modifies the central nervous system and that forgetting is produced by deterioration over time of the '*trace'* in the central nervous system. Such deterioration of the '*trace' i*s believed to occur because of the normal metabolic processes of the brain. With the passing of time, the normal metabolic processes of the brain

PSYCHOLOGY NUGGET

Forgetting in Working Memory: Time-Related Decay or Interference-Based

The time-based resource-sharing model of working memory assumes that memory traces suffer from a time-related decay when attention is occupied by concurrent activities. Using complex continuous span tasks in which temporal parameters are carefully controlled, **P. Barrouillet, S. Bernardin, S. Portrat, E. Vergauwe** and **V. Camos** (2007) recently provided evidence that any increase in time of the processing component of these tasks results in lower recall performance. However, **K. Oberauer** and **R. Kliegl** (2006) pointed out that, in this paradigm, increased processing times are accompanied by a corollary decrease of the remaining time during which attention is available to refresh memory traces. As a consequence, the main determinant of recall performance in complex span tasks would not be the duration of attentional capture inducing time-related decay, as **Barrouillet et al.** (2007) claimed, but the time available to repair memory traces, and thus would be compatible with an interference account of forgetting. **Sophie Portrat, Pierre Barrouillet** and **Valérie Camos** (2008) demonstrate here that even when the time available to refresh memory traces is kept constant, increasing the processing time still results in poorer recall, confirming that time-related decay is the source of forgetting within working memory.

are thought to cause the traces of material once learned to disintegrate and decay gradually and finally to disappear altogether resulting in forgetting of the learned material. Forgetting thus, according to this view is the result of the failure of storage.

This explanation for the cause of forgetting has proved inadequate due to several reasons. It is common fact that some learning is forgotten instantly, while some learning is retained for a very long time even though it may not be used for a very long time. If the disuse theory is to be believed, this discrepancy should not be there. Another point of contention is that if disuse or decay operates, then this process should affect equally the retention of different materials learned at the same time. This is not the case. Again, we see that memories may become unavailable but not necessarily decayed. According to this argument, LTM is fairly permanent and information is not lost from it. The difficulties arise in getting access to the information and pulling it out of storage. Researches conducted on LTM suggest that forgetting is more due to the failure in retrieval or in finding out what one knows than to its loss.

The highest objection to this theory is that it is possible to demonstrate that forgetting is affected by the activities that a subject engages in during the retention interval. The evidence from the neurosciences is at best equivocal; partly there is a lack of evidence for the decay theory, and partly there is a difficulty in framing experiments to test the theory, the difficulty being finding ways to simulate learning followed by complete inactivity in a context allowing the screening out of other effects. In a very old study done by **Jenkins** and **Dallenbach** (1924), the results showed that forgetting is negatively accelerated. Forgetting is rapid at first and slower later. The important finding is that there is a substantial difference in retention between the sleep conditions and the waking one. Thus, disuse alone cannot be held solely responsible for forgetting. In another experiment done by **Ekstrand** (1967), the difference between forgetting rates between conditions of sleep and waking has been confirmed. **Fowler**, **Sullivan** and **Ekstrand** (1973) found that most of the forgetting that takes place during sleep occurs during the stage of sleep associated with dreaming (dreams occur mainly during periods of 'rapid-eye-movement'-REM). These studies lend support to the fact that forgetting is a function of the nature of the activity that precedes original learning or activity that fills the retention interval.

The **Bjork** and **Bjork's** (1992) theory of disuse suggests that decay occurs not because of time but because of the inability to associate or use the information with any other information. Bjork and Bjork believed that the memory traces if used constantly or associated with other information would not begin to fade and the memory could be retrieved easily.

The decay theory also fails to explain a number of familiar phenomena, such as the regular survival of certain motor skills even if not practiced for half a century and more, or the ease with which procedural memory in particular can be restored after a short refresher course. It is also extremely difficult to design experiments to exclude all the effects that can suggest decay in memories (**Gross** and **McIlveen** 1999). Hence, it is generally held nowadays that decay theory is not fruitful enough to pursue, and that memory loss is rarely due to neurological decay, with obvious exceptions such as Alzheimer's (**Solso** 1995).

We thus conclude that the disuse theory is inadequate as a complete explanation of forgetting but we still cannot say that disuse does not account for forgetting at all.

Perseveration—Consolidation Theory

As we saw in the critical evaluation of the disuse theory that difference existed between forgetting rates between conditions of sleep and waking but the earliest attempts to, account for this was the contribution of **Muller** and **Pilzecker** (1900). They evaluated the differences and developed the perseveration theory. This is a physiological theory, the idea being that the neural activity produced by learning tends to perseverate (persist or continue) after the end of explicit practice itself. Perseveration has the function of consolidating learning. However, a question arises: Is perseveration a part of ordinary memorial processes?

Hebb (1949) helped make the theory postulated by Muller and Pilzecker clearer. He proposed that the memory trace is held in the form of reverberating electrical circuit while a more permanent structure is laid down. **Duncan** (1949) gave some support to this hypothesis. He tested the effects of *electro convulsive shock* (ECS) on *avoidance learning* in rats. The data obtained showed that the process of consolidation, at least in rats, is essentially completed in one hour. Duncan's conclusions cannot escape criticism yet at least some of the effects he observed were due to the disruption of consolidation.

If the time of occurrence of the interpolated activity is varied, then the perseveration theory finds it difficult to account for the results thus obtained. Nevertheless, a condition of interpolated learning results in substantially worse retention than a 'rest' condition, even when the interpolated learning task is given midway in a retention interval of six weeks (**Bunch** and **McTeer** 1932). Further, it is seen that earlier learning can affect the retention of material learned later. Finally, there are effects due to similarity, between original and interpolated learning, based on the *Skaggs Robinson hypothesis* that are not associated easily by the perseveration theory.

All this makes it clear that the perseveration theory is an inadequate general theory of forgetting. However, the evidence from the studies of electro convulsive shock (**Duncan** 1949) suggests that there may be some effects of perseveration on STM.

Very recently, **Wixted** (2004) argued that the secret of forgetting may lie in consolidation theory.

Interference Theory

This is one of the most important theories of forgetting. This theory comes from a specific aspect of a broader view of behavior known as *associationism*. In the interference theory, the element unit of analysis is the bond between a specific stimulus and a specific response. Once such a S-R connection is established, it is not weakened by the passage of time; however, S-R associations interact with one another, producing behavioral changes that may be either facilitatory or inhibitory. Forgetting is one manifestation of an inhibitory interaction.

EXPERIMENTAL PERSPECTIVE

Forgetting Due to Retroactive Interference

Ebbinghaus' seminal work suggested that forgetting occurred as a function of time. However, it raised a number of fundamental theoretical issues that still have not been resolved in the literature. **Müller** and **Pilzecker** (1900) addressed some of these issues in a remarkable manner but their observations have been mostly ignored in recent years. Müller and Pilzecker (1900) showed that the materials and the task that intervene between presentation and recall may interfere with the to-be-remembered items, and they named this phenomenon 'retroactive interference' (RI). They further asked whether there is a type of RI that is based only on distraction, and not on the similarity between the memoranda and the interfering stimuli. Their findings, and follow up research done by **Michaela T. Dewara**, **Nelson Cowanb** and **Sergio Della Salaa** (2007), in healthy volunteers and amnesiacs, confirm that forgetting can be induced by any subsequent mentally effortful interpolated task, irrespective of its content; the interpolated 'interfering' material does not have to be similar to the to-be-remembered stimuli.

Transfer: We can study the interaction of S-R associations in either of two contexts. Transfer concerns how previous experience affects the acquisition of some specific material. Proaction and retroaction refer respectively to how the retention of material learned at some time may be affected by prior learning or subsequent learning. Since performance on one task can be either helped or hindered by the existence of other things learned, we have the following possible effects: in retention, we can have proactive or retroactive facilitation and proactive or retroactive inhibition. In acquisition, we can have positive or negative transfer.

EXPERIMENTAL PERSPECTIVE

Interference-Based Forgetting in Verbal Short-Term Memory

Stephan Lewandowsky, Sonja M. Geiger and **Klaus Oberauer** (2008), in an article, presented four experiments that tested predictions of SOB (Serial Order in a Box), an interference-based theory of short-term memory. Central to SOB is the concept of novelty-sensitive encoding, which holds that items are encoded to the extent that they differ from already-encoded information. On the additional assumption that distractors are encoded into memory in the same manner as list items, the theory predicts differential effects of interfering activity based on the similarity structure of distractors. Consistent with predictions, three experiments showed that overt articulation of distractors in between recalls of list items did not affect forgetting when the same distractor was repeated multiple times, whereas forgetting was observed if several different distractors were articulated within the same time span. A fourth experiment showed that the absence of forgetting with repeated articulations of the same item was not due to compensatory attentional refreshing of memory traces. The data support the notion that forgetting from short-term memory arises from interference and are difficult to reconcile with temporal decay.

How prior experience affects later learning is the key question that transfer studies answer. In these studies, a distinction is made between general and specific sources of transfer. When transfer is attributed to specifiable relations of similarity between stimuli and/or responses used in successive tasks, it is then said to be specific. When transfer effects are not demonstrably specific in origin, we talk of general transfer.

Though the above explanation of general transfer is a fairly loose one, however, it has been possible to distinguish between two categories of general transfer: *warm-up* and *learning how to learn*. Warm-up is like loosening up the stiff muscles by exercise before the performance of a motor skill. It includes such things as adjusting the rhythm of the memory drum and finding the posture most conducive to attending to the material to be learned. (It will not be wrong to equate the warming-up with what **Thorndike** (1898) says in his *law of readiness.*) Such adjustments occur in early trials and then disappear fairly rapidly after the end of practice.

Learning to learn results in a more permanent change. It is the acquisition of learning skills with practice. Learning to learn is a general phenomenon. Even animals show it.

Within the category of specific transfer, the most widely investigated topic concerns similarity. The *paired-associate* task is the method usually used in such investigations. The maximum positive transfer occurs when both stimuli and responses are similar or the same. Maximum negative transfer occurs when stimuli are identical and responses are opposite.

The proactive and retroactive designs are given in Tables 7.1 and 7.2.

TABLE 7.1 Experimental Design for the Study of Proaction

Groups	Step 1	Step 2	Step 3	Results
Experimental Group	Learns List A	Learns List B	Retention Test on B	
Control Group	Rest (No Activity)	Learns List B	Retention Test on B	

TABLE 7.2 Experimental Design for the Study of Retroaction

Groups	Step 1	Step 2	Step 3	Results
Experimental Group	Learns List A	Learns List B	Retention Test on A	
Control Group	Learns List A	Rest (No Activity)	Retention Test on A	

In both retroaction and proaction, experimentally produced forgetting takes place when the control group retains more than the experimental group. The classical term for this forgetting is *proactive* or *retroactive inhibition* - depending on the design. A newer term is *interference*, which is probably better because it avoids the physiological connotations of the term inhibition.

Development of The Interference Theory: Retroaction Response Competition

McGeoch (1942) stated the original version of the interference theory. He assumed that original associations remain intact, while new associations were acquired during interpolated learning. This has been called the *independence hypothesis*, since it suggests that two sets of related associations may exist in storage without mutual interference (**Barnes** and **Underwood** 1959). According to this theory, the cause of forgetting is not a failure of storage, but is competition between alternative responses at recall. Such competition is, unfortunately, all too common an experience.

Melton and **Irwin** (1940) undermined the independence hypothesis in a famous study. Their experiments determined the influence of amount of practice at the interpolated task on the retention of the first task in a retroaction experiment. This experiment and others (**Underwood** 1948) suggest two factors at work in the retroactive inhibition experiment and one in the proactive inhibition experiment. In the retroactive design, learned responses appropriate to the first task become unavailable during the learning of the second. In addition, the second task produces learned responses, which compete at the time of the retention test for the first task with those of the first task. In the proaction experiment, only competition is at work. Since the

interfering task is learned first, there is no additional learning task interposed before the test for retention that would permit unlearning of the correct responses of the second list.

A hypothesis favoring the independence hypothesis was first proposed by **Newton** and **Wickens** (1956) and was further elaborated by **Postman**, **Stark** and **Fraser** (1968). This hypothesis was known as the hypothesis of *response-set competition*. This hypothesis has further received support from studies done by **McGovern** (1964), **Postman** and **Stark** (1969), among others. The phenomenon of response—set competition or suppression, although important, cannot account for retroaction. It is best to think of response-set competition as an elaboration of the two-factor theory, rather than an alternative to it (**Postman** and **Underwood** 1973). Our best current guess is that response-set suppression and unlearning of specific stimulus-response associations are both implicated in forgetting.

In an elaboration to the two-factor theory and to explain why interpolated learning did not result in an ever-increasing number of overt intrusions in the study by **Melton** and **Irwin** (1940), **Underwood** (1945) pointed out that the extent to which the subject will be able to recall the responses appropriate to the first list is a function of the degree to which he can tell which responses go with which list i.e. his ability to differentiate. Underwood assumed that the degree of differentiation of two lists would depend on the absolute and relative strengths of the competing association and the length of time between the end of learning of the second list and the subsequent retention test. Other experiments done by **Deese** and **Marder** (1957); **Winograd** (1968) confirm the importance of list differentiation as a factor contributing to forgetting. As with response-set suppression, it represents an elaboration of the classic two-factor interference theory.

Proaction in the Interference Theory

Greenberg and **Underwood** (1950), in an experiment, examined whether subjects learn how to recall in the same sense that they learn how to learn. The subjects learned a list of ten paired adjectives to a criterion of eight out of ten correct. Recall was measured after a period of 48 hours thereafter. On the day following recall, subjects were given a new list to learn to the same criterion and recall was measured after 48 hours. This procedure was repeated for two additional lists. The accuracy of recall was studied as a function of number of previous lists learned. It was found that recall did not improve, but instead, fell from about 69 percent on the first list learned to about 25 percent on the fourth list. The existence of intrusions from previous lists suggested that proactive interference was the source of the decrement in recall. Thus, the forgetting of material learned in the laboratory may be in large part the result of previous lists learned in the same laboratory. Underwood, after reviewing many previous experimental studies in which recall was measured after 24 hours, determined the average number of lists the subjects were required to learn before learning the list on which recall after 24 hours was measured, in each of the experimental studies reviewed by him. Thereafter he plotted recall as a function of the number of previous lists and produced a graph (Fig. 7.12). This figure provides clear evidence of the importance of proactive interference in retention.

One thing should be kept in mind and made clear that there are two different effects of learning several lists successively. We know that recall gets worse with successive practice but at the same time, the phenomenon of learning to learn asserts itself in that subjects learn successive lists to criterion more quickly with more practice. These two phenomena illustrate the distinction between proaction and transfer.

Criticism of the Interference Theory

In most of the studies done related to the interference theory, it is seen that the loss of information occurs in both the control group and the experimental group. This loss is comparatively more in the experimental group. This forgetting in the control group could be the result of interference from previous habits learned

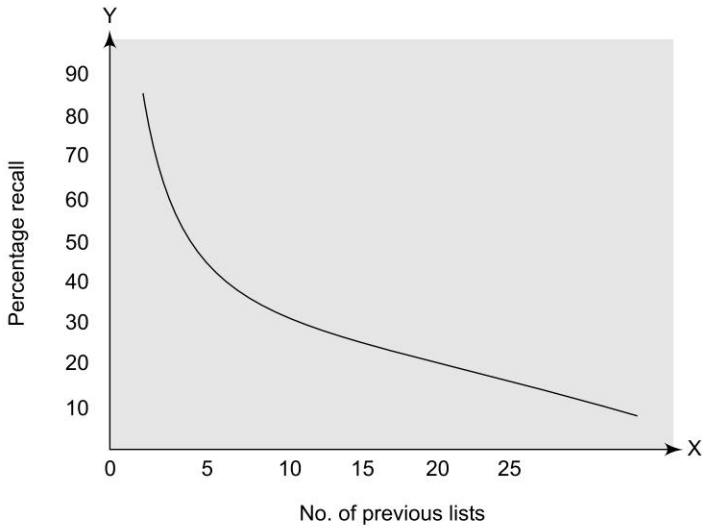

Fig. 7.12 Proactive Interference in Retention

outside the experimental laboratory. **Underwood** and **Postman** (1960) investigated these extra-experimental sources of interference in the retention of simple verbal tasks in the laboratory. However, the results of the experiment were disappointing. There was forgetting during one-week period for all lists, but there was no statistically reliable differential forgetting among the lists. The only reliable evidence that the investigations found was that high-probability syllables were relearned more rapidly than everything else was. The results thus cast doubt on the importance of interference as an explanation of forgetting.

Underwood and **Postman** (1960) soon suffered another setback when their findings about the role of extra experimental language habits were put to test. It was pointed out that the plausibility of their theory hinges upon the adequacy of the unlearning hypothesis i.e. that during the learning of a list extra-experimental associations are actually weakened. It was, however, found after testing three groups of subjects that there was no difference among the three groups. It was concluded that learning one or two interpolated lists did not seem to cause any unlearning of pre-experimental associations. However, evidence of unlearning of experimentally learned associations was obtained. Underwood and Ekstrand tried to experiment by equating both conditions mentioned above in a proactive experimental task. They found that *distributed practice* led to little, if any, proactive inhibition, while *massed practice* led to large amounts of proactive inhibition. In addition, the effect of the degree of learning was not large and was noticeable only in the massed learning conditions. This result has serious implications for interference theory. The failure of associations learned under distributed practice to interfere with associations learned in the laboratory is a major embarrassment for interference theory. If the interference theory is to be believed, then if a subject learns a list to a fixed criterion in the laboratory, the rate of forgetting should be essentially independent of the nature of the list. This should not be as such if the findings of **Underwood** and **Ekstrand** (1966) are to be taken into consideration.

Baddeley (1990) considered the ecological validity of the interference experiments that have been made. He states that the tasks given to subjects are too close to each other and, in real life, these kind of events are more spaced out. **Solso** (1995) also considered experiments performed in this field. He said that proactive interference experiments use nonsense syllables and this would be difficult to demonstrate in real life.

Alternatives to the Interference Theory

Over the years, a lot of discontentment has grown over the interference theory but no single accepted alternative has been put forward. One attempt on a theoretical level has been the idea of *cue-dependent forgetting*. **Anderson** and **Bower** (1973) have made another attempt in organizing the field of memory by proposing a '*neo associationistic model of memory*'. Some theorists have adopted a 'cognitive' viewpoint'. According to this viewpoint, the human learner is active rather than passive in his interaction with the informational aspects of the environment, and that what is learned forms a *schema* or organized mental structure. However, cognitive psychologists have not yet produced a theory powerful enough to make specific predictions about a wide range of phenomena, but they have demonstrated some very interesting empirical effects that are embarrassing to any straightforward interpretation of interference theory. Under-distributed practice to interfere with associations learned in the laboratory is a major embarrassment for interference theory. If the interference theory is to be believed, then if a subject learns a list to a fixed criterion in the laboratory, the rate of forgetting should be essentially independent of the nature of the list. This should not be as such if the findings of **Underwood** and **Ekstrand** (1966) are to be taken into consideration.

Current Status of the Interference Theory

Some of the problems with interference theory have resulted in changes in the theory, but at the same time, a whole lot of confusion has been created (**Postman** and **Stark** (1969); (**McGovern** 1964; **Shiffrin** 1970). **Baddeley** and **Scott** (1971) have produced experimental data that tends to support the decay theory over interference, while it is also the case that interference is much easier to demonstrate when the experimental task involves remembering nonsense words rather than meaningful ones. This implies that interference is a phenomenon to be associated with episodic memory, rather than the more stable semantic memory where the semantic information about meaningful words would be stored (**Solso** 1995).

Current theories in interference assume that 'forgetting reflects the disruption of the memory trace by other traces, with the degree of interference depending on the similarity of the two mutually interfering memory traces (**Baddeley** 1990)'.

Jacoby et al. (2001) argued that proactive interference might occur for two reasons: One because of problems in retrieving the correct response (discriminability) and second because of the strength of the incorrect response learned initially (bias or habit). Research shows the latter to be the case.

Lustig and **Hasher** (2001b) used a word completion task to show that implicit memory is vulnerable to interference. Most research is based on the probably incorrect assumption that individuals passively allow themselves to suffer from interference. **Kane** and **Kane** and **Engle** (2000) found that individuals with high attentional or working-memory capacity would be better able to resist proactive interference unless they were performing an attentionally demanding task at the same time as the learning task. **Anderson** (2003) argued for the role of control mechanisms that allow us to select certain memories whilst inhibiting others. **Anderson** and **Green** (2001) provided evidence for an inhibitory mechanism.

It is probable that forgetting can be attributed to both types of interference. Research is limited in several ways: Few studies of processes used to minimize interference. The theory largely ignores the role of inhibitory processes. Implicit memory information is lacking. Special (non-real-life) conditions are needed to see substantial interference. Associations learned outside the lab seem less liable to interference, than those learned inside.

MOTIVATED FORGETTING

The explanation of *motivated forgetting* stresses on a person's motives in remembering and forgetting. One aspect of this type of forgetting is the *principle of repression*, whereby some memories become inaccessible to recall

because of the way in which they relate to our personal problems. The Motivated Forgetting Theory suggests that people forget things because they do not want to remember them or for a certain reason. Freud considered that repression was one of the main reasons people forget. Painful and disturbing memories are made unconscious and are, therefore, very difficult to retrieve, but still remain in storage. Psychoanalytic studies of normal people suggest that repression is a very general phenomenon, but laboratory studies are not yet very satisfactory.

Anderson (1995) considered that repression caused memory loss, but believed that, when a person forgot disturbing memories, it was more to do with post-traumatic shock. He also discovered that very specific time periods are forgotten by humans. For example, Sirhan could not remember shooting Robert Kennedy. **Parkin** (1993) stated that another factor of repression was post-traumatic stress disorder. He discovered that survivors of the Holocaust that seemed well adjusted were less able to recall their dreams than those survivors who were not well adjusted, when woken from rapid eye movement sleep.

The nature of forgetting that occurs in dramatic instances of *amnesia* aids in the understanding of *repression*. The amnesia victim forgets items of personal reference while still retaining a rich store of memories and habits to conduct current activities. The beginning of the amnesia can often be traced to some severe emotional shock that the individual suffered and from which the amnesia provides an escape. Amnesia, according to **Parkin** (1987), 'is not some general deterioration of memory function, but a selective impairment in which some functions, such as learning novel information, are severely impaired, while others, including memory span and language, remain normal'. There is also evidence that shows that amnesia sufferers retain normally functioning short term memories. Amnesia is a complicated form of memory loss and shows that the human mind is an extremely vast area of psychology and is very difficult to explain by theories alone.

Table 7.3 lists out different types of forgetting.

TABLE 7.3 Types of Forgetting

Type of Forgetting	Definition	Mnemonic	Examples
Proactive Interference	Current (new) information is lost because it is mixed up with previously learned, similar information.	Earlier information *proj*ects itself forward and interferes with what we try to learn next.	1. You have trouble recalling your new phone number because you get it mixed up with your old number. 2. A student finds a new concept to be hard to understand because she confuses it with similar ideas she has already learned.
Retroactive Interference	Previously learned information is lost because it is mixed up with new and somewhat similar information.	New information interferes with older information, much like a *retroactive* pay raise influences previous pay checks.	1. You have trouble recalling your old phone number because you get it mixed up with your new number. 2. A student understood a concept last week but can no longer discuss the concept correctly, because he confuses it with other concepts studied since that time.
Disuse/Decay	We can no longer recall information from our memory because of disuse.	There was once a clear memory, but it has decayed because the information was never used.	1. You cannot recall your family's phone number when you were in the first grade, because your family has not lived at that house in over 40 years. 2. A student correctly identifies concepts on the unit test, but gets these concepts wrong on the final exam ten weeks later, because she has not used or reviewed those concepts during the intervening time.
Distortion	An imperfect image is recalled from long-term memory.	The information is still in memory, but it is *distorted*, so that it is no longer the same as what was originally stored.	1. You think you can recall your phone number from the first grade, but actually you have it partially confused with another number. 2. A student gives an answer that is partially correct, but is largely inaccurate because it contains a blend of both accurate and inaccurate pieces of information.

PSYCHOLOGY NUGGET

Is Motivated Forgetting an Indication of Our Guilt?

People routinely engage in dishonest acts without feeling guilty about their behavior. When and why does this occur? Across four studies done by **Lisa L. Shu, Francesca Gino** and **Max H. Bazerman** (2009), people justified their dishonest deeds through moral disengagement and exhibited motivated forgetting of information that might otherwise limit their dishonesty. Using hypothetical scenarios (Studies 1 and 2) and real tasks involving the opportunity to cheat (Studies 3 and 4), we find that dishonest behavior increased moral disengagement and motivated forgetting of moral rules. Such changes did not occur in the case of honest behavior or consideration of the behavior of others. In addition, increasing moral saliency by having participants read or sign an honor code significantly reduced or eliminated unethical behavior. While dishonest behavior motivated moral leniency and led to strategic forgetting of moral rules, honest behavior motivated moral stringency and diligent recollection of moral rules.

METHODS OF IMPROVING MEMORY

Most of us have complained about our memory one time or other. Memory problems are common. Memory occurs in the brain, but it is not limited by the brain. Many things around us influence our ability to make and retrieve memories. Physiological, emotional, social and environmental processes, as well as by cognitive processes other than memory *per se* (e.g. perception, reasoning, decision-making), are now accepted as affecting memory functioning in everyday life. When we generally talk about poor memory, we are really talking about poor recall. Recall is possible only if the content is retained in the memory. This is possible only if we have encoded information and then stored it into memory. That is, unless we have not assimilated, we cannot recall at all. Even if we encode information in our memory, we may not be able to recall it. The main reasons range from encoding failures to problems in retrieval. William James and many others, including mnemonists emphasized to how we encode things into our memory.

Now, let us discuss some simple techniques to improve memory. These are based on facts, which were discussed about memory and its functioning.

1. **Sharp Attention**: As we saw that for information to be sent into the short-term memory from the sensory register, it was important that it be attended to properly. Without giving proper attention, you possibly cannot expect to memorize anything, let alone forgetting it. Therefore, the first step is to pay rapt attention.
2. **Encode Information**: When you are exposed to information, you tend to organize it into categories. Your proper encoding of information is very important for recall. Suppose you come across a new word 'improvident', you will immediately associate it with its opposite 'provident' and store it in that category. If by mistake or otherwise you mix it up with word 'providence', you will associate it with the same and wrongly encode it. On recall, you will search for that word and retrieve 'improvidence', instead of 'improvident'. Thus, it is very important that you encode the information in a correct manner.
3. **Use Your Learning Mode**: We as humans function based on some common psychological principles, yet there are individual differences in our style. Some of us encode information best by seeing or

EXPERIMENTAL PERSPECTIVE

Effect of Mnemonic Training upon the Working Memory Capacity

A study done by **Yuh-Shiow Lee** and **Hsiang-Chun Chen** (2005), examined whether mnemonic training had an effect on working memory capacity. Two types of visual imagery mnemonic training, including Method of Loci and Body Hook, were adopted. The experimental group who received the mnemonic training was compared with the control group on six working memory tasks. Forty freshmen participated in this study. They were equally divided into the experiment and control groups. At first, all participants took the six working memory tasks, including Forward digits span, Backward digits span, Operation span, Reading span, Simple visuo-spatial span, and Spatial span tasks. A week later, both the experimental and control groups took a two-hour training course. The experimental group received training on imagery mnemonics, while the control group received the thinking method training unrelated to mnemonics. A week after the training, all participants took the six working memory capacity tasks again.

The result showed that the imagery mnemonic training increased the working memory capacity of reading span, simple visuo-spatial span and spatial span. These results indicated that working memory capacity enhanced by training. Imagery mnemonics made the storage of information more effective by using visual imagery and further increased the capacity of visual working memory.

reading, while others find it more convenient to hear it and encode it. You should adopt the strategy you feel comfortable with for example - listen to a prerecorded audio tape or read a book or notes. However, the best encoding takes place through a combination of both types – audio and visual.

4. **Dummy Run**: Encoding is essential in the initial stages but rehearsal of the encoded information is important for long-term storage of the same. If you are introduced to someone at a party and he verbally tells you his mobile number and you want to remember it, you will have to consciously repeat the digits of the number quietly for a few times. The same applies to any information you are exposed to and want to put into your memory. It is important that when you do rehearsal, you should do elaborative rehearsal giving it organization and meaning. This way, you can be sure that it will be stored properly in your memory and easily available to you when required.
5. **Add a Cue**: When we are exposed to any new information, we unconsciously associate it with what it relates. The best way to enable correct recall is to consciously make an effort and add a retrieval cue to the information at the time of encoding. Suppose, you are learning the Malayalam language and you were told that water is called '*vellam'* in that language. What you can do immediately is add the retrieval cue 'well' to it because well relates with water. When later on, you are asked what water is called in Malayalam, you will immediately think of the well and pull out the word '*vellam'* from your memory store.
6. **Connect Like a Web:** Your memory already must be containing a lot of information about things in the world. When you are exposed to fresh information immediately, relate and connect it with the information already stored in your memory. This will broaden your knowledge and ease your search engine job, enabling it to conveniently retrieve information you have fed into the browser in your brain.
7. **Permit Sharing**: In a computer with the enabling of networking, one can share information. The same applies with you. Your knowledge increases when you share it. This is so because while sharing you are giving fresh rehearsals to the already stored input in your memory, making it stronger.
8. **Mince Carefully**: When we are exposed to information, the constructive processes begin to operate automatically on their own, modifying the information, which is to be remembered. We encode what

we infer and if this inference of ours is faulty, it may lead us to omit important details. Thus, while encoding information we must try switching on to a manual mode and encode the information taking care not to omit important details.

9. **Visualize**: An important aspect of long-term memory is the way in which incoming information is encoded. Whenever we hear about anything, we try to visualize it, i.e. form an image of the same. This visualization helps us in encoding that information. These images are not exact copies of the input but partial and altered representations of what is around us. Studies have shown that when we encode information by forming images, they aid in recall.
10. **Prioritize**: You simply cannot afford to take in all the information you are exposed to throughout the time. There is a capacity to what you can take in, process the same and store it. Even a computer cannot possibly process and store beyond its capacity. It is wise to set your priorities and focus on what you really need to know and store in your memory. This will also not put unnecessary stress on your resources and your memory will function to its full capacity.
11. **Write**: Though taking help of notes or other devices for remembering do no good to your memory, but they surely assist you in reminding you and not forgetting. However, you still will have to remember to make the note and key in the information in your device.
12. **Exercise**: A healthy mind stays in a healthy body. There is no right or wrong form of exercise. There is a huge array of exercise forms one could choose from, be it indoor or outdoor exercises. However, one should consult a physician who could recommend an appropriate exercise routine, which suits one's body. Regular exercises will strengthen the body and help in the reduction of your stress, depression and anxiety levels. All these associated disorders adversely affect the memory.
13. **Relax**: Relaxation will give rest to your body and mind as well. Your fatigue, mental as well as physical, will go and your will feel rejuvenated. There are various relaxation techniques you can do like yoga, meditation, spending quality time with friends and family, take occasional massage therapies, listening to music, watching humorous movies, etc.
14. **Sleep Well**: A good night sleep reenergizes your systems, makes you healthy and wise. So, follow a definite sleep schedule and sleep as per the requirements of your body, thereby putting the devil of forgetfulness to sleep.
15. **Quit Smoking**: Smoking heightens the risk of vascular disorders that can cause strokes and constrict arteries that deliver oxygen to the brain. This less supply of oxygen to the brain will reduce its capacity to function efficiently. Hence, avoid trying to blow away your memory in smoke.
16. **Eat Healthy**: Avoid skipping your meals. Include food that contains vitamin B6, B12, and folic acid in your diet. Vitamin E and beta-carotene and omega-3 fatty acids- all these together provide the required resources to the body for effective functioning. This, in turn, will also benefit your brain and thereby memory functioning. So feed your forgetfulness a proper and balanced diet so that it may disappear.
17. **Be Positive:** The manner in which we perceive things makes a lot of difference about how we will encode the same. Having a negative outlook influence inferences, we end up in faulty encoding. Having a positive outlook will not only motivate us to accomplish a task but also to do it with the best of our ability. This will ultimately also influence the manner in which we will encode the information. Learning something just for the sake of it will lead us to distorted encoding due to negativity. We will not pay attention and do proper rehearsals. So always, keep a positive outlook towards the tasks you have to do or learn.

KEY TERMS

Recall
Recognition
Relearning
Short-term memory
Long-term memory
Sensory memory
Sperling's research
Echoic memory
Working memory
Semantic memory
Declarative memory
Procedural memory
Retrieval cues
Decay theory
Interference theory
Motivated forgetting

EVALUATE YOURSELF

Multiple Choice Questions

1. The most essential feature of memory is
(a) Recall (b) Recognition
(c) Retention (d) Forgetting

2. The information processing theory was given by
(a) Hilgard-Atkinson (b) Atkinson-Shiffrin
(c) Rundus-Atkinson (d) Richard Atkinson

3. The capacity of STM is limited to
(a) 7 chunks (b) 7 + 2 chunks
(c) 7 − 2 chunks (d) 7 ± chunks

4. The 'tip of the tongue' phenomenon illustrates
(a) The primacy effect (b) Levels of processing
(c) Organization in long-term memory (d) The recency effect

5. 'Memories are laid down electrochemically in the brain as entire images containing information.' This concept is related to
(a) Information processing theory (b) Semantic memory
(c) Sensory memory (d) Episodic trace model

6. Span of apprehension implies
(a) The number of items a person can remember after a brief exposure
(b) The number of items a person forgets after learning
(c) The maximum number of items one can apprehend
(d) The minimum number of items one can apprehend

7. Which of the following is not a subcomponent of working memory?
(a) The central executive (b) The engram
(c) The visuo-spatial sketch pad (d) The phonological loop

8. Autobiographical memory is a complex mixture of
(a) Iconic and echoic memory (b) Working and sensory memory
(c) Declarative and implicit memory (d) Episodic and semantic memories

9. When prior learning interferes with recall of a later learning, it is called
(a) Retroactive inhibition (b) Reverse inhibition
(c) Proactive inhibition (d) Active inhibition

10. Which of the following is the most scientific and experimentally tested explanation of forgetting?
(a) Forgetting is through decay (b) Interference effects
(c) Motivated forgetting (d) Disintegration of memory trace

Descriptive Questions

1. How many memory systems are there? Support your answer with research evidence.
2. 'Humans are like digital computers.' Discuss this statement in the light of information processing.
3. 'The greater the depth of information processing, the longer it will be retained.' Critically evaluate this statement.
4. Are there two long-term memory systems? Support your answer with relevant research studies.
5. 'Our senses have a storage system which is subject to rapid decay.' Argue with supportive evidence.
6. How can we experimentally study short-term memory? Briefly discuss its methods.
7. What is the mechanism of forgetting in short-term memory? Discuss.
8. 'Working memory is generally viewed as the combination of multiple components working together.' Explain this statement with supportive research studies.
9. Outline the difference between declarative and procedural memory.
10. What are the major causes of forgetting? Discuss each of them briefly.

Critical Thinking Questions

1. Anil studies in college and is 20 year old. To date, he remembers vividly the color or pattern of a particular 'favorite' shirt when he was 10 year old. But he can not remember a step in a geometry problem in a test after preparing for it in the night before. Why do you think Anil could recall such an old fact but could not recall a particular step while solving the problem despite his preparation?
2. Do you think playing crossword puzzles regularly will enhance your vocabulary and general knowledge? Why?
3. Is forgetting a deliberate act? Why or why not?
4. You have learnt about learning in the previous chapter. Is memory related to learning?

PRACTICAL EXERCISES

1. Ask your students to watch five film songs that they are unfamiliar with on YouTube, DVD player, or on television (try the 1950's or 60's songs). Ask them to listen to a different set of five songs on mobile or any other music player (audio). Ask them to spell out the lyrics from both the sets. Do you see any pattern in the students' memory? Discuss your findings with the class.
2. Ask your students to recall or remember a photograph which he/she thinks is 'interesting'. Ask them to describe briefly the reason they find it interesting. Do they also remember the source accurately where they saw the photograph.
3. Ask the students about their icons. Ask each student to list 3–5 characteristics of his/her icon.

Answers to Multiple Choice Questions

1. (c) **2.** (b) **3.** (d) **4.** (c) **5.** (d) **6.** (a) **7.** (b) **8.** (d) **9.** (c) **10.** (b)

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Chapter 8

THINKING AND LANGUAGE*

'*Cogito, ergo sum'* (I think, therefore I am.)
—**Rene Descartes**

CHAPTER OBJECTIVES

After reading this chapter, you will learn:

- About the nature of thinking, its various interpretations and theories, and frameworks to explain the process of thinking.
- The background research and an overview of the history of evolution of the study of thinking , including the famous Gestaltic thinking school.
- About various styles of thinking.
- About the development of language and the social basis of language development.
- The various theoretical frameworks of language acquisition and their critical evaluation and also the various structures and rules in language.
- About concept development process, its typology, methodologies of learning concepts, and the strategies of concept formation.
- Problem-solving as a psychological process, the construct and approaches to problem-solving, and creativity as a special case of problem-solving.
- Decision-making and judgment within a heuristic framework.

NATURE OF THINKING

What is thinking? Thinking is a part of our fundamental identity as humans. The word *thinking* means a variety of things. It expresses beliefs such as 'I think water is the best drink' and 'Rani thinks honesty is

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not always the best policy'. The expression 'Amrit is sure to think of a solution' makes thinking a realm of problem-solving—the mental construction of an action plan to achieve a goal. The complaint 'why don't you think before you speak' emphasizes that thinking can be a kind of a foresight, a way of seeing the possible future. 'What do you think about it?' makes thinking a judgment, an assessment of the desirability of an option. 'She is always lost in thought' is when thinking is a sort of a mental meadow through which a person might meander on a rainy afternoon, oblivious to the world outside.

PSYCHOLOGY IN EVERYDAY LIFE

Is Google Changing the Way We Think?

The Net is fast becoming a universal medium, the conduit for most of the information that flows through the eyes and ears and into the mind. The advantages of having immediate access to such an incredibly rich store of information are many, and they have been widely described and appreciated. "The perfect recall of silicon memory," *Wired*'s Clive Thompson has written, "can be an enormous boon to thinking." But that boon comes at a price. The media theorist Marshall McLuhan stated in the 1960s, that the media are not just passive channels of information, they supply the stuff of thought, but they also shape the process of thought. And what the Net seems to be doing is chipping away the capacity for concentration and contemplation. The mind now expects to take in information the way the Net distributes it: in a swiftly moving stream of particles.

The use of the Web has also decreased the capacity to stay focused on long pieces of writing. Some of the bloggers have begun mentioning this phenomenon in their blogs. Scott Karp, who writes a blog about online media, confessed that he has stopped reading books altogether. "I was a lit major in college, and used to be [a] voracious book reader," he wrote. "What happened?" He speculates on the answer: "What if I do all my reading on the Web not so much because the way I read has changed, i.e. I'm just seeking convenience, but because the way I THINK has changed?"

It is clear that users are not reading online in the traditional sense. Indeed there are signs that new forms of "reading" are emerging as users "power browse" horizontally through titles, contents pages and abstracts going for quick wins. It almost seems that they go online to avoid reading in the traditional sense.

The ubiquity of text on the Internet, the popularity and the new sense of the self that it has given may be weakening our capacity for the kind of deep reading that emerged when an earlier technology, the printing press, made long and complex works of prose commonplace. "We are not only *what* we read," says Maryanne Wolf, a developmental psychologist at Tufts University and the author of *Proust and the Squid: The Story and Science of the Reading Brain*. "We are *how* we read." Wolf worries that the style of reading promoted by the Net, a style that puts "efficiency" and "immediacy" above all else, makes us "mere decoders of information." Our ability to interpret text, to make the rich mental connections that form when we read deeply and without distraction, remains largely disengaged. Reading, explains Wolf, is not an instinctive skill for human beings. It's not etched into our genes the way speech is. We have to teach our minds how to translate the symbolic characters we see into the language we understand. And the media or other technologies we use in learning and practicing the craft of reading play an important part in shaping the neural circuits inside our brains. Experiments demonstrate that readers of ideograms, such as the Chinese, develop a mental circuitry for reading that is very different from the circuitry found in those of us whose written language employs an alphabet. The variations extend across many regions of the brain, including those that govern such essential cognitive functions as memory and the interpretation of visual and auditory stimuli. We can expect as well that the circuits woven by our use of the Net will be different from those woven by our reading of books and other printed works.

During most of our waking hours, and even when we are asleep and dreaming, we are thinking; it is hard not to think as you read these words you are thinking, and even if you stop thinking about what you

are reading and your thoughts wander off to something else—perhaps to what you are going to do tomorrow-you will still be thinking. What do we do when we think? Loosely speaking, we might say that we mentally or cognitively process information. More formally, we might say that thinking consists of the cognitive rearrangement or manipulation of both information from the environment and the symbols stored in long-term memory. A symbol represents, or stands for, some event or item in the world; as we will see, images and language symbols are used in much of our thinking. The general definition of thinking given above encloses many different varieties of thought. For instance, some thinking is highly private and may use symbols with very personal meanings. This kind of thinking is called *autistic thinking*; dreams are an example of autistic thinking. Other thinking is aimed at solving problems or creating something new; this is called *directed thinking*. It is also the type of thought we value so much in the great human thinkers. The definition of thinking given above also covers the thinking that we believe animals engage in when they solve certain kinds of problems. From another viewpoint, thinking is the 'form of information processing that goes on during the period between a stimulus event and the response to it'. In other words, thinking is the set of cognitive processes that mediate, or go between, stimuli and responses. To illustrate, suppose you are trying to make a decision about buying a new turntable for your hi-fi. The salesperson presents several turntables in your price range (the stimuli), and you eventually purchase one of them (the response). Before making the response, however, you weigh the advantages and disadvantages of the several turntables, you process the information you have about them. Your information processing your thinking about the turntables-thus mediates between the turntables as stimuli and your eventual response of buying one of them. Thinking consists of the cognitive re-arrangement or manipulation of both information from the environment and the symbols stored in long-term memory. A symbol represents, or stands for, some event or item in the world.

EXPERIMENTAL PERSPECTIVE

Stroop Effect

When we first learned to tie shoelaces, we needed to carefully think through each step of the process. Now we do not even seem to think about the steps, but simply initiate a series of movements that seem to proceed without any further influence. When a behavior or skill seems to no longer require direct interaction, cognitive psychologists say it is *automatized*. Many behaviors can become automatized: typing, reading, writing, bicycling, piano playing, driving and so on. Automatization is an important part of our daily life. We perform a variety of automatized behaviors quickly and effortlessly.

Now what would happen in a situation where an automatized response is in conflict with the desired behavior. Stroop (1935) noted that when one tries to name the color in which color words are printed, it takes longer when the color word differs from the ink color than when the color word is the same as the ink color. He was able to successfully elicit cognitive confusion (interference) through presenting participants with stimuli that were each composed of incongruent characteristics. This effect is a demonstration of interference, in which the brain experiences slowed processing time because it is trying to sort through conflicting information.

A common explanation for the Stroop effect is that it has automatized the process of reading. Thus, the color names of the words are always processed very quickly, regardless of the color of the ink. On the other hand, identifying colors is not a task that observers have to report on very often, and because it is not automatized it is slower. The fast and automatic processing of the color name of the word interferes with the reporting of the ink color.

The Stroop task and its many variations are commonly used tools in cognitive psychology to explore how different types of behaviors interact and the interplay between mental processes that are automatic and those that are under conscious control.

Thinking can also be considered a process that mediates, or goes between, stimuli and responses. Thinking uses images and language. The images used in thinking are abstractions and constructions based on information stored in long-term memory. In using language as a 'tool of thought', we draw on word meanings and grammatical rules stored in our semantic long-term memories. While language is often used in thinking, we do not literally 'talk to ourselves' when thinking. Thinking or cognition refers to a process that involves knowing, understanding, remembering and communicating.

Thinking may be viewed as a cognitive process that is characterized by the use of symbols as representation of objects and events. Thought can deal with remembered, absent or imagined objects and events. Thought incorporates present perceptions and activities into its topics, but it deals with their meanings in ways that go beyond the present; hence, thought reflects upon and elaborates what is given in perception and movement.

The symbolic activity of thinking can be very simple or very complex. In its simplest form, it means link more than 'remember' or recall but at the other extreme, the word 'think' may refer to such highly vigorous and reflective activity as a scientist undertakes when he attempts to solve a complex problem. Whether thinking is simple or complex, it always seems to involve one thing: A symbolic mediating process. When we think something links past experience with our present responses, mediating process fills in the gap between the stimulus situation and the responses we make to it.

The word 'thinking' is often used when we simply express opinions or when we recall past events. On the other hand, we also use the word 'thinking' in connection with the process of solving problems.

Considerable research evidence suggests that thinking is achieved only after a long period of development from earlier forms of behavior. Other evidence suggests that a stimulus of some sort may be required to initiate thinking, and still other studies have often indicated that human thinking often indicates symbols.

Thinking may be defined as a complex cognitive form of behavior that occurs only at a relatively advanced stage of development when simpler and more direct methods of dealing with the environment have proved ineffective.

Thinking can be seen as kind of master skill, able to meet not only the challenges of the immediate environment, but also those that come from the past and the future, and that are expressed in some kind of symbolic form such as words, numbers or colors.

Humphrey (1963) has put forth a number of generalizations that summarize much of what we know about thinking today.

1. Thinking is defined as that which occurs in experience when an organism, human or animal, recognizes and solves a problem.
2. A problem is defined as a situation that for some reason prevents an organism from reaching a goal.
3. Thinking involves some kind of active combination of features that, as part of the problem situation, were originally discrete.
4. It involves past experience, but exactly how past experience is employed in thinking is still not completely understood by psychologists.
5. All thought-activity involves 'trial and error', whether animal or human, and regardless of whether the activity is overt or covert.
6. Motivation is important in thinking, and in fact, all thinking is goal directed.
7. Language cannot be equated with thinking, but on the other hand, it is ordinarily of great assistance in human thinking.
8. A number of different kinds of elements may be involved in a total response to a problem situation. These include (a) images of various kinds, (b) muscular activities, (c) speech and (d) concepts.

According to **Barlett** (1965), thinking is related in a number of respects to relatively elementary sorts of motor skills such as figure skating or playing tennis. There are experts in both skills, and expertness is

acquired, both in thinking and in other skills, at least partially through practice. Furthermore, every kind of motor skill is based upon stimuli picked up directly or indirectly from the environment and thinking is also based upon stimuli or information from the environment. Thinking typically does not involve a single response, but rather a sequence of responses, each evoked by a specific stimulus.

Thinking in Closed or Open Systems

A useful distinction to make in discussing thinking is one between thinking 'closed systems' and thinking in 'open systems'. A closed system is defined as one possessing a limited number of units or items. Furthermore, the properties of the units that are to be used are known at the outset and do not change as the thinking proceeds. Logical and mathematical types of thinking are examples of this kind.

Open system thinking, on the other hand, requires that the individual move from what is regarded as one field of knowledge to a different one in which he may have to handle novel elements, properties and relations as well as novel rules.

Gestalt View of Thinking

For the Gestalt psychologists, the problem was within the structure of the situation that posed it. When the potential solver was faced with the situation, he would find that its incomplete structure aroused stresses in him of various kinds. This was, they hypothesized because the situation was perceived as incomplete. As a result, the subject set to work to try to complete it. Kohler's experiments on monkeys proved that thought activity could either proceed by steps or in a single brilliant leap—steps up to a point and then in a flash of 'insight', the immediate solution to the problem.

EXPERIMENTAL PERSPECTIVE

GESTALT SCHOOL

Gestalt psychology or **gestaltism** : (German: *Gestalt*—"essence or shape of an entity's complete form") given by **Kurt Koffka** (1886–1941), **Wolfgang Köhler** (1887–1967), **Max Wertheimer** (1880–1943) of the Berlin school is a theory of mind and brain positing that the operational principle of the brain is holistic, parallel, and analog, with self-organizing tendencies. The **Gestalt effect** is the form-generating capability of our senses, particularly with respect to the visual recognition of figures and whole forms instead of just a collection of simple lines and curves Thinking proceeds from the whole to the parts, treating a problem as a whole, and permitting the whole to command or dominate over the parts.The phrase "The whole is greater than the sum of the parts" is often used when explaining Gestalt theory.

Gestalt psychologists think of problems as a whole. Max Wertheimer considered thinking to happen in two ways: productive and reproductive:

Productive thinking is solving a problem with insight. This is a quick insightful unplanned response to situations and environmental interaction.

Reproductive thinking is solving a problem with previous experiences and what is already known. (1945/1959). This is a very common thinking. For example, when a person is given several segments of information, s/he **deliberately** examines the relationships among its parts, analyzes their purpose, concept, and totality, he/she reaches the "aha!" moment, using what is already known. Understanding in this case happens **intentionally** by reproductive thinking.

Thinking, therefore, may be defined operationally as the establishing of order(s) in the apprehended world. This ordering relates to objects as well as to representations of the world of objects. Thinking is also the ordering of relations between objects and the ordering of relations between representations of objects. When a symbol stands for a class of objects or events with common properties, we say that it refers to a concept. By means of concepts, we are able to order and classify our environment. In other words, the 'categorization' of objects and events on the basis of features and relationships that are either common to the objects perceived or judged to be so by the individuals, concepts. Features essentia1 to the concept are termed 're1evant' and those which are unimportant are termed 'irrelevant'. Usually, a concept is given a symbol, a name. The word, therefore, is not the concept itself but only a symbol.

Rips and **Conrad** (1989) elicited judgments from college students about how various mentalistic terms relate to one another. Using statistical techniques, the investigators were able to summarize these relationships in two diagrams, shown in Fig. 8.1. Figure 8.1(a) shows a hierarchy of *kinds* or categories. Roughly, people believe planning is a kind of deciding, which is a kind of reasoning, which is a kind of conceptualizing, which is a kind of thinking. People also believe that thinking is *part of* conceptualizing, which is part of remembering, which is part of reasoning and so on [Fig. 8.1(b)]. The kinds ordering and the parts ordering are similar; most strikingly, 'thinking' is the most general term in both orderings—the grand superordinate of mental activities that permeate all the others.

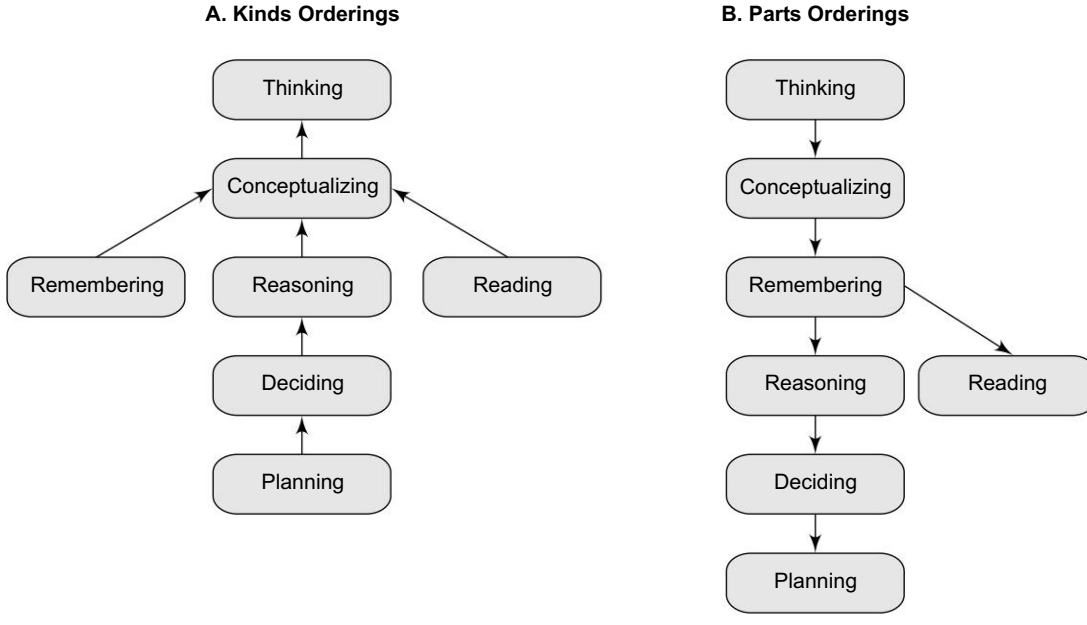


Fig. 8.1 **People's Conceptions of the Relationships Among Terms for Mental Activities: (a) Ordering of 'Kinds' and (b) Ordering of 'Parts'**

It is not easy to make the move from the free flow of everyday speech to scientific definitions of mental terms, but a preliminary definition of thinking suggests *thinking is the systematic transformation of mental representations of knowledge to characterize actual or possible states of the world, often in service of goals*.

This definition introduces a plethora of terms with meanings that need clarity but at which we can only hint. A *mental representation* of knowledge is an internal description that can be manipulated to form other descriptions. To count as thinking, the manipulations must be *systematic* transformations governed by certain constraints. Whether a logical deduction or a creative leap, what we mean by thinking is more than unconstrained associations (with the caveat that thinking may indeed be disordered). The internal representations created by thinking describe states of some external world (a world that may include the thinker as an object of self-reflection)—that world might be our everyday one, or perhaps some imaginary construction obeying the 'laws' of magical realism. Often (not always—the daydreamer, and indeed the night dreamer, are also thinkers), thinking is directed toward achieving some desired state of affairs, some goal that motivates the thinker to perform mental work. Our definition thus includes quite a few stipulations, but notice also what is left out. We do not claim that thinking necessarily requires a human (higher-order primates, and perhaps some other species on this or other planets, have a claim to be considered thinkers) or even a sentient being. (field of artificial intelligence). Thinking often seems to be a conscious activity of which the thinker is aware (*cogito, ergo sum*); however, consciousness is a thorny philosophical puzzle, and some mental activities seem pretty much like thinking, except for being implicit, rather than explicit. Finally, we do not claim that thinking is inherently rational, optimal, desirable, or even smart. A thorough history of human thinking will include quite a few chapters on stupidity. The study of thinking includes several interrelated subfields that reflect slightly different perspectives on thinking, which are as follows.

1. ***Reasoning***, which has a long tradition that springs from philosophy and logic, places emphasis on the process of drawing inferences (*conclusions*) from some initial information (*premises*)? In standard logic, an inference is *deductive* if the truth of the premises guarantees the truth of the conclusion by virtue of the argument form. If the truth of the premises renders the truth of the conclusion more credible but does not bestow certainty, the inference is called *inductive*.
2. ***Judgment and decision-making*** involve assessment of the value of an option or the probability that it will yield a certain payoff (judgment) coupled with choice among alternatives (decision-making).
3. ***Problem-solving*** involves the construction of a course of action that can achieve a goal. Although these distinct perspectives on thinking are useful in organizing the field (and this volume), these aspects of thinking overlap in every conceivable way. To solve a problem, one is likely to reason about the consequences of possible actions and make decisions to select among alternative actions. A logic problem, as the name implies, is a problem to be solved (with the goal of deriving or evaluating a possible conclusion). Making a decision is often a problem that requires reasoning. These subdivisions of the field, like our preliminary definition of thinking, should be treated as guideposts, not destinations.

Simply put, thinking refers to a process that involves knowing, understanding, remembering and communicating. Thinking involves a number of mental activities listed below, and cognitive psychologists study them in great detail.

1. Symbols and language
2. Concepts
3. Problem-solving
4. Decision-making
5. Judgment Formation

To summarize, thinking is a complex, cognitive form of behavior that occurs only at a relatively advanced stage of development when simpler and more direct methods dealing with the environment have proved ineffective. It might also be said that thinking occurs when familiar ways of organizing and using remembered information are tried and found inappropriate.

A BRIEF HISTORY

Thinking and reasoning long have over the past century emerged as core topics of empirical investigation and theoretical analysis in the modern fields known as cognitive psychology, cognitive science and cognitive neuroscience. Before psychology was founded, the eighteenth-century philosophers Immanuel Kant and David Hume laid the foundations for all subsequent work on the origins of causal knowledge, perhaps the most central problem in the study of thinking.

If we were to choose one phrase to set the stage for modern views of thinking, it would be an observation of the British philosopher.

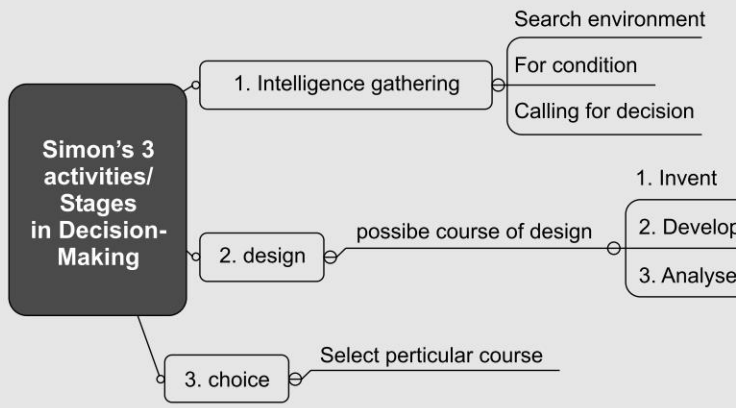
Thomas Hobbes, who, in 1651, in his treatise *Leviathan*, proposed, 'Reasoning is but reckoning'. 'Reckoning' is an odd term today, but in the seventeenth century it meant *computation*, as in arithmetic calculations. It was not until the twentieth century that the psychology of thinking became a scientific

EXPERIMENTAL PERSPECTIVE

Research of Herbert Simon

Herbert Alexander Simon (June 15, 1916–February 9, 2001) contended that in today's complex world, individuals cannot possibly process or even obtain all the information they need to make fully rational decisions. Rather, they try to make decisions that are good enough and that represent reasonable or acceptable outcomes.

He called this view of human decision-making 'bounded rationality' or 'intended rational behavior' and described the results it brought as 'satisfying'. In his book *Administrative Behavior*, he explained the implications of this approach, rejecting the notion of an omniscient 'economic man' capable of making decisions that bring the greatest benefit possible and substituting instead the idea of 'administrative man' who 'satisfies'—looks for a course of action that is satisfactory or 'good enough'.



Simon's interest in decision-making led him logically into the fields of computer science, psychology and political science. His belief that human decisions were made within clear constraints seemed to conform with the way that computers are programmed to resolve problems with defined parameters.

In the mid-1950's, he teamed up with Allen Newell of the Rand Corporation to study human decision-making by trying to simulate it on computers, using a strategy he called thinking aloud.

endeavor. The first half of the century gave rise to many important pioneers who in very different ways laid the foundations for the emergence of the modern field of thinking and reasoning. Foremost were the Gestalt psychologists of Germany, who provided deep insights into the nature of problem-solving.

Most notable of the Gestaltists were Karl Duncker and Max Wertheimer, students of human problem-solving, and Wolfgang Kohler, a keen observer of problem-solving by apes. The pioneers of the early twentieth century also include Sigmund Freud, whose complex and ever-controversial legacy includes the notions that forms of thought can be unconscious and that cognition is tangled up with emotion. As the founder of clinical psychology, Freud's legacy also includes the ongoing integration of research on normal thinking with studies of thought disorders, such as schizophrenia. Other pioneers in the early and mid-twentieth century contributed to various fields of study that are now embraced within thinking and reasoning. Cognitive development continues to be influenced by the early theories developed by the Swiss psychologist Jean Piaget and the Russian psychologist Lev Vygotsky). In the United States, Charles Spearman was a leader in the systematic study of individual differences in intelligence. In the middle of the century, the Russian neurologist Alexander Luria made immense contributions to our understanding of how thinking depends on specific areas of the brain, anticipating the modern field of cognitive neuroscience. Around the same time, in the United States, Herbert Simon argued that the traditional rational model of economic theory should be replaced with a framework that accounted for a variety of human resource constraints such as bounded attention and memory capacity and limited time. This was one of the contributions that in 1978 earned Simon the Nobel Prize in Economics. In 1943, the British psychologist Kenneth Craik sketched the fundamental notion that a mental representation provides a kind of model of the world that can be 'run' to make predictions (much like an engineer might use a physical scale model of a bridge to anticipate the effects of stress on the actual bridge intended to span a river). In the 1960s and 1970s, modern work on the psychology of reasoning began in Britain with the contributions of Peter Wason and his collaborator Philip Johnson-Laird. The modern conception of thinking as computation became prominent in the 1970s. In their classic treatment of human problem-solving, **Allen Newell** and **Herbert Simon** (1972) showed that the computational analysis of thinking (anticipated by Alan Turing, the father of computer science) could yield important empirical and theoretical results. Like a program running on a digital computer, a person thinking through a problem can be viewed as taking an input that represents initial conditions and a goal, and applying a sequence of operations to reduce the difference between the initial conditions and the goal. The work of Newell and Simon established computer simulation as a standard method for analyzing human thinking. Their work also highlighted the potential of production systems that were subsequently developed extensively as cognitive models by John Anderson and his colleagues. The 1970s saw a wide range of major developments that continue to shape the field. Eleanor Rosch, building on earlier work by Jerome Bruner (**Bruner**, **Goodnow** and **Austin** 1956), addressed the fundamental question of why people have the categories they do, and not other logically possible groupings of objects. Rosch argued that natural categories often have fuzzy boundaries (a whale is an odd mammal) but nonetheless have clear central tendencies or prototypes (people by and large agree that a bear makes a fine mammal). The psychology of human judgment was reshaped by the insights of Amos Tversky and Daniel Kahneman, who identified simple cognitive strategies or heuristics that people use to make judgments of frequency and probability. Often quick and accurate, these strategies can in some circumstances lead to non-normative judgments.

After Tversky's death in 1996, this line of work was continued by Kahneman, who was awarded the Nobel Prize in Economics in 2002. The current view of judgment that has emerged from 30 years of research is summarized by Kahneman and Frederick. In 1982, a young vision scientist, David Marr, published a book called *Vision*. Largely a technical treatment of visual perception, the book includes an opening chapter that lays out a larger vision—a vision of how the science of mind should proceed. Marr distinguished three levels of analysis that he termed the level of *computation*, the level of *representation and algorithm* and

EXPERIMENTAL PERSPECTIVE

Latest Research in Thinking and Problem-solving

Human beings use symbolic processes to solve problems, reason, speak and write, learn and invent. Over the past 45 years, cognitive psychology has built and tested empirical models of these processes as they are used to perform simple tasks and then more complex ones. The models take the form of computer programs that simulate human behavior. Perhaps the best-known and most impressive example of this line of research remains the work by Allen Newell and Herbert Simon. Simple laboratory-based tasks can be useful in explicating the steps of logic and reasoning that underlie problem-solving; however, they omit the complexity and emotional valence of 'real-world' problems.

Research extending the range of such explanations of human thinking to new phenomena and domains has focused on (i) learning from examples, (ii) CaMeRa (a model using visual imagery in reasoning), (iii) finding good problem representations, (iv) EPAM (a unified theory simulating perception and memory) and (v) the psychology of scientific discovery (BACON and other programs).

Computer programs that can learn new skills by examining worked-out examples of solved problems have been built. Using these programs as models, with colleagues in the Chinese Academy of Sciences, an entire secondary school mathematics curriculum has been designed (algebra and geometry) that is being used successfully in a score of Chinese schools.

By experimenting on the relation between problem difficulty and the way a problem is formulated, research has centered around trying to understand how problem-solvers can discover more effective problem representations. Experiments and computer models of perception (CaMeRa) are also aimed at explaining why visual diagrams often provide powerful aids to problem-solving. [Note: Running versions of CaMeRa are available for both PC-Windows and older Macintosh's using either Macintosh Common Lisp or Allegro common Lisp.]

The EPAM program explains behavior in a score of experimental paradigms, including (1) the classical experimental domain of verbal memory, (2) experiments on expert memory, and (3) learning to categorize stimuli. A public version of EPAM has been prepared for dissemination to other cognitive psychologists. In research on scientific discovery, computer programs are capable of making actual discoveries that model important cases from the history of science. Laboratory experiments with subjects in discovery situations have also been conducted.

All of the research involves comparing computer models that simulate behavior with laboratory experiments in which people perform the same tasks. Making extensive use of production system programming languages for cognitive simulation, which were introduced about 30 years ago, provides a new and more sophisticated interpretation of stimulus-response relations.

the level of *implementation*. Each level, according to Marr, addresses different questions that he illustrated with the example of a physical device, the cash register. At Marr's most abstract level, computation (not to be confused with computation of an algorithm on a computer), the basic questions are 'What is the goal that the cognitive process is meant to accomplish?' and 'What is the logic of the mapping from the input to the output that distinguishes this mapping from other input–output mappings?' A cash register, viewed at this level, is used to achieve the goal of calculating how much is owed for a purchase. This task maps precisely onto the axioms of addition (e.g. the amount owed should not vary with the order in which items are presented to the sales clerk, a constraint that precisely matches the commutativity property of addition). It follows that without knowing anything else about the workings of a particular cash register, we can be sure (if it is working properly) that it will be performing addition (not division). The level of representation and algorithm, as the name implies, deals with the questions: 'What is the representation of the input and output?' 'What is the algorithm for transforming the former into the latter?' Within a cash register, addition might be performed using numbers in either decimal or binary code, starting with either the leftmost or rightmost

digit. Finally, the level of implementation addresses the question, 'How are the representation and algorithm realized physically?' The cash register could be implemented as an electronic calculator, a mechanical adding machine, or even a mental abacus in the mind of the clerk. In his book, Marr stressed the importance of the computational level of analysis, arguing that it could be seriously misleading to focus prematurely on the more concrete levels of analysis for a cognitive task without understanding the goal or nature of the mental computation. In the most recent quarter-century, many other springs of research have fed into the river of thinking and reasoning, including the field of analogy, neural network models and cognitive neuroscience. This collectively paints a picture of the state of the field at the dawn of the new millennium.

STYLES OF THINKING

These are some of the styles of thinking:

A. Sensory Focused Dimensions; Exploring Sensory Representational Systems

1. *Visual Thinking*: The use of pictures, diagrams and visual imagery internally and externally.
2. *Auditory Thinking*: A focus on the use of words and language, listening and talking things through.
3. *Kinesthetic Thinking*: The use of feelings, emotions, intuition and physical exercise.
4. *Digital Thinking*: Involves a focus on the facts, and/or the use of data and statistics.

B. People Focused Dimensions; Exploring Interactions with People

5. *Internally Referenced Thinking*: Relies on their own judgments and standards, believes oneself to be right, ignores feedback.
6. *Externally Referenced Thinking***:** Relies on feedback from others, believes that others are right.
7. *Self Referenced Thinking*: Puts their own needs first and ignores the needs of other people.
8. *Others Referenced Thinking*: Responsive to the needs of others and willing to help other people.
9. *Matching Thinking*: Wants to fit in, dislikes confrontation and takes a non-challenging approach.
10. *Mismatching Thinking*: Dislikes being told what to do, will challenge and confront.
11. *Collaborative Thinking*: Involves others, shares information and prefers a team environment.
12. *Competitive Thinking*: Wants to win and better either the competition or ones' own performance.

C. Task Focus Dimensions; Exploring Approaches To tasks and Problem-solving

13. *Detail Conscious Thinking*: Believes details are important and attends to detailed information.
14. *Big Chunk Thinking*: Focuses on general principles and summary information often in terms of key points.
15. *Left Brain Thinking*: Processes systematically in sequence, ordered, completes one task at a time.
16. *Right Brain Thinking*: creative, naturally multi-tasks, has an untidy workspace, works backwards.
17. *Procedural Thinking*: Procedures are important, follows instructions and the correct way of doing things.
18. *Options Thinking*: Explores opportunity and possibility, seeks choice and alternatives, adds to work.
19. *Moving Away From Thinking*: Focuses on problems, makes contingency plans, may worry.
20. *Moving towards Thinking*: Focuses on goals and targets, says what they want and has a positive attitude.
21. *Reactive Thinking*: Waits, analyses and plans, reviews all the relevant information and considers consequences.
22. *Proactive Thinking*: Initiates action, gets on with things and has proactive approach.
23. *Sameness Thinking*: Seeks stability and the familiar, prefers gradual change, and notices similarities.
24. *Differences Thinking*: Notices what is different, seeks variety, has a high capacity and tolerance for change.

25. *Simplicity Thinking*: Often simplifies complex issues and prefers things to be easy.
26. *Complexity Thinking*: Enjoys the challenge of difficulty and of complex issues.

LANGUAGE

A symbol is anything that stands for or refers to something other than itself. Words are thus important components of our symbol system. We think in symbols because verbal language is a rich symbolic process, much thinking goes on in terms of language. A symbol conveys meaning. It provides information about some object or event to which it refers and thereby suggests appropriate action to the person who perceives it. Symbolic stimuli differ from stimuli in general because the symbolic stimuli produce reactions appropriate to some stimulus other then themselves. Human communication and language are masterpieces of symbols and their uses.

Prior to learning language, the human infant, although certainly able to learn, lives mainly in the present and reacts largely to those stimuli that directly affect the senses. The past and the future, as abstract concepts, do not affect his behavior. His motives are purely biological in nature. As language develops, almost every aspect of his behavior begins to change—new motives proliferate and the ways of satisfying the biologically based motives are altered. Perception is markedly affected by language, as are the processes of learning and memory. Thinking and problem-solving are also interconnected with language. In short, humans live in a world affected by language.

There are at least three ways from which human communication differs from that of other primates. First, human communication is symbolic in nature. A gesture, a facial expression or a sound stands for something else. Second, these symbols are learned. Finally, the symbols involved do not simply express emotions; rather, they describe or designate objects, events or actions. Thinking and language intricately intertwine (Fig. 8.2). Language influences thinking. **Whorf** (1956) suggested that language determines the way we think, e.g. Hopi, he noted, did not have past tense for verbs, therefore, Hopis could not think readily about the past. When a language provides words for objects or events, we can think about these objects more clearly and retain them. It is easier to think about two colors with two different names (A) than colors with the same name (B) (**Özgen** 2004). Figure 8.3 demonstrates this effect pictorially.

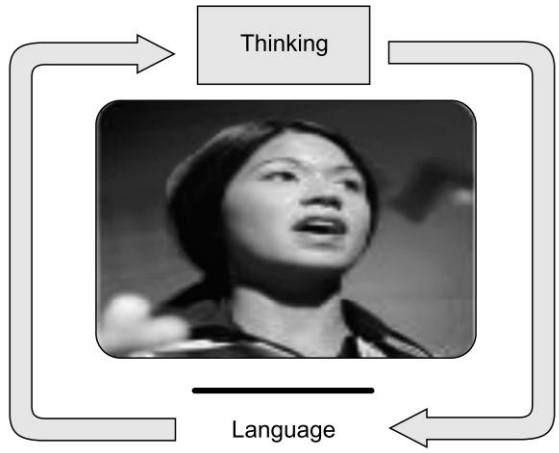


Fig. 8.2 Thinking and Language

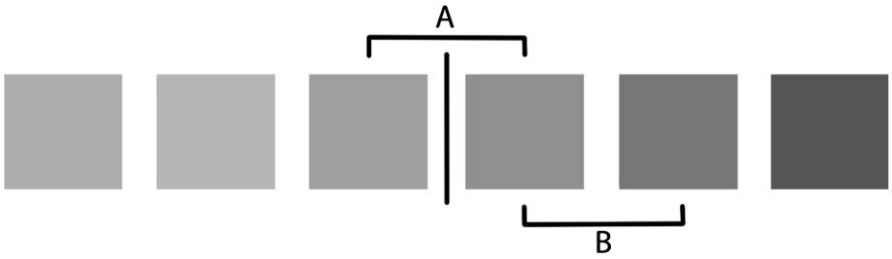


Fig. 8.3 Similar Colors are Difficult to Name (Ozgen 2004)

PSYCHOLOGY NUGGETS

Does Thought Depend on Language?

It may seem that we cannot speak without thinking, but

- We may use a word correctly before we fully understand the concept.
- We express ourselves in paralinguistic ways of gesture and facial expressions.
- Some people certainly think in images and pictures and artists express themselves in this way.
- Sometimes, we "know" something but can not find the right words to express ourselves.

Does language determine thought?

Many psychologists believe that language dictates the way we think. Others say that it actually determines our ideas themselves—not only how we think but also what we think.

Some important studies and theories that have been made in this regard are given below.

Wittgenstein said: "The limits of language mean the limits of my world." He meant that the only way we can understand our world is through language.

Sapir claimed that we experience things because the language we use guides our very thoughts. An extension of this is that different languages guide their speakers in different ways - different language speakers not only speak differently, they think differently.

Whorf opined: "... we cut nature up, organize it into concepts and describe significances as we do, largely because we are party to an agreement which holds in the pattern of our language."

So all of these researchers believe that language determines our concepts - and we can only think through the use of concepts. This is called 'linguistic determinism'. Different language speakers 'cut nature up' in different ways and this is **the linguistic relativity hypothesis**. Some examples of linguistic relativity are given below:

- Hopi Indians use the same word for 'insect', 'aeroplane' and 'pilot'. They also have no tenses for their verbs. For them, 'lightning', 'flame', 'meteor' and 'puff of smoke' are all verbs e.g. 'it puff-of-smoked'.
- Zuni Indians use the same word for 'yellow' and 'orange'.

The use of language to describe the colors of the spectrum has been studied in depth as it provides strict criteria and definitions. Brown and Lenneberg (1954) compared English with Shone (from Zimbabwe) and Bassa (from Liberia) and found that colors that have no name in the language are more difficult to recognize than those that have a name in the language.

However it has been concluded that *while language acts as a label to help us remember it may distort our recollection of things seen, or tend to make us think in a particular way, but it does not determine what we have seen.*

Berlin and Kay (1969) determined that there are eleven basic color categories: black, white, red, green, yellow, blue, brown, purple, pink, orange and grey. English uses all eleven, the Ibibio (from Nigeria) use four and the Jalé (from New Guinea) use two. Many psychologists think now that the Whorf hypothesis is exaggerated and the general view is that

- as the similarities in the way that different languages interpret colors are greater than the differences, and
- as it appears quite easy for cultures with limited language words to learn new words identifying the 'missing' colors (Rosch 1973), language has a less significant influence on thought than Whorf supposed, though it does affect it in superficial ways.

To a large extent, thinking is language based. Like when alone, we talk to ourselves. However, we also think in images. The ability to use language is a very important part of human cognition. In fact, some would argue that it is this ability which distinguishes us from other animals. Regardless of one's view of the capability of animals to use language or language-like symbols, the fact that humans have language abilities far superior to those of other animals cannot be ignored. Despite the ubiquity of human linguistic ability, pinning down exactly how language helps us and how we use it is not at all a straightforward task. One obvious use for public language is to communicate one's thoughts to other people. In fact, this may seem like the only, or at least the most important, use of our linguistic abilities. However, both Howard Gardner and Andy Clark stress other uses. Gardner, for example, lists four discrete uses for public language in his *Frames of Mind: The Theory of Multiple Intelligences*:

1. People use language to induce action in other people. Examples of this might include a child asking a parent to hand him a toy that is on a high shelf or a boss sending a memo out to his employees asking them to hand in budget drafts by next Wednesday.
2. Language can be used as a tool by one individual to help that individual remember things. In this way, language expands cognitive abilities that are already present in the human brain. For example, a child may not be able to remember how many days are there in December or May, but by learning the rhyme that begins, 'Thirty days hath September', he will easily be able to store these facts in his memory. Wearing nametags at a conference and making oral or written shopping lists are other examples of using language to aid memory.
3. The third use of language involves the transfer of explanations or knowledge from one person to another. For example, the parent teaching his child how to tie his shoes and the professor giving a lecture on ionic bonding are both using language to share their knowledge with another person. It is this use that can lead to cultural evolution, which will be discussed later in this chapter.
4. The fourth discrete use of language is to talk about language itself, or as Gardner states, 'to use language to reflect upon language, to engage in 'metalinguistic' analysis'. A child asking his father what the word 'wish' means and a linguist examining the syntactic rules of various languages are both using this type of 'metalinguistic analysis'.

Gardner acknowledges the wide variety of ways in which we use language, but he believes that they all fit into one of these four categories.

Social Basis of Language

There are social norms relating to language- norms that are present in the groups with which one affiliates or which in one is born. And just as one is expected to conform in matters of dress and demeanor in order to be an acceptable member of a certain social group, one must conform in language usage.

The social basis of language is especially apparent in 'special languages'. Medical students develop a special language based on anatomical and medical terms they are required to learn. In fact, 'thousands of

vocations, businesses and recreational groupings have their special vocabularies that the newcomer has to acquire and use correctly in order to be on the inside' (**Lindesmith et al.** 1975). To become a psychologist, then, or a successful student of psychology, one must learn to speak what we call '*psychologese*'. Indeed, it should be readily apparent that a good deal of time in this introductory course is taken up with the learning the jargon or language that psychologists use to communicate to one another.

Language obviously gives human beings a tremendous advantage over other animals in dealing with the environment. In a sense, language has enabled humans to 'invent' both time and space. Thus, man can react to events that took place years ago, and he can imagine or conceive to future events accordingly.

Whether or not language is synonymous to thinking is a matter of some debate. Bruner regards language as the 'great emancipator in the child's cognitive life, for it allows him to be freed from the perpetually dominant characteristics of the environment' (**Endler et. al**. 1968). **Furth** and **Youniss** (1968), on the other hand, regard thinking and language as completely independent. They note that deaf children are 'seriously deficient in linguistic skill and minimally exposed to the ordinary linguistic environment'. Yet, on certain tasks involving symbol use, they do virtually as well as normal children.

What, then, is the relationship between thinking and language? We can say that thinking can occur without language, but that language (or more fundamentally, the ability to manipulate symbols) greatly influences the nature of thinking in human beings. This is particularly true in concept formation.

Development of Language

Both learning and maturation are involved in the development of language. According to **Kaplan** and **Kaplan** (1970), there are four stages in language development. Stage 1 lasts from birth until about 3 weeks of age. In this stage, the infant's limited vocalization involves cries, coughs and gurgles. Stage 2 lasts from 3 weeks until roughly four to five months. During this stage, variations in the baby's cries involve differences in duration, pitch and articulation. Stage 3 lasts from about five months to 1 year. This is the babbling stage, in which the infant produces vowel-like and consonant-like sounds. Stage 4 is about 1 year of age onward. This is the true 'language period', while the preceding three stages may be termed '*prelingua*l'. Most children utter their first word at about one year of age.

Studies of prelingual infants suggest that all human infants are remarkably similar in the sound they make. As the infant grows, however, he begins to utter more frequently those sounds appropriate to the language group in which he was born. This suggests that learning plays some role in prelingual development; the early similarity in babbling suggests that at least initially, maturation is the primary determinant. Deaf children, for example, make the same babbling sounds as children with normal hearing.

By two years of age, the average child has a vocabulary of about 50 words, and, as noted earlier, one year later (at age 3) the vocabulary includes some 1000 words. Between 18 and 24 months, the child begins to use simple two-word sentences such as 'more milk' and 'daddy gone' (Table 8.1). By 4½ years, the child masters the basic grammar of adult language.

TABLE 8.1 Language Development

SUMMARY OF LANGUAGE DEVELOPMENT	
Month (approximate)	**Stage**
4	Babbles many speech sounds.
10	Babbling resembles household language.
12	One-word stage.
24	Two-word, telegraphic speech.
24+	Language develops rapidly into complete sentences.

THEORIES OF LANGUAGE ACQUISITION

Over the last fifty years, several theories have been put forward to explain the process by which children learn to understand and speak a language. These are summarized as given in Table 8.2.

TABLE 8.2 Theories of Language Acquisition

Theory	Central Idea	Individual Associated With The Theory
Behaviorist	Children imitate adults. Their correct utterances are reinforced when they get what they want or are praised.	Skinner
Innateness	A child's brain contains special language-learning mechanisms at birth.	Chomsky
Cognitive	Language is just one aspect of a child's overall intellectual development.	Piaget
Interaction	This theory emphasizes the interaction between children and their caregivers.	Bruner

Behaviorism

The behaviorist psychologists developed their theories while carrying out a series of experiments on animals. They observed that rats or birds, for example, could be taught to perform various tasks by encouraging habit-forming. Researchers rewarded desirable behavior. This was known as **positive reinforcement**. Undesirable behavior was punished or simply not rewarded—**negative reinforcement**. The behaviorist **B.F. Skinner** then proposed this theory as an explanation for language acquisition in humans. In *Verbal Behavior* (1957), he stated: 'The basic processes and relations that give verbal behavior its special characteristics are now fairly well understood. Much of the experimental work responsible for this advance has been carried out on other species, but the results have proved to be surprisingly free of species restrictions. Recent work has shown that the methods can be extended to human behavior without serious modifications.' (cited in **Lowe** and **Graham** 1998)

Skinner suggested that a child imitates the language of its parents or caretakers. Successful attempts are rewarded because an adult who recognizes a word spoken by a child will praise the child and/or give it what it is asking for. Successful utterances are, therefore, reinforced while unsuccessful ones are forgotten.

Limitations of Behaviorism

There are many objections to behaviorism. Language is based on a set of structures or rules that could not be worked out simply by imitating individual utterances. The mistakes made by children reveal that they are not simply imitating but actively working out and applying rules. For example, a child who says 'drinked' instead of 'drank' is not copying an adult but rather over-applying a rule. The child has discovered that past tense verbs are formed by adding a /d/ or /t/ sound to the base form. The 'mistakes' occur because there are irregular verbs that do not behave in this way. Such forms are often referred to as intelligent mistakes or virtuous errors.

The vast majority of children go through the same stages of language acquisition. There appears to be a definite sequence of steps. We refer to developmental milestones. Apart from certain extreme cases (see the case of Genie), the sequence seems to be largely unaffected by the treatment the child receives or the type of society in which s/he grows up.

Children are often unable to repeat what an adult says, especially if the adult utterance contains a structure the child has not yet started to use. The classic demonstration comes from the American psycholinguist David McNeill. The structure in question here involves negating verbs:

Child: Nobody don't like me
Mother: No, say, 'Nobody likes me.'
Child: Nobody don't like me.
(Eight repetitions of this dialogue)
Mother: No, now listen carefully: say, 'Nobody likes me'.
Child: Oh! Nobody don't likes me.
(McNeil in *The Genesis of Language* 1966)

Few children receive much explicit grammatical correction. Parents are more interested in politeness and truthfulness. According to **Brown**, **Cazden** and **Bellugi** (1969), 'it seems to be truth value rather than well-formed syntax that chiefly governs explicit verbal reinforcement by parents which renders mildly paradoxical the fact that the usual product of such a training schedule is an adult whose speech is highly grammatical but not notably truthful' **(Lowe** and **Graham** 1998).

There is evidence for a critical period for language acquisition. Children who have not acquired language by the age of about seven will never entirely catch up. The most famous example is that of Genie, discovered in 1970, at the age of 13. She had been severely neglected, brought up in isolation and deprived of normal human contact. Of course, she was disturbed and underdeveloped in many ways. During subsequent attempts at rehabilitation, her caretakers tried to teach her to speak. Despite some success, mainly in learning vocabulary, she never became a fluent speaker, failing to acquire the grammatical competence of the average five-year old.

Innateness

Noam Chomsky published a criticism of the behaviorist theory in 1957. In addition to some of the arguments listed above, he focused particularly on the impoverished language input children receive. Adults do not typically speak in grammatically complete sentences. In addition, what the child hears is only a small sample of language.

Chomsky concluded that children must have an inborn faculty for language acquisition. According to this theory, the process is biologically determined - the human species has evolved a brain whose neural circuits contain linguistic information at birth. The child's natural predisposition to learn language is triggered by hearing speech and the child's brain is able to interpret what s/he hears according to the underlying principles or structures it already contains. This natural faculty is known as the *Language Acquisition Device* (LAD)**.** Chomsky did not suggest that an English child is born knowing anything specific about English, of course. He stated that all human languages share common principles. (For example, they all have words for things and actions—nouns and verbs.) It is the child's task to establish how the specific language s/he hears expresses these underlying principles.

For example, the LAD already contains the concept of verb tense. By listening to such forms as 'worked', 'played' and 'patted', the child will form the hypothesis that the past tense of verbs is formed by adding the sound /d/, /t/ or /id/ to the base form. This, in turn, will lead to the 'virtuous errors' mentioned above. It hardly needs saying that the process is unconscious. Chomsky does not envisage the small child lying in its cot working out grammatical rules consciously!

Chomsky's ground-breaking theory remains at the centre of the debate about language acquisition. However, it has been modified, both by Chomsky himself and by others. Chomsky's original position was

that the LAD contained specific knowledge about language. Dan Isaac Slobin has proposed that it may be more like a mechanism for working out the rules of language: 'It seems to me that the child is born not with a set of linguistic categories but with some sort of process mechanism—a set of procedures and inference rules, if you will —that he uses to process linguistic data. These mechanisms are such that, applying them to the input data, the child ends up with something that is a member of the class of human languages. The linguistic universals, then, are the *result* of an innate cognitive competence rather than the content of such a competence.' (Cited in **Russell** 2001)

Evidence to Support the Innateness Theory

Work in several areas of language study has provided support for the idea of an innate language faculty. Three types of evidence are offered here:

1. Slobin has pointed out that human anatomy is peculiarly adapted to the production of speech. Unlike our nearest relatives, the great apes, we have evolved a vocal tract that allows the precise articulation of a wide repertoire of vocal sounds. Neuro-science has also identified specific areas of the brain with distinctly linguistic functions, notably Broca's area and Wernicke's area. Stroke victims provide valuable data: depending on the site of brain damage, they may suffer a range of language dysfunction, from problems with finding words to an inability to interpret syntax. Experiments aimed at teaching chimpanzees to communicate using plastic symbols or manual gestures have proved controversial. It seems likely that our ape cousins, while able to learn individual 'words' have little or no grammatical competence. **Pinker** (1994) offers a good account of this research.
2. The formation of Creole varieties of English appears to be the result of the LAD at work. The linguist Derek Bickerton has studied the formation of Dutch-based creoles in Surinam. Escaped slaves, living together but originally from different language groups, were forced to communicate in their very limited Dutch. The result was the restricted form of language known as a pidgin. The adult speakers were past the critical age at which they could learn a new language fluently—they had learned Dutch as a foreign language and under unfavorable conditions. Remarkably, the children of these slaves turned the pidgin into a full language, known by linguists as a Creole. They were presumably unaware of the process but the outcome was a language variety, which follows its own consistent rules and has a full expressive range. Creoles based on English are also found, in the Caribbean and elsewhere.
3. Studies of the sign languages used by the deaf have shown that, far from being crude gestures replacing spoken words, these are complex, fully grammatical languages in their own right. A sign language may exist in several dialects. Children learning to sign as a first language pass through similar stages to hearing children learning spoken language. Deprived of speech, the urge to communicate is realized through a manual system which fulfills the same function. There is even a signing Creole, again developed by children, in Nicaragua. For an account of this, see **Pinker** 1994 (pp. 36–37).

Limitations of Chomsky's Theory

Chomsky's work on language was theoretical. He was interested in grammar and much of his work consists of complex explanations of grammatical rules. He did not study real children. The theory relies on children being exposed to language but takes no account of the interaction between children and their caretakers. Nor does it recognize the reasons why a child might want to speak, the functions of language.

In 1977, **Bard** and **Sachs** published a study of a child known as Jim, the hearing son of deaf parents. Jim's parents wanted their son to learn speech, rather than the sign language they used between themselves. He watched a lot of television and listened to the radio, therefore receiving frequent language input. However,

his progress was limited until a speech therapist was enlisted to work with him. Simply being exposed to language was not enough. Without the associated interaction, it meant little to him.

Subsequent theories have placed greater emphasis on the ways in which real children develop language to fulfill their needs and interact with their environment, including other people.

Cognitive Theory

The Swiss psychologist Jean Piaget placed acquisition of language within the context of a child's mental or cognitive development. He argued that a child has to understand a concept before s/he can acquire the particular language form which expresses that concept. A good example of this is seriation. There will be a point in a child's intellectual development when s/he can compare objects with respect to size. This means that if you gave the child a number of sticks, s/he could arrange them in order of size. Piaget suggested that a child who had not yet reached this stage would not be able to learn and use comparative adjectives like 'bigger' or 'smaller'.

Object permanence is another phenomenon often cited in relation to the cognitive theory. During the first year of life, children seem unaware of the existence of objects they cannot see. An object that moves out of sight ceases to exist. By the time they reach the age of 18 months, children have realized that objects have an existence independently of their perception. The cognitive theory draws attention to the large increase in children's vocabulary at around this age, suggesting a link between object permanence and the learning of labels for objects.

Limitations of The Cognitive Theory

During the first year to 18 months, connections of the type explained above are possible to trace but, as a child continues to develop, it becomes harder to find clear links between language and intellect. Some studies have focused on children who have learned to speak fluently despite abnormal mental development. Syntax, in particular, does not appear to rely on general intellectual growth.

Input or Interactionist Theories

In contrast to the work of Chomsky, more recent theorists have stressed on the importance of the language input children receive from their caretakers. Language exists for the purpose of communication and can only be learned in the context of interaction with people who want to communicate with you. Interactionists such as Jerome Bruner suggest that the language behavior of adults when talking to children (known by several names by most easily referred to as child-directed speech or CDS) is specially adapted to support the acquisition process. This support is often described to as scaffolding for the child's language learning. Bruner also coined the term Language Acquisition Support System or LASS in response to Chomsky's LAD. Colwyn Trevarthen studied the interaction between parents and babies who were too young to speak. He concluded that the turn-taking structure of conversation is developed through games and non-verbal communications long before actual words are uttered.

Limitations of Input Theories

These theories serve as a useful corrective to Chomsky's early position and it seems likely that a child will learn more quickly with frequent interaction. However, it has already been noted that children in all cultures pass through the same stages in acquiring language. We have also seen that there are cultures in which adults do not adopt special ways of talking to children, so CDS may be useful but seems not to be essential.

The various theories should not be seen simply as alternatives. Rather, each of them offers a partial explanation of the process.

STRUCTURE AND RULES OF LANGUAGE

To explain the structure of human language, **Brown** (1965) asks that we ourselves faced with devising a communication system that will transmit infinitely many meanings. To accomplish this, we might try to assign a brief, unique sound for each message or meaning. For example, if we wanted to communicate 'I am going out', it would be easy to assign a distinctive grunt or whistle for this message. In fact, this is exactly the way in which many animals other than human beings communicate. Such signals, incidentally, are apparently, unlearned and merely express emotions; they do not designate or describe objects or events. The problem with such a communication system, according to Brown, is that 'the number of messages to be communicated is very greatly in excess of the number of distinct sounds humans can identify'. We would do better, he says, to design our system on the principle that all human languages follow. That principle involves a stock of basic sounds called '*phonemes'*.

Phonemes are vowels and consonants that correspond roughly to the alphabet. For example, the *th* in *the* and the *sh* in *shop* are phonemes. In themselves, they have no meaning, and no language uses very many. English employs 45 phonemes, and the range in other languages is from 15 to approximately 85. These limited numbers of basic sounds can, however, be combined or arranged in sequences so that larger units can be constructed. The larger units are also called '*morphemes'*.

Morphemes (combination of phonemes) may or may not be words, but each one has a meaning. For example, lion is a single morpheme, but lions consists of two morphemes- 'lion' and 's'. Morphemes are sometimes prefixes and sometimes suffixes. The word un- bridge-able, for example, consists of three morphemes. Furthermore, with only 45 phonemes, it is possible to construct some 100,000 morphemes without making any of them particularly long. Obviously, by using morphemes we can communicate a substantially greater number of meanings than if we used a system in which a distinctive grunt or whistle conveyed the message.

'Grammar' is the term we use to refer to the rules whereby morphemes are sequentially arranged.

PSYCHOLOGY NUGGET

HUMAN COMMUNICATION VS THAT OF OTHER PRIMATES

In his book *The Language Instinct* (1994), Steven Pinker pointed out two fundamental facts about human language, which were used by linguist Noam Chomsky to develop his theory about how we learn language. **The first** is that each one of us is capable of producing brand new sentences never before uttered in the history of the universe.

Language cannot be a repertoire of responses; the brain must contain a recipe or program that can build an unlimited set of sentences out of a finite list of words. That program may be called a mental grammar (not to be confused with pedagogical or stylistic 'grammars', which are just guides to the etiquette of written prose).

The second fundamental fact is that children develop these complex grammars rapidly and without formal instruction and grow up to give consistent interpretations to novel sentence constructions that they have never before encountered. Therefore, Chomsky argued that children must be innately equipped with a plan common to the grammars of all languages, a Universal Grammar, that tells them how to distill the syntactic patters out of speech of their parents. Children have the ability to produce much

greater language output than they receive as input but it is not done idiosyncratically. The language they produce follows the same generalized grammatical rules as others.

The more we understand how human language works, the more we begin to realize how different human speech is from the communication systems of other animals.

Nonhuman communication systems are based on one of three designs: a finite repertory of calls (one for warnings of predators, one for claims of territory, and so on), a continuous analog signal that registers the magnitude of some state (the livelier the dance of the bee, the richer the food source that it is telling its hivemates about), or a series of random variations on a theme (a birdsong repeated with a new twist each time: Charlie Parker with feathers).

Human language has a very different design. The discrete combinatorial system called "grammar" makes human language infinite (there is no limit to the number of complex words or sentence in a language), digital (this infinity is achieved by rearranging discrete elements in particular orders and combinations, not by varying some signal along a continuum like the mercury in a thermometer), and compositional (each of the finite combinations has a different meaning predictable from the meanings of its parts and the rules and principles arranging them) (Pinker, p. 342).

This difference between human and nonhuman communication is also reflected in the role that different parts of the brain plays in language as opposed to other forms of vocalization.

The vocal calls of primates are controlled not by their cerebral cortex but by phylogenetically older neural structures in the brain stem and limbic systems, structures that are heavily involved in emotion. Human vocalizations other than language, like sobbing, laughing, moaning, and shouting in pain, are also controlled subcortically. Subcortical structures even control the swearing that follows the arrival of a hammer on a thumb, that emerges as an involuntary tic in Tourette's syndrome, and that can survive as Broca's aphasic's only speech. Genuine language . . . is seated in the cerebral cortex, primarily in the left perisylvian region.

Rather than view the different forms of communication found in animals as a hierarchy, it is better to view them as adaptations that arose from the necessity to occupy certain evolutionary niches. Chimpanzees did not develop the language ability because they did not need to. Their lifestyles did not require the ability. Humans, on the other hand, even in the hunter-gatherer stage, would have benefited enormously from being able to share kind of detailed information about plants and animals and the like, and thus there could have been an evolutionary pressure that drove the development of language.

CONCEPT FORMATION PROCESSES

Concepts are the basic elements of thought, without them we would not be able to make any sense of the world. Concepts are an important class of language symbols used in thinking. A concept is a symbolic construction representing some common and general feature or features of objects or events. Some natural or basic concepts are easily acquired and appear in thinking early in life. Other concepts are acquired by discrimination learning by seeing examples of a concept in different contexts, and by definition, mental grouping of similar objects, events, ideas or people. There are varieties of chairs but their common features define the concept of *chair.*

First, we organize concepts into category hierarchies (see Fig. 8.4). (*Refer to Fig. 7.7 in Chapter 7 on Memory and Forgetting.*) Second, some members of a category are perceived to be more typical of that category than others. When people are asked to list properties of different concepts, the most typical members, called prototypes, have more of these properties than others.

Development of Concepts

We form some concepts by definitions, e.g. a triangle has three sides [Fig. 8.5(c)]. But mostly, we form concepts by a mental image or a typical example (prototype), e.g. robin is a prototype of a bird, but penguin is not [Figures 8.5(a) and (b)].

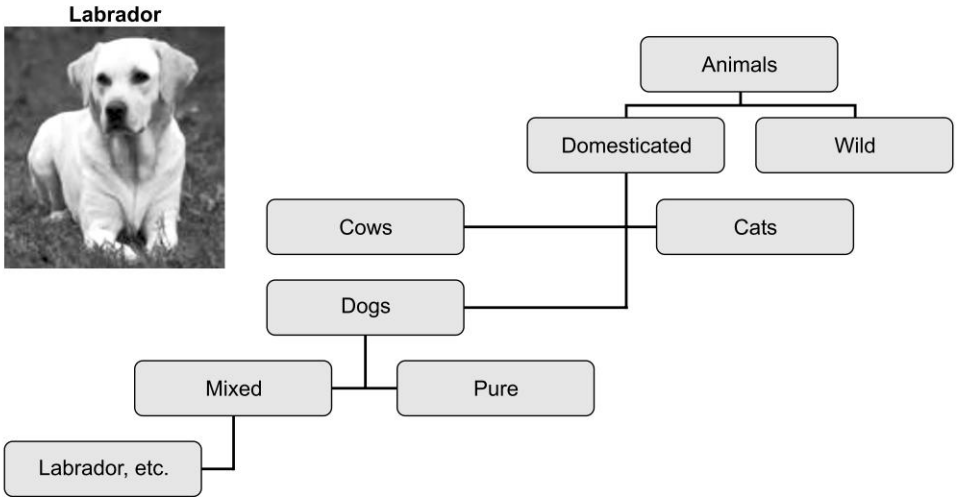


Fig. 8.4 Organization of Concepts in Hierarchies

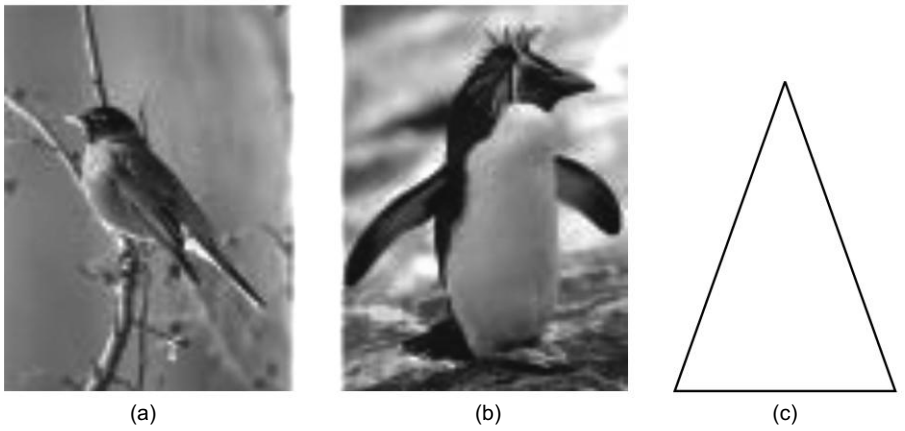


Fig. 8.5 Concepts Formed by Categories

We also form some concepts by categories. Once we place an item in a category, our memory shifts toward the category prototype. The apple you ate at breakfast was a specific object but apples in general are a concept. When someone is generous, it is a specific act but 'generousness' is a concept. Concepts are categories of things, events' or qualities that are linked together by some common factors or features in spite of their differences. Once we place an item in a category, our memory shifts towards the category prototype.

A computer generated face that was 70 percent Caucasian, lead people to classify it as Caucasian (Fig. 8.6).

Concept formation as a process of development from childhood to adolescence takes place by way of 'qualitative new acquisitions' (Vygotsky). Various phases can be distinguished. **Vygotsky** (1962) describes three phases (each of which is divided into stages).

The child unites diverse concrete objects in groups under a common 'family name' on the basis of external relationships.

Fig. 8.6 Computer-Generated Face

He forms 'potential' concepts by establishing objective relations and connections 'uniting and generalizing single objects', 'singling out certain common attributes'. This is objective and connective thinking.

He considers the elements 'outside the actually existing bond' between objects, 'detaches', 'abstracts' and 'Isolates the individual elements'. He then attains the formation of genuine concepts. The term is also applied to the process of abstraction and generalization of qualities or properties in any individual conceptualization.

Process of Concept Formation

The process of concept formation is complex and involves interplay of the basic processes of perception, learning, remembering and thinking and in many instances, also the process of motivation. Some of the basic steps involved in the acquisition and development of the concepts are:

Observation

The first stage in the formation of concepts is the observation of an event, object or experience. This can also be called the stage of becoming aware, directly or indirectly. The child can see a dog and become aware of it—this is direct observation. He may also hear about the dog from others and become aware—this is indirect observation. Generally repeated experiences or awareness's provide the basis for the development of the concepts.

Discrimination or Differentiation

The observation leads to understanding the differences and similarities in the objects and things. So, we differentiate one class of objects from the others on the basis of the similarities each group of objects possess.

Abstraction

The child has seen dogs and also seen cats, then he sees a dog only. He is not observing both of them on the same occasion, yet he compares the experiences of the two inwardly and appreciates the similarities and differences between them. This analysis is called abstraction. It is abstraction which actually transforms comparable and contrasting experiences into concepts. This ability to respond to concrete situations in the absence of actual situation is known as *abstract thinking ability.* As the child grows older, the process of abstraction plays an increasingly important role in the development of concepts. *Generalization* repeated experiences or observation of different objects result in a tendency to form a general idea. When the child sees a number of dogs and other animals, he is able to abstract the common quality of dogs and then begin to form a general idea of the dog. Based on this common quality, he comes to the assumption that any object, thing or individuals possessing that common quality must belong to a particular group. This is called the *process of generalization.* The process of generalization explains how the child acquires 'many concepts like gender shape, number, etc.

Human beings because of their language ability are able to deal with all sorts of concepts, from fairly concrete ones such as dog to highly abstract ones, such as *gravity, justice and god.* The concrete concepts are known as denotative concepts and abstract concepts are known as connotative concepts. Studies by **Hiedbreder** (1947) indicated that concrete characteristics are generally easier to conceive than the more abstract relationships of form and number.

These studies used the paired-associate technique. On each trial, several stimuli were presented one at a time, and the subject was required to anticipate the response paired with each stimulus. The experiments arbitrarily assigned a different nonsense word as the response for each concept. Thus, POLP might refer to the concern object tree, FARD to the spatial concept of circular patterns and PILT to number concepts of live objects. On the second trial, *new* stimuli representing the same concepts were paired with the original responses. The results of a series of such experiments showed that object concepts were the easiest to learn, spatial forms the next easiest to learn and then numbers. Our thinking apparently tends to run to *objects,* rather than abstraction.

In order to pin down connotative meanings of concepts more precisely, a method of measurement called the semantic differential has been developed (**Snides** and **Osgood** 1969). The method is called 'semantic differential' because it has to do with meaning. To determine the connotation of a word by the semantic differential method, the subject is asked to rate the words according to a number of bipolar adjective pairs; example is the pair 'strong-weak'. One member of the adjective pair is placed at one end of a seven-point scale, the other member at the opposite end. Then, the subject indicates the direction and intensity of judgment by rating the word under study at some point along the scale.

Types of Concepts

The term concept, as has been seen, refers to properties that objects and events have in common. If only one set of property defines the concepts, we may ca1l it a 'simple' concept. But most concepts are 'complex because several common characteristics enter into their defining' (**Bruner et al**. 1956).

Conjunctive Concepts

This type of concept is defined by the joint presence of several characteristics. Three green squares comprise conjunctive concept. The joint presence of three of something, greenness and squareness defines the concept in this case. Such conjunctive concepts seem to be fairly easy for people to achieve.

Disjunctive Concepts

A member of a disjunctive concept class contains at least one element from a larger group of elements. For instance, suppose we take three green squares as our group of elements, any card which has three of anything or contains something green, or contains a square, has one clement from the larger group and is a member of the conceptual class. Disjunctive concepts are relatively difficult for people to attain.

Relational Concepts

This type of concept is defined in terms of relationships between the elements in a situation. An example is a test of analogy. A cat is to a kitten, as a dog is to a . . . . (The blank is to be filled by the word 'pup' because it has the same relation as parent-child.)

Concept formation is a special kind of thinking in which hypothesis about defining characteristics of the concept are tested by examining positive and negative instances of the concept.

Methods of Learning Concepts

There area three ways of learning concepts—discriminative learning, context and definition.

Discriminative Learning

The person has the problem of attaching word labels to objects and in the course of learning to do this abstracts some common properties of objects. A classic experiment illustrating this route to simple concept attainment used Chinese characters as 'nonsense' material (**Hull** 1920).

Hull presented his subjects with a series of twelve packs of cards. Each card carried a Chinese character and one of the characters in each pack included a 'concept'. For example, the concept '00' was represented by check like character. The subjects were practiced on a given series until they could give the correct concept. In a latter part of the experiment, the subjects were tested for their ability to generalize the learned concepts, or in other words, recognize them in new situations. Hull analyzed his results in terms of ordinary discrimination learning. The subject, he argued, learns to discriminate the common element in the characters and on the basis of his experience, can recognize and utilize similar elements when they appear in new settings.

Context

A second way to learn concepts especially simple and conjunctive ones, is through context. If we do not know the meaning of a word but see or hear it used in different contexts, we usua1ly devo1op a fairly accurate idea of its meaning.

Definition

A third way of learning new concepts is by definition.

Strategies of Concept Formation

The strategies of concept formation are discussed below.

Transfer

When a person already knows a concept similar to the one learned, he can learn it quickly. This is positive transfer. But if the original concept is similar to the earlier in one respect but quite different it might make the attainment of the new concept difficult Here, to capitalize on transfer, the experimenter must point out both the similarities and the differences.

Distinctiveness

A second factor in concept attainment is the degree to which common elements are isolated, grouped otherwise made conspicuous. This is called distinctiveness. Anything that is done to make this common property of the concept stand out aids concept attainment; whatever obscures it or embeds it in details retards concept attainment. In the experiment on Chinese characters, if all characters with qualities were grouped together, it would have been easier to learn the concepts.

Other Factors

Three other factors help to determine the effectiveness of concept attainment (**Johnson** 1955). One manipulate materials. If a person is allowed to rearrange, redraw or reorganize the material's common properties, he is more likely to learn or discover the appropriate concepts. Another is the instructions or general purpose. If a person is told to discover the common element that is to search for the concepts, he does better than if he is

not given such a general purpose. Finally, a person usually learns faster if he has all the relevant information available at the same time instead of being given only a piece of information at a time.

One characteristic of concept that makes them easier or more difficult is their inclusiveness that is how many numbers are there of the concept. Concepts that are of medium degree of inclusiveness, known as basic concepts seem to be easier to learn. For example, the concept of 'vehicles' contains a great many elements (boats, airplanes, cars, etc.), many of which are concepts themselves. This kind of broad concept is a superordinate concept. 'Cars', on the other hand, are a basic concept of a medium degree of inc1usiveness. Further, 'Zens' and 'Santros' are much less inclusive concepts, they are known as *subordinate concepts. Rosch* suggests that basic concepts are naturally easier to learn. If you notice a child's learning, he will learn the concept car first then they learn the superordinate concepts like vehicles, and then the subordinate concepts like 'Zen' and 'Santro'. Table 8.3 shows concept development in children.

PROBLEM-SOLVING

We may consider a person to have a problem when he or she wishes to attain a goal for which no simple, direct means is known. Some examples are given below:

- Solve the crossword puzzle in today's newspaper.
- Get my car running again.
- Solve the statistics problems assigned by my Stats teacher.
- Feed the hungry.
- Find out where the arena for the concert is located.
- Get a birthday present for my mother.

Problem-solving activity is a basic part of everyday life. We are constantly coming up with problems that need to be solved. Most of the problems involve discrepancies between what we know and what we do not know. When we solve problem, we reduce these discrepancies to get at the missing information. Problem-solving is an important kind of thinking. In general, a problem is any conflict or difference between one situation and another we wish to produce-the goal. Many instances of problem-solving can be considered a form of information processing. Once a problem is represented (whether it's through words, static images or mental models), we try out possible solutions and test to see if they work. If the problem is solved, life goes on. If not, we return to the proverbial drawing board to come up with new ideas.

Problem-solving Processes

There are many different ways to find solutions, but there are four basic problem-solving processes: *trial and error*, *algorithms*, *heuristics* and *insight*.

Trial and Error

This is the simplest problem-solving strategy and it is often effective. **Edward Thorndike** (1898) studied animal intelligence by putting cats in a 'puzzle box', placing food outside a door, and timing how long it took for them to figure out how to escape. At first, the cats tried various ineffective behaviors.

They tried reaching with their paws, but the food was too far away. They scratched at the bars, but that did not work. They pushed at the ceiling, but that did not work either. Then, they would literally stumble upon the solution (which was to step on a lever that opened the door) and repeat that solution whenever they were in the box. The cats solved the problem by trial and error.

TABLE 8.3 Concept Development in Children

PHASES:	MATH Polya's Thinking Phases	READING KW(H)L	SCIENCE Scientific Process	WRITING Process Writing	CONSTRUCT MEANING	STUDY SKILLS The 4C'S	CREATIVE DECISION MAKING PROCESS
BEFORE	Understanding ■ Identify Assumptions, data (explicit/implicit), questions(s) ■ link real situations	Examine what you KNOW	Determine a researchable question ■ Create a problem ■ Hypothesize	Determine context, topic, audience... brainstorm, map, web	Assess/activate prior knowledge Build prereq-uisite knowledge Develop important vocabulary	Clarify the learning situation	Recognize and define the problem
	Planning ■ review understand ■ brainstorm options ■ select a strategylies ■ hypothetically set up procedures	Determine what it is you WANT to know or yuou WONDER Determine HOW you will find out	Develop a procedure and identify materials needed	Prewriting ■ extend map/ web ■ sequence ideas ■ outline ■ consider format	Establish a purpose for reading Clarify misconceptions	Construct a learning strategy	Plan tentative conclusions
DURING	Carrying-out ■ verify understanding ■ follow plan ■ check for reasonable results	READ the material	Conduct the experiment and record the results on a chart/table or graph	Writing ■ rough draft ■ revise ideas ■ edit/proof	Select and organize important information Monitor and evaluate information	Carry out the strategy	Test tentative conclusions
AFTER	Reflecting Back ■ analyze effectiveness of plan/ group work ■ identify things to remember for next time/key ideas ■ share ideas/ solutions	REFLECT on what it is that you LEARNED	Draw conclusions and compare to hypothesis	Sharing... present, publish	Reflect and integrate prior knowledge with new understandings Summarize and synthesize what has been learned	Check results	Evaluate

Identify problem:

Car will not start.

Gather information:

Out of gas or dead battery?

Try a solution:

Not out of gas, so I'll dry off the wires.

Evaluate results:

Car starts, yeah!

Car does not start—try another solution.

As you can imagine, this aimless, hit-or-miss approach is not the most efficient way to proceed. Yet, it is usually our first response. If possible, however, it is better to take a more systematic, planned approach.

The solution to problems in a systematic planned way is guided by rules-*algorithms* and *heuristics*.

Algorithms

These are sets of rules that if followed correctly, guarantee a solution to a problem, methodical, logical rule or procedure that guarantees solving a particular problem. Algorithms exhaust all possibilities before arriving at a solution. They take a long time. Computers use algorithms.

Heuristics

Heuristics make it easy for us to use simple principles to arrive at solutions to problems. If we were to unscramble the letters **S P L O Y O C H Y G** to form a word, using an algorithm approach would take 907,208 possibilities. Heuristics are simple thinking strategies that often allow us to make judgments and solve problems efficiently; speedier but more error-prone than *algorithms*. For forming a word from the letters **S P L O Y O C H Y G**, try putting Y at the end and see if the word starts to make sense:

PS SP YL OC HY O CL OH G Y

Heuristics are strategies or approaches to a problem that are usually based on past experience, likely to lead to a solution, but do not guarantee success. One common heuristic is breaking a larger problem down into smaller sub-problems which when solved, will lead to the solution to the overall, larger problem. Solution to the problem depends, to a large degree, on choosing good heuristic rules to follow and set can predispose us to select appropriate or inappropriate heuristics. The hindering effects of habit and set on problem-solving are discussed at some length. Functional fixedness is an example of the hindering effects of habit and set on problem-solving.

Heuristic Strategy for hill climbing entails the following:

- Plan one step ahead.
- Distance to goal guides search.
- Local versus global maximum.
- Sometime, may not achieve solution (SF example).

Figures 8.7(a), (b) and (c) show the hill climbing heuristic strategy.

Insight

Insight involves sudden novel realization of a solution to a problem. Insight is in humans and animals (*refer chapter on learning*).

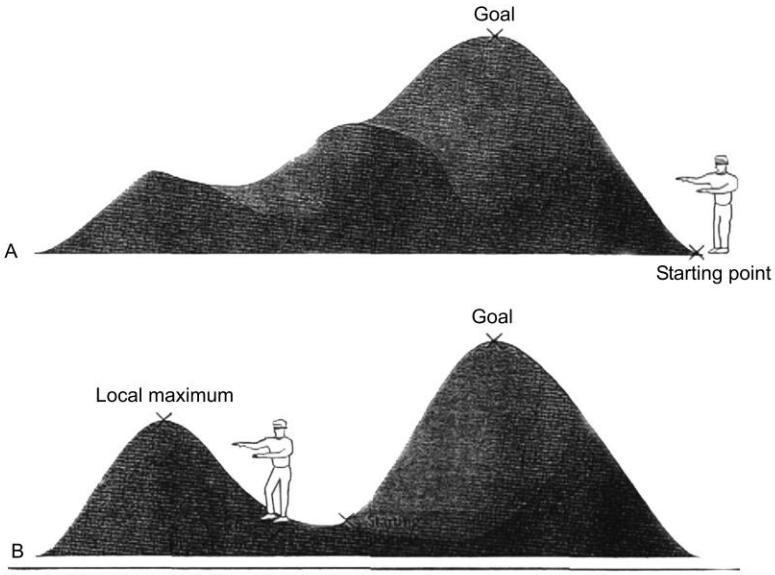
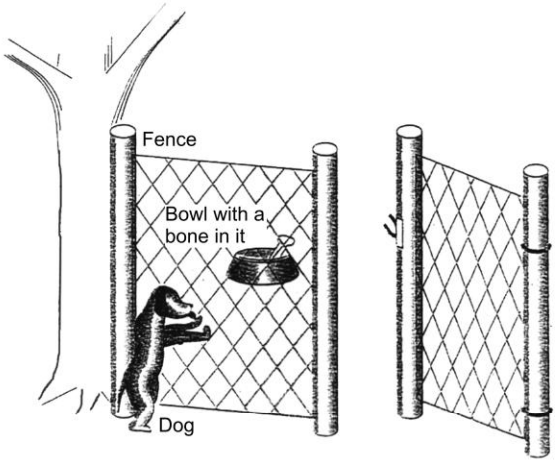


Illustration of Hill Climbing Heuristic: The terrain represents the closeness to problem solution with higher elevation being closer to the goal. Panel A shows a blindfolded person moving steadily up the hill by feeling the terrain. Panel B shows the problem of local maximum for this heuristic.

Limits on the Hill-Climbing Strategy



According to hill-climbing strategy, the dog should at each step choose a path that moves it closer and closer to the goal. However, this strategy will fail here since the dog needs first to move away from the bone in order to reach the bone.

Fig. 8.7 Hill Climbing Heuristic Strategy

Obstacles in Solving Problems

The obstacles in solving problems are discussed below.

1. *Confirmation Bias*: A tendency to search for information that confirms a personal bias.
2. *Fixation*: Inability to see a problem from a fresh perspective and impediment to problem-solving. Two examples of fixation are (a) *mental set* and (b) *functional fixedness.*
   (a) Mental set is a tendency to approach a problem in a particular way, especially a way that has been successful in the past.
   (b) Functional fixedness is a tendency to think of the only familiar functions for objects.
3. *Using and Misusing Heuristics*: Two kinds of heuristics have been identified by cognitive psychologists: (a) representative and (b) availability heuristics.
   (a) Representativeness heuristic: Judging the likelihood of things or objects in terms of how well they seem to represent, or match a particular prototype.
   (b) Availability heuristic: Why does our availability heuristic lead us astray? Whatever increases the ease of retrieving information, increases its perceived availability.
4. *Overconfidence*: Intuitive heuristics, confirmation of beliefs and knack of explaining failures increases our overconfidence. It is a tendency to overestimate the accuracy of one's beliefs and judgments.
5. *Exaggerated Fear*: Opposed to overconfidence is our tendency for exaggerated fear about how things may happen. Such fears may be ill-founded.
6. *Framing Decisions*: How an issue is framed can significantly affect decisions and judgments.
7. *Belief Bias*: The tendency for one's preexisting beliefs to distort logical reasoning sometimes by making invalid conclusions.

Problem Spaces

How do we define a problem in real life? We normally perceive the difference between the present state and the desired goal. A problem, therefore, is defined as follows:

1. An initial state of incomplete information that you start with
2. A goal state the information or state that you hope to obtain
3. A set of operations that is steps that you take to move from the initial state to goal state.

Together, these three parts define the *problem space.* Psychologists have always been intrigued by the laws that relate successive thoughts in the area of problem-solving, and this issue assumes particular importance. What guides the mind from one idea to another until it reaches a solution? What principles govern its search?

The classical theory of association assumed no directional aspect to thought. The course of mental processing was solely governed by the laws of spatial and temporal contiguity. Although the nondirective aspect of associational doctrine was strongly attacked by many psychologists and philosophers, the first experimental evidence on this point was provided by Watt and Ach of the Wurzburg School. Their subjects reported in their introspections that the requirements of a particular task (such as 'name a superordinate of the presented word') induced a set that determined the type of thoughts that reached consciousness. The Wurzburg psychologists regarded these reports as evidence that purely associational account of problem-solving was insufficient. One must also consider the 'determining tendencies' induced by the task.

Selz added a new element to extant theory by trying to specify the representation of the given problem. On the basis of introspective data, Selz concluded that problems were represented by schemata. **Humphrey** (1951) writes: 'For Selz a problem is a 'schematically anticipated complex'. The final solution is, of course, not given explicitly in the data, or there would be no problem. But there is a sense in which it is given

implicitly, in that it is known to stand in certain 'general and expressly given' relations to the data. Thus, the problem is a set of data with a gap; and the effect of the determination (determining tendencies) is to initiate previously applied methods to fill the gap.'

Although Selz tried to be more concrete about the operations involved in problem-solving, the process is still somewhat mysterious. Describing Selz' theory, Humphrey writes, 'these operations he calls Means (i.e. means to the end of the solution) and an important part of the process of solution is accorded to the findings of the Means'.

Another approach to problem-solving and the question of directed search was contributed by the Gestalt psychologists. They claimed that the processes of both perception and problem-solving involved restructuring of the phenomenal field. This process of reorganization or restructuring was believed to underline the experience of insight. The reorganization was a response to the stresses set up by the initial neural representation of the problem. Problem-solving was very much an equilibrium process: The neural structure representing the initial problem spontaneously reorganized so as, to achieve a state of low stress, and the resting state corresponded to the solution to the problem. Because the Gestalt psychologists could not specify the initial neural organization that resulted from a particular task, their experiments were never able to finish out the theory. But the dual motion that solving a problem reduces discrepancies in an internal state and that these discrepancies drive the search for a solution has persisted in present day theories of problem-solving.

When we try to solve problems, we engage in special forms of thinking that are called *reasoning.* There are two types of reasoning that we use:

1. Deductive reasoning
2. Inductive reasoning

It was initially Aristotle who was concerned with defining logical reasoning relationships between statements that would lead to valid conclusions. Deductive *reasoning* involves the correct application of such logical rules.

According to **Holyoak** and **Spellman** 1993, **Johnson-Laird** and **Byrne** 1991; **Rips** 1990; we may have so general abstract sense of formal logic, but the real-world deductive reasoning is affected by both the specific knowledge one possesses about the word and the *representational* resources one brings to bear on a reasoning problem.

How does the knowledge wield an influence on deductive reasoning? Take this syllogism:

Premise I: All things that have motor need oil.
Premise 2: Automobiles need oil.

Conclusion: Automobiles have motors.

Is this a valid conclusion? According to rules of logic, it *is not,* because premise one leaves open the possibility that many things that do not have motors need oil. But the conclusion is not untrue.

When the problem is familiar in your real life, you can make use of a *pragmatic scheme.*

When people do not use the pragmatic reasoning scheme, they may carry out deductive reasoning by constructing *mental models* (**Johnson-Laird** and **Byrne** 1991). Mental models reproduce the details of the situation as accurately as possible.

The general conclusion is that we reason best when we can develop a unique model of the word. The only danger is that we will make errors if we fail to see that the premise of a problem allow more than one model.

Inductive Reasoning

Inductive reasoning is a form of reasoning that uses available evidence to generate likely but not certain conclusions. In real-life circumstances much of the problem-solving ability relies on inductive reasoning. If

EXPERIMENTAL PERSPECTIVE

Luchin's Water Jug Experiment (Luchin 1942, 1959)

In this experiment, the subject is given a set of jugs of various stated capacities and is asked to measure out a desired quantity of water. Table 8.4 lists out the problems of measuring out the desired quantity of water using three jars.

TABLE 8.4 Using Three Jars with the Indicated Capacities to Measure Out the Desired Amount of Water

Problem	Capacity of Jug A	Capacity of Jug B	Capacity of Jug C	Desired quantity
1	21	127	3	100
2	14	163	25	99
3	18	43	10	5
4	9	42	6	21
5	20	59	4	31
6	23	49	3	20
7	15	39	3	18
8	28	76	3	25
9	18	48	4	22
10	14	36	8	6

All problems except 8 can be solved by B − 2C − A.
For problems 1 through 5 this solution is simplest.
For problem 7 and 9, the simpler solution is A + C.
Problem 8 cannot be solved by B − 2C − A, but can be solved by A − C.
Problems 6 and 10 can be solved more simply as A - C.
Subjects who worked through all problems in order:
83% used B − 2C − A on problems 6 and 7.
64% failed to solve problem 8.
79% used B − 2C − A on problems 9 and 10.
Subjects who saw only last 5 problems.
Fewer than 1% used B − 2C − A. Only 5% failed to solve problem 8.
Problem can be overcome by warning subjects.
After problem 5, Lurchins told some subjects "Don't be blind", which caused more than 50% to find the simpler solution to the remaining problems.
Were you able to solve all 9? See the discussion below once you have given it a try.
The set can prevent you from choosing a good solution strategy.
'Persistence of set' in the water jar problem (**Luchins** 1942)
Problems 2 through 6 can all be solved by filling Jar B, then subtracting Jar A once, then subtracting Jar C twice. This creates a 'set' for solving the problems this way.
Problems 7 and 8 can be solved using the same method as used in the previous problems, but they could be solved more efficiently by starting with Jar A instead. The 'set' for starting with Jar B often prevents people from seeing the simpler solutions.
Problem 9 cannot be solved in the same way as problems 2 through 6. You must break out of the set to find a solution.

Luchins study demonstrated that problem-solving experience provides the subject with a 'set' and this interfere with subsequent problem-solving.

you have forgotten your keys inside the house, what should you do? The first is to call from memory what you did in the past which worked. This process is called *analogical problem-solving.*

One establishes an analogy between the features of a current situation and the features of previous situation (**Hlolyoak** and **Nisbett** 1988).

There is caution for inductive reasoning. We might find that sometimes what has worked in the past does not work now and actually the past experience hampers us in finding a solution in the present problem situation because it has created a *mental set*, for example, Luchins' water jar problem (**Luchins** 1942).

Figure 8.8 shows one more interesting problem-solving example—that of arranging six matchsticks to form four equilateral triangles.

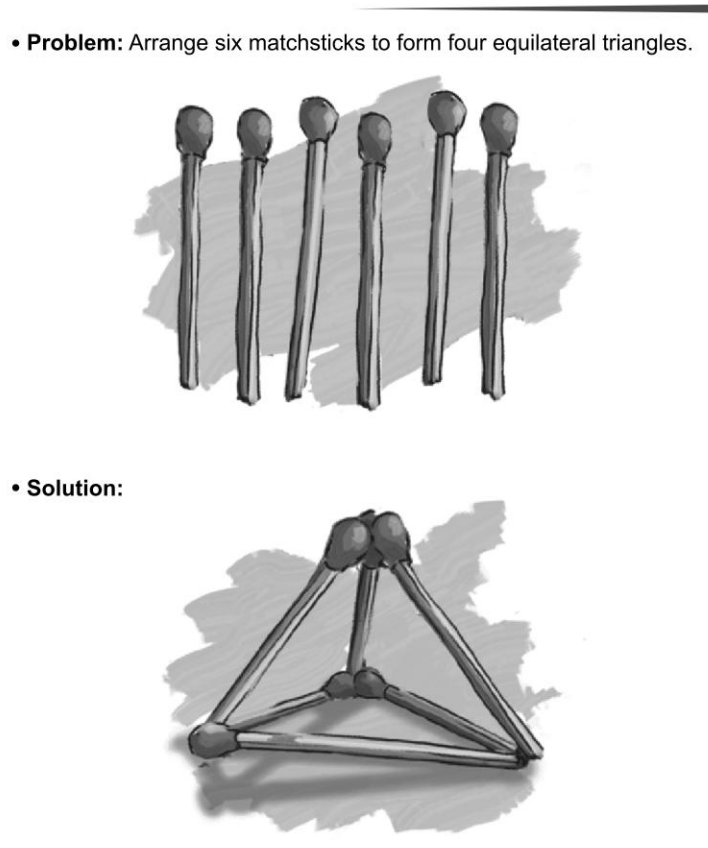


Fig. 8.8 The Matchstick Problem

Key Approaches to Problem-solving

There are several different ways of problem-solving, all with their own advantages and disadvantages. The process an individual adopts as a manager will be influenced by organizational policies, the kind of information available about the problem and his/ her own personality and communicative style. Broadly, there are three problem-solving models available to a manager.

PSYCHOLOGY NUGGETS

Theories of Problem-solving

There are three major theories of problem-solving behavior:

1. Meditational Theory: This theory holds that thinking is a matter of implicit and essentially physiological responses. In simple words. it means that the processes of problem-solving are internal and are related with the processing in the brain.
2. Hypothesis Theory: It views thinking in terms of manipulating symbols and creating and applying hypotheses. This essentially covers the entire gamut of the psychological theories explaining how we learn to solve problems.
3. Information Processing Theory: This theory utilizes the computer as a model when solving problems, people function as computers or, conversely, computers behave like people. Here, problem-solving is likened to the way the computer solves problems based on the analogy that the human brain can be likened to a computer.

Rational Problem-solving

The brain can think in two ways—emotionally (governed by instinctive feelings) and rationally (governed by acquired knowledge and beliefs). Emotional thinking happens in the limbic system—an interconnected system of brain nuclei associated with basic needs and emotions, for example, hunger, pain, pleasure, satisfaction, sex and instinctive motivation). When something catches one's attention, the brain, in a lightning flash, looks through all the inherited and remembered patterns to see if there is a match, and responds with the closest pattern that it can find. Emotional thinking is very clear-cut, black and white, all or nothing. For example, when a black shape on the path looks like a snake, one feels frightened and runs away. Rational thinking, on the other hand, is a function of the part of the brain called the neocortex - the wrinkled outer layer of the front parts of the brain (the cerebral hemispheres), the functions of which include the perception of sensations, learning, reasoning and memory. The power to think rationally gives an individual greater flexibility of response. One has a lot more control over what one does. So that one realizes that the black shape on the path, though it looks like a snake, could also be a stick, examines it more closely before deciding what to do. Rational problem-solving rests on the following principles (R.K. Wagner, 'Learning to Solve Practical Problems'):

- Problems are identified by comparing actual performance with an expected standard performance
- Problems are deviations in actual performance from the expected standard
- A precise and complete description of the problem is needed to identify a solution:
  (a) What is happening?
  (b) Where is it happening?
  (c) When is it happening?
  (d) To what extent is it happening?
- The cause of the problem will be found by comparing problem and non-problem situations.
- Recent problems are a result of some change in the situation that has caused an unwanted deviation from expectations.

Rational Decision-making

This model requires the following steps which, if followed, are assumed to lead to 'value-maximizing choices'. The steps are as follows:

- Define the problem.
- Identify the decision criteria
- Weigh the criteria to determine rank of importance.
- Generate possible alternative solutions.
- Rate each alternative on each criterion.
- Compute the optimal decision.

The case again rational problem-solving is the flawed assumption that every problem is defined clearly and precisely that might not be always possible. Also, rating each of the alternative problem solutions relatively in terms of set or predetermined criteria can be a tricky task.

Lateral or Creative Problem-solving

During 1950–1960, some significant research was done by Roger Sperry that won him the Nobel Prize for Medicine in 1981. Sperry's work demonstrated that human brain is divided into two major parts or hemispheres - the right brain and the left brain. The left brain is associated with verbal, logical and analytical thinking. It excels in naming and categorizing things, symbolic abstraction, speech, reading, writing and arithmetic. The left brain is very linear: it places things in sequential order—first things first and then second things second, etc. Left brain engages in a very systematic, sequential and exact approach to getting the job done. The left brain strives for accuracy in the process of the job being done.

The right brain, on the other hand, functions in a non-verbal manner and excels in visual, spatial, perceptual and intuitive information. It is associated with the realm of creativity. The right brain processes information differently than the left brain. The processing happens very quickly and the style of processing is non-linear and non-sequential. The right brain looks at the whole picture and quickly seeks to determine the spatial relationships of all the parts as they relate to the whole. This component of the brain is not concerned with things falling into patterns because of prescribed rules. So, lateral or creative problem-solving does not follow a standard set of procedures. It is a 'subconscious process based on past distilled experiences'. It is based more on the gut feeling of the manager, than on an objective process of weighing alternatives. There are a set of conditions and it is accepted that under those conditions, intuitive approach is generally preferred to rational approach. Intuitive method is preferred when:

- A high level of uncertainty exists.
- There is little precedence to draw on.
- Variables are not reliably predictable.
- Facts are limited or facts are contradictory.
- Analytical data are of little use.
- There are several plausible solutions.
- Time is limited and decision must be made.

The creative problem-solving is flexible. So, it can be used to examine real problems and issues. According to 'brainstorming' creator Alex Osborn and Dr Sidney Parnes, creative problem-solving process involves six steps that together provide a structured procedure for identifying challenges, generating ideas and implementing innovative solutions.

The following are the six steps:

1. Objective (Mess) Finding: The problem-solver discusses the situation about the problem and brainstorms a list of objectives or goals which he/she might have for him/her creative effort. Through some process, arrive at consensus on one or more objectives the group is willing to attempt.

2. Fact Finding: The problem-solver brainstorms all the facts that might even remotely be related to the objective. S/he has made sure that each perspective and participant is represented on the listing. S/he has to

take some time for the participants to point out which facts they feel are most relevant to the objective and its eventual solution.

3. Problem-Solving: One of the most powerful aspects of creativity is rephrasing the problem definition to one that is both closer to the real problem and reveals more obvious solutions. One technique for this is to brainstorm different ways to state the problem. Most people recommend that the problem statement be written as: 'In what ways might we...' One has to pay particular attention to changing the verbs and the nouns in the problem statement. Asking 'Why' and 'How' will also result in some interesting problem statements. Let the owner of the problem select the statement or statements that seem to best capture the 'real' problem.

4. Solution Finding: In this step, the ideas with the greatest potential are evaluated and the problem owner selects an idea or set of ideas to take action on. One of the most effective methods for this step is to brainstorm the criteria that determine the best idea such as cost and appearance, then select the most useful criteria. These criteria are then used in a decision matrix in which every idea is evaluated on every criterion and the judgments combined to select the idea worth putting into action.

5. Acceptance Finding: In this phase, the problem-solvers consider the real-world issues of the change from the old way to the proposed new way as well as issues that are likely to have a bearing upon the acceptance and implementation of the envisaged change. The ideas developed in this step are then integrated into the plan, increasing its likelihood of success. Unlike many other problem-solving methods, the process emphasizes the need to defer judgment on possible ideas and solutions until a final decision is made. In this way, the flow of ideas in the third step is not interrupted, and possible solutions, however, bizarre, are accepted.

Problem-Solving Process

There is a variety of problem-solving processes. But each process consists of a series of steps—identifying the problem, searching for possible solutions, selecting the most optimal solution and implementing a possible solution. It is useful to view problem-solving as a cycle because, sometimes, a problem needs several attempts to solve it or the problem changes.

1. Identify
2. Explore
3. Set goals
4. Look at alternatives
5. Select
6. Implement evaluate

1. Identifying the Problem

The first step in the problem-solving process is sizing up the situation to identify the problem. That sounds simple enough, but sometimes managers might be uncertain about what the problem is; they might just feel general anxiety or be confused about what is getting in the way of their objectives. If that is the case, they can ask themselves or their friends or a professional expert. Other useful techniques for identifying the problem include:

- Comparison with others
- Monitor for weak signals
- Comparison of current performance with objectives or past performance
- Checklists
- Brainstorming

2. Exploring the Problem

Having identified the problem, managers should analyze it to see what the root cause is. Often people get caught up in symptoms or effects of a problem or issue and never get down to the real cause. They get mad at someone's attitude, anger or actions that are not the cause of the problem. The key here is to focus on analyzing the problem for the real cause without being affected by emotional issues. Seeing answers for questions such as the following will help explore the problem:

Identify the Problem—Ask Who:

- Who says that this is a problem?
- Who caused or is causing the problem?
- Who does it or will it affect?
- Who has done something about the problem?

Identify the Problem—Ask What:

- What happened or will happen?
- What are the symptoms?
- What are the consequences for others?
- What circumstances surround the occurrence of the problem?
- What is not functioning as desired?

Identify the Problem—Ask When:

- When did it or will it happen?
- Why did it happen?
- When did it first occur?

Identify the Problem—Ask Where:

- Where

Both problem-solving and reasoning activities require the combination of current information and information from the past stored in our memory. This will lead some goal or conclusion or a solution.

DECISION-MAKING AND JUDGMENT

Our day-to-day experiences are filled with uncertainty. We do not know what the future holds for us, so we can only guess and therefore we can never be very sure of correct judgments and decisions. So, the process judgment and decision-making must operate in such a manner that we can efficiently deal with uncertainty. According to Simon, our thought processes are guided by bounded rationality. Our judgments and decisions might not be as good and as 'rational' as they could be.

Before we go any further, it is important to make a distinction between judgment and decision-making. Judgment is the process by which one forms opinions, reaches conclusions and makes critical evaluations of events and people. We very often make judgments spontaneously.

Decision-making is a process of choosing between alternatives, and selecting and rejecting available alternatives. Judgments and decision-making are interrelated processes.

When we enter a new class-room situation where we meet many other students, we may judge some of them, being more intelligent, interesting and having similar attitudes to our own. Then, we may decide to form friendships with them.

Our decisions are often made on the basis of our judgments. Decision-making is a kind of problem-solving where one is presented with several alternatives, out of which we have to choose one. Why does a person buy one car and not another? Why does one opt for one subject and not another.

These people are trying to achieve some objective. They might be trying to minimize their loss or they might be trying to maximize their gain. They are trying to make optimum decision. In psychological terms, they are optimizing their utility perceived benefits or psychological value in making their decisions.

In making decisions, we must have the knowledge of probabi1ity. In real-life situations, we do not know what the chances of various outcomes are; we can only make our own estimates of these probabilities. These known as subjective probabilities. In decision-making, we use similar heuristics as in judgments.

PSYCHOLOGY IN EVERYDAY LIFE

Decision-Making can be Drudgery While Shopping Too!

Each day, we are bombarded with options—at the local coffee shop, at work, in stores or on the TV at home. Do you want a double-shot soy latte, a caramel macchiato or simply a tall house coffee for your morning pick-me-up" Having choices is typically thought of as a good thing, but researchers have found we are more fatigued and less productive when faced with a plethora of choices. **Kathleen D. Vohs concluded that making choices apparently depletes a precious resource within the human mind.** "Maintaining one's focus while trying to solve problems or completing an unpleasant task was much harder for those who had made choices compared to those who had not," says Vohs. "This pattern was found in the laboratory, classroom and shopping mall. Having to make the choice was the key. It did not matter if the researchers told them to make choices, or if it was a spontaneously made choice, or if making the choice had consequences or not." Even when one has to make fun choices our mental acuity is affected. In their last experiment, researchers determined that making a few enjoyable decisions, such as spending four minutes selecting items for a gift registry, was shown to be less mentally draining than when participants spent 12 minutes doing the same task. In other words, even if people are having fun making decisions, their cognitive functions are still being depleted with every choice they make.

Vohs says these experiments provide evidence that making choices, as opposed to just thinking about options, is what is especially taxing.

"There is a significant shift in the mental programming that is made at the time of choosing, whether the person acts on it at that time or sometime in the future. Therefore, simply the act of choosing can cause mental fatigue," says Vohs. "Making choices can be difficult and taxing, and there is a personal price to choosing."

What is the best way to make judgments? Of course, the best method would be to weigh all the pros and cons and then come to a conclusion. But in real-life situations, we rarely have the complete information and we also have to come to some judgment quickly, so what do we do? According to Amos Tversky and Danial Kahneman, we rely on Heuristics. Heuristics are informal rule of the thumb that provide shortcuts, reducing the complexity of making judgments.

There are three kinds of Heuristics:

1. Availability.
2. Representativeness and
3. Anchoring.

Availability

One basis the judgments on information that is readily available in memory, most of the time it will lead to accurate judgment. Trouble only arises when (1) memory process give rise to a biased sample of information or (2) the information stored in the memory is not accurate.

Representativeness

Here, we use past information to make judgments about similar circumstances in the present. This means using inductive reasoning. Most of the times making judgment on the basis of similarity will be quite reasonable but if it causes us to ignore other information, we may make errors of judgment.

Anchors

We have an original starting value when judging the probable value of some event or an outcome. In other words, our judgment is 'anchored' too firmly to an original guess.

CREATIVE THINKING AND FOSTERING CREATIVITY

The creative thinker, whether an artist, a scientist or an inventor, is always trying to achieve something new. Creative thinking is similar to insight, and it seems likely that the ideas rise to consciousness after much unconscious rearrangement of symbols.

Creativity can be defined as a special case of problem-solving. What makes it special may be the open mindedness' of the problem, the originality (and in some sense, value) of the solution, or the nature of the process by which solution is achieved.

Problems relevant to creativity include instances of scientific innovation and artistic or literary production. With respect to originality, it is generally agreed that a creative response is not only novel but also effective and appropriate: **Meltzman** (1960), in fact, defined creativity as 'originality evaluated'.

Stages in Creative Thinking

Creative thinking tends to proceed in five stages:

1. Preparation
2. Incubation
3. Illumination
4. Evaluation
5. Revision

In Stage 1, preparation, the thinker formulates his problem and collects the facts and materials he considers necessary for its solution. Very frequently, he finds that he cannot solve the problem even after hours of concentrated effort. Often, he deliberately and involuntarily turns away from the problem, he is then in Stage 2, incubation. During this period, some of the ideas that were interfering with the solution to the problem fade. On the other hand, things he experiences or learns in the meantime may provide the clue to the solution. During incubation, the unconscious processes may be at work. In Stage 3, illumination, the thinker often has an 'Aha' insight experience. An idea for the solution may suddenly dawn on him. Next, in Stage 4, evaluation, he determines whether the apparent solution is in fact the correct one. Frequently, it turns out to be

wrong and the thinker is back where he started. In other cases, it is the right idea but it needs modification or requires the solution to other relatively minor problems. Thus Stage 5, revision is reached.

Convergent and Divergent Thinking

Creativity is defined in general terms, as the ability to produce 'products' (such as plays, solution to social problems, poems, etc.) that are both novel and socially-valued (useful, aesthetical1y beautiful, informative and so on).

To a considerable extent, there is an overlap between creativity and general intelligence. A majority of the individuals that we think of as being highly creative are also highly intelligent (**Butcher** 1968). But most researchers in the area of creativity believe that creative thinking is separate to some extent from general intel1igence. There are some highly creative people, in other words, who are not highly intelligent and vice-versa.

This distinction between intelligence and creativity is closely related to the distinction between convergent and divergent thinking. Convergent thinking is logical and focused on a problem until a solution is found. Divergent thinking is loosely organized, only partially more concrete, a measure of divergent thinking that is commonly used in psychological research asks the individual to list as many novel uses as possible for common objects. Those individuals who list the most novel uses, whether they are 'sensible' uses or not, are considered to be the most divergent thinkers. Divergent thinkers, in other words, more easily break out of sets that limit our thinking. People who are good divergent thinkers, therefore, tend to be thought of as creative (**Butcher** 1968). But as said earlier, a good many highly intelligent individuals are talented in both divergent and convergent thinking. This may be the ideal combination as it would seem to allow for problem-solving that is both creative and practical.

Paul Torrance has found that if divergent thinking on specific tasks is encouraged and rewarded by teachers, it can be developed somewhat in most children (**Torrance** 1965).

Fostering Creativity

A number of general skills and abilities basic to creative thinking and problem-solving have been identified. Some of the strategies and materials that can be used to foster creative thinking in children are:

1. Sensitivity training-providing opportunities to think in different and novel ways.
2. Observation-Making children observe different things around them and making them write about their observations.
3. A1iteration-Making different sentences. Each one starting with a word with the same alphabet.
4. Multiple uses-Ask them to think of different ways of using a common object.
5. Story-writing-Giving a beginning of the story and asking children to finish it in their own way using their imagination.
6. Classifications-Categorizing objects of different kinds-in one class.
7. Key words- cognition, thinking, concepts, problem, algorithm, heuristics, creative thinking, divergent thinking.

KEY TERMS

Gestalt view
Psychologese
Behaviorism
Innateness
Chomsky's theory
Cognitive theory
Phonemes
Morphemes
Discriminative learning
Problem-solving
Inductive learning
Creative thinking

EVALUATE YOURSELF

Multiple Choice Questions

1. The term 'thinking' is a synonym for
(a) Organization (b) Learning
(c) Cognition (d) Sensation

2. According to your text, the three building blocks of thought are
(a) Semantics, phonemes and morphemes
(b) Stream of consciousness, sensory registry and perception
(c) Language, images and concepts
(d) Cognition, feelings and language

3. The sounds of 'th,' 'ch,' and 'ph' are
(a) Phonemes (b) Semantics
(c) Morphemes (d) Syntax

4. The language rules that determine how sounds and words can be combined and used to communicate meaning within a language are collectively known as
(a) Morphemes (b) Semantics
(c) grammar (d) Syntax

5. Most concepts that people use in thinking
(a) Accurately account for critical differences among various images
(b) Are fuzzy and overlap with one another
(c) Allow them to generalize but not to think abstractly
(d) Do none of the above

6. A mental model containing the most typical features of a concept is called a
(a) Description (b) Stereotype
(c) Algorithm (d) Prototype

7. Our conception of events as we think will probably be called
(a) A non-compensatory model (b) An idealized cognitive model
(c) A prototype (d) A prototype

8. Many people fail to solve the 'pieces of chain' problem or the 'six matches' problem discussed in the text because
(a) They develop conceptual blocks resulting from overly rigid assumption
(b) They use hill-climbing instead of creating sub-goals
(c) They use an incorrect algorithm
(d) They use heuristic methods rather than trial and error

9. What is it called when decision-making is based on information that is most easily retrieved from memory, even though this information may not be accurate?
(a) Means-end analysis (b) Functional analysis
(c) The availability heuristic (d) Compensatory model

10. Which of the following is most consistent with the research evidence about the connection between language and cognition?
(a) There is a positive correlation between superior cognitive abilities and teaching children in their native language only.
(b) No link between language skills and cognitive abilities exists.
(c) There is a positive correlation between superior cognitive abilities and bilingual education.
(d) None of the above is true.

Descriptive Questions

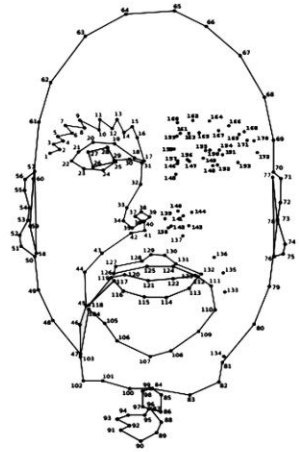
1. How is language learned?
2. Discuss the theories of language acquisition.
3. Thinking is a complex cognitive activity. Explain what is thinking.
4. What is problem-solving? Discuss the processes people use to solve problems.
5. How are concepts formed?
6. What is reasoning?
7. What are the different kinds of reasoning?
8. What are the key approaches to problem-solving?
9. What are the major theories of thinking?
10. What is creativity?

Critical Thinking Questions

1. Do we always think before we act? Analyze and explain using an appropriate framework from this chapter.
2. What does the expression 'thinking out of the box' connote?
3. Is language necessary to think? Can you relate language development with evolution?
4. How does a child add vocabulary to the language when it develops from a toddler to an adult?

PRACTICAL EXERCISES

1. Give a 'connecting the dots' handout to the class. Analyze the similarities and dissimilarities in the final pattern and share the result with the class.



2. Examine the main anchors of fostering critical thinking. Write a short essay on the topic.
3. Critically review Piaget's framework on cognitive process of thinking and language acquisition.

Answers to Multiple Choice Questions

1. (c) **2.** (c) **3.** (a) **4.** (c) **5.** (b) **6.** (d) **7.** (b) **8.** (a) **9.** (c) **10.** (c)

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Chapter 9

MOTIVATION

CHAPTER OBJECTIVES

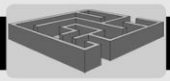
After reading this chapter, you will learn:

- Concept of motivation and about the formalized definition of motivation.
- About homeostasis and its linkages with motivation.
- The approaches to the study of motivation, including the work of Abraham Maslow.
- The sociogenic and psychogenic factors of motivation and learn about the researches in these areas.
- The framework for explaining conflicting motives with the help of model.
- About the various milestone researches, which gave rise to famous theories of motivation, including that of Maslow's, McClleland's and others.
- About the development of motivation.

INTRODUCTION

Though the actions of humans, such as his thinking, beliefs and anticipation, are guided by his cognitions, but when we seek to find an answer behind the reasons for such actions then we are asking the question of motivation. The answer to motivation is given in terms of active, driving forces represented by such words as 'wanting' and 'fearing': the individual wants power, he wants status and he fears threat to his self-esteem. In addition, a motivational analysis specifies a goal for the achievement of which a human spends his energies. Wanting power, he commits his effort, time and substance to become a minister. Wanting status, he tries to buy his way into the elite club such as the Delhi Gymkhana club. Fearing social ostracism, he avoids those people and friends who would ask his cooperation in unpopular social causes. Fearing threats to self-esteem, he avoids situations like group discussions, debates, etc. where his intellectual competence might be challenged.

The question 'why', does not end with a single simple answer that gives reason for an individual's behavior. It goes beyond to another question asking 'why'. Why does an individual choose one action and reject alternative action? This question has to do with direction of action. Another question that arises is why people persist in a chosen action for a long time irrespective of the obstacles and difficulties that arise out of that action of theirs. This question is related to the persistence of action. The study of motivation takes into account the direction and persistence of action.



PSYCHOLOGY IN EVERYDAY LIFE

Why are we Motivated to Pursue Hobbies and Pastimes?

We all have some hobby or the other, which can range from reading novels authored by our favorite author, gardening, keeping pets, going outdoors or just relaxing and listening to music. When we indulge in any such activity, we do not realize how time flies by. Now imagine what will happen if you are forced to indulge in an activity that you do not like or even dread engaging in. You simply will not enjoy doing that activity. In life, there are many such activities that we have to do even though we do not enjoy doing them. The question is: 'How well is your performance on activities you like and those you dislike and what is the driving or inhibiting force underlying the same?' The answer is simple. We indulge freely and happily in those activities for which we have an underlying motive and see it as fulfilling some need of ours. We don't like indulging in activities which are not needed satisfying. However even though activities which are not need satisfying have to be indulged in – you have to stand in long queues to pay your bills or buy tickets, drive on congested roads and so on. So next time when you indulge in an activity examine the goal minutely – if its need satisfying you will be enjoying it and if not you will be doing it half-heartedly.

Taking into account what has been discussed so far, we can say that motivation includes all those internal conditions, which begin an activity or sustain it. It is a hypothetical process involved in the determination of behavior in addition to the effect of a stimulus or perceived situation, the processes of learning and certain other factors such as abilities. Whereas abilities primarily influence the yield or level of adaptation to a specific pattern of behavior, motivation determines its level of activation, intensity and consistency, as well as the general direction. Learning or acquired associations determine, for non-instinctive behavior, the concrete directions towards a given object. The effect of stimuli is not always distinctly separate from the effect of motivation. Some categories of excitation, above all those, for which internal stimuli are responsible, are often interpreted as corresponding to primary needs, while other stimuli have valances and act as motives or releasers. The state of motivation is then understood as a factor, which lowers the stimulus threshold for these stimuli.

As mentioned before, that motivation is a hypothetical process, the objective phenomena for such an opinion can be argued by the fact that behavior shows preferences for the objects or situations in the environment, and that these objects are desired or avoided with varying degrees of intensity and perseverance.

Now after discussing what motivation is, we will discuss the definitions of motivation given by the various eminent psychologists.

DEFINITION OF MOTIVATION

The word 'motivation' finds its origin in the Latin word '*mooveers*', the English equivalent of which is 'to move'. In plain simple words, motivation is the process of arousing movement in the organism. H.W. Bernard refers to motivation as 'those phenomena which are involved in the stimulation of action towards particular

objectives where previously there was little or no movement towards these goals'. Hebb highlights these aspects of the term motivation. It refers to the existence of an organized sequence, its direction and content and its persistence in given direction or stability of content. In the words of J.P. Guilford, 'a motive is a particular internal factor or condition that tends to initiate and to maintain activity'. Atkinson defines motivation as the arousal of tendency to act, to produce one or more effects. According to James Drever, motivation is an affective conative factor, which operates in determining the direction of an individual's behavior towards an end or goal consciously apprehended or unconscious. For Abraham Maslow, motivation is constant, never ending, fluctuating and complex and is an almost universal characteristic of particularly every organismic state of affairs. Goods has defined motivation in very simple terms, as the process of arousing, sustaining and regulating activity. A more recent definition given by **Petri** (1996) defines motivation as the process by which activities are started, directed, and continued so that physical or psychological needs or wants are met. Motivation as defined by **Daft** (1997), refers to 'the forces either within or external to a person that arouse enthusiasm and persistence to pursue a certain course of action'.

In brief, we can say that most of the definitions share a core character of motivation, i.e., it is a process involving the arousal of an organism generated by a need that disturbs the equilibrium. To stabilize this disequilibrium, the organism's behavior is directed towards the attainment of the desired goal in accordance with the end product. To have a closer scrutiny of the process of motivation, we will have to examine in detail the formula proposed by Hilgard, which indicates that needs, drives, and incentives are the essential parts of motivation. However before that we need to know about the basic approaches used in the study of motivation. Figure 9.1 illustrates four types of motivation.

Fig. 9.1 Four Types of Motivation

CONCEPT OF HOMEOSTASIS

Human biological adjustments are basic in the sense that they are life functions and have their equivalents in animals. Needs continually arise and are met. Many physiological adaptations occur automatically. The

blood remains slightly alkaline within a very narrow range of change; any larger variation in the direction of acidity or increased alkalinity would result in death. Body temperature is controlled by the 'thermostat' in the brain. This thermostat regulates various processes such as combustion of food, perspiring, and dilatation or constriction of the capillaries. Such adaptations are labeled as *homeostasis*. The *hypothalamus* plays a major role in the maintenance of homeostasis. It helps provide a constant body temperature and monitors the amount of nutrients stored in the cells.

In brief, homeostasis in physiology is an overall term for the tendency of biological systems to maintain a state of equilibrium. This tendency ranges from systems of internal balance in individual organisms to ecological patterns of balance in a community of organisms, as between numbers of predators and prey. The concept was first advanced in the 19th century by the French physiologist Claude Bernard, and was given its name by the American physiologist Walter B. Cannon. Cannon made a distinction between hierarchical, homeostatic levels: *reflex* and *instinctive behavior*, *acquired habits* and *adaptations*, and *willed actions*, which serve the self-regulating system intent upon maintaining a 'fluid' equilibrium. Examples of homeostasis include the body's self-regulation of hormone and acid-base levels, the composition of body fluids, and cell growth and body temperatures. On a broad scale, the world community of organisms tends to maintain some degree of evolving balance when not seriously disturbed. The so-called *Gaia hypothesis* of the earth as a living organism, which gained great popularity in the 1980s, may in some ways be regarded simply as an extension of homeostasis concepts.

Homeostatic Drives

Homeostatic drives are believed to arise as a direct consequence of internal stimulation that results when an essential physiological process deviates from some optimal level of functioning. Homeostatic processes maintain vital physiological or biochemical functions within the rather narrow limits. If this balance is disturbed by increased output or insufficient input, neural and/or chemical changes occur; these stimulate specific central regulatory mechanisms and exert a facilitatory effect on non-specific reticular mechanism.

The primary indicators of homeostatic functions may be chemical events such as changes in blood sugar, the concentration of other chemicals in the extra-cellular fluids, or osmotic pressure gradients.

The chemical events affect the central regulatory mechanisms and related aspects of the non-specific reticular system:

1. Directly, by a stimulating or facilitating action on specific sub-cortical or cortical neurons.
2. Indirectly, via a stimulating or inhibiting effect on peripheral introceptors, which in turn control the activity of the central regulatory mechanisms.
3. Directly or indirectly, by stimulating other central neural functions, which contribute to the excitation or inhibition of the specific regulatory mechanisms.

Although homeostatic drives are related specifically and exclusively to a single physiological need, a number of physiological and biochemical processes may contribute to, or be affected by, a particular homeostatic mechanism.

The activity of the central mechanisms does not appear to be a simple additive function of all facilitating and inhibiting inputs. Instead, the various chemical and neural messenger systems may be carriers of essentially the same information, so that one or more of them can be eliminated without materially affecting the central regulation. Artificial regulation of a single messenger system may nevertheless produce marked effects on the central regulatory mechanism, because a single input may suffice to control the activity of the central regulation.

The specific central regulatory mechanisms are composed of complex, interacting systems of nuclei and pathways, which are diffusely represented in *rhinencephalic* (cortical) and related sub-cortical structures.

A more diffuse representation of the central regulatory functions is also suggested by the recent experimental findings that such homeostatic drives as hunger or thirst appear to be significantly affected by lesions and/or stimulation of a variety of rhinencephalic and related sub-cortical regions. Since lesions and stimulation of specific hypothalamic areas typically produce more drastic effects, it can still be argued that the extra-hypothalamic mechanisms merely contribute information to the hypothalamic regulatory centers; thus, the effects of rhinencephalic lesions or stimulation may be the result of adding or subtracting excitatory or inhibitory influences.

However, Grossman proposes that the hypothalamus is merely a part of a complex system of interacting nuclei and pathways and that the apparently unique effects of hypothalamic changes or stimulations may be a 'geographic' artifact.

APPROACHES TO THE STUDY OF MOTIVATION

Two quite different theoretical approaches to human motivation are illustrated by *psychoanalytic theory* and *social learning theory*. The *psychoanalytic theory* of Freud emphasizes two basic drives: *sex* and *aggression*. These motives arise in infancy, but their expression is forbidden by parents, and *repression* occurs. A repressed tendency remains active, however, as an *unconscious motive* and finds expression in indirect or symbolic ways.

Social learning theory, on the other hand, focuses on patterns of behavior that are *learned* in coping with the environment; learning may occur through direct reinforcement or *vicariously* through observing the consequences of behavior *modeled* by another person. *Cognitive processes* enable a person to foresee probable consequences and to alter behavior accordingly. *Self reinforcement*, based on one's own standards of conduct, also provides an important motivational control.

The psychoanalytic and the social learning approaches to human motivation can be illustrated by considering aggression as a motive. Aggression, defined as behavior *intended* to injure another person or to destroy property, may be primarily *hostile* - aimed at inflicting injury - or *instrumental* - aimed at goals other than the victim's suffering. For Freudian theorists, aggression is an *instinct* or a *frustration produced drive*; for social

EXPERIMENTAL PERSPECTIVE

Maslow's Experiments With Baby Rhesus Monkeys

Maslow, early in his career, while working with monkeys noted an interesting thing about precedence of needs. He observed that some needs take precedence over others. If needs like hunger and thirst occur simultaneously, one tends to quench thirst first and then satiate the hunger. This is so because one can live without food for days together but not without water. In psychological terms, thirst is a "stronger" need as compared with hunger. Now let us compare the thirst need with that of breath. If you are feeling very thirsty and at the same time trapped in a room filled with mineral water bottles and full of smoke, you will first try to get out of the room and take a breath of fresh air. Here fresh air has taken priority over your thirst because it is more essential. In the same manner, the sex drive is last in the list of priority—one simply does not die if he does not indulge in sexual activities.

Based upon this simple logic, Maslow created his famous need hierarchy theory. Beyond the details of air, water, food, and sex, he laid out five broader layers: the physiological needs, the needs for safety and security, the needs for love and belonging, the needs for esteem, and the need to actualize the self, in that order. We will explore these in detail later in the chapter.

learning theorists it is a *learned response*. Evidence indicates that observing aggressive behavior, either live or filmed, is not cathartic; it tends to increase aggressiveness.

The *humanistic approach* to motivation primarily focuses on the motivation towards *self actualization*. Thus, **Abraham Maslow** (1970, 1987) in his *need hierarchy theory* places self-actualization at the peak. A minimum level of lower level needs satisfaction has to be attained before one could strive towards self-actualization. Apart from self-actualization, the other needs analyzed by him are: need to explore the environment for competence and need to master the environment.

Finally, *the homeostatic approach* to motivation is based on behavior directed towards the reduction of tension in the system caused by the deprivation or a need. Thus, according to this approach, behavior is motivated towards need-reduction. However, this approach cannot explain certain behaviors like exploratory and self-actualization behavior which increases the tension in the system rather than reduce it.

NEEDS

As used in psychology, the word designates an internally or externally aroused, brain-located force, often coupled with an accelerating emotion, subjectively experienced as an impulsion or felt necessity to act so as to produce a certain specifiable terminable effect, which is accordingly expected to prove beneficial to the individual, and less painful or more pleasurable, relative to the arousing situation.

Need has two indispensable motivational properties: *First*, it has the power to mobilize and select cognitive representors of an inviting, want satisfying aim for action (which also include wish fulfilling fantasies and long range plans). *Secondly*, if the need is strong enough, relative to competing needs, then it has the power to energize the imaginably directed actional process, until if possible, by some motor, verbal, or mental skill or tactic, the aim has been sufficiently achieved. However, how successful this will be, will depend upon factors such as good health, knowledge, competence, confidence and volition.

However, we cannot limit the concept of need to arousal for beneficial end products. We should also take into account that in an individual there is a need for sleep; riddance and avoidance needs such as keeping out of danger; intellectual needs; need to learn or to perfect a skill, needs to please or benefit another person, etc.

One thing should be kept in mind that it is not exactly the need that brings about desired activity, but the desire for the actualization of the given aim that does so. Need deprivation does not necessarily lead to an attempt at satisfaction. It depends upon whether or not the organism expects that some appropriate action will satisfy the need.

A question that arises next is, do needs exist in a hierarchy of prepotency, starting with bodily needs and ending with self-actualization. Though **Abraham Maslow** (1943), in his *theory of sequential development* proposed such an idea, there seems yet insufficient evidence for support to this notion.

DRIVE

Certain physiological states, such as food deprivation, tend to increase animal's behavioral output. A number of early animal experiments showed that, in comparison with satiated rats, hungry rats would run more in the activity wheels, and would explore more in a novel situation. These effects were commonly assumed to be unlearned, and to be general with respect to the source of physiological disturbance, the kind of behavior affected, and the situation in which the effects occurred. The animal was believed to be inert unless motivated by some disturbance or threat to its well-being. Motivation was supplied by a hypothetical source or energy

designated as 'drive'. **Woodworth** (1918) to describe this hypothetical force or energy first used the word 'drive'. **Freud** (1915) used it essentially in the same way.

Within a few years, virtually everyone came to believe in some form of the drive concept. The concept was extended to include non-physiological sources of motivation, to give learned drives, social drives, higher drives and so on. The drive concept was applied as readily to human social behavior as to instinctive behavior in the lower animal.

Hull (1943) and **Brown** (1961) eventually combined these ideas. Hull emphasized the generality of drive. While there were many potential sources of drives, he said, they contributed to the total pool of energization.

In brief, we can say that a drive is the output of a motivational system that energizes a specific, functionally-related set of behavioral patterns. Some drives are postulated to fluctuate in accordance with the internal state.

The drive concept is less popular than formerly, its neural basis has remained elusive and many consider it to be impossible to define it other than in terms of observed behavior. However, the word 'drive' will probably continue to be used for some time, as it was originally, i.e. to describe the existence or operation of some motivation system with a physiological basis even though it lacks descriptiveness.

INCENTIVES

To start with, we will first discuss the need-drive-incentive pattern. If a specific need encounters an obstacle to its gratification, it is not extinguished by this deprivation, but its inherent dynamic drive must seek for some outlet or detour to accord with the basic impulse. Usually the closest approximation to the previous specific, now thwarted, form is chosen. This target is an incentive.

Incentive is an aspect of motivation that results from expectations of reward or punishment. The concept was first introduced into the behavior theory by **Hull** (1943), and it has since developed into a variety of formulations. As compared to drives, which are unlearned, general, and have a presumed physiological basis,

EXPERIMENTAL PERSPECTIVE

Self-efficacy and Incentive Value Relationship

In a study done by **Ruiz** and **Cid** (1997), they saw the interactive effect of self-efficacy and incentive value on peripheral physiological reactivity in the performance of a cognitive task. The aim of their experiment was to determine whether both self-efficacy and incentive value exert their effects on autonomic and somatic physiological reactivity in an interactive manner. Thirty-two subjects were assigned to 4 groups resulting from combining two conditions of self-efficacy manipulation (high and low) with two conditions of incentive value manipulation (high and low). All the subjects completed a computer-aided word-chaining task, which involved verbal responses. 4 physiological variables were measured: respiratory and heart rate, electrodermal resistance and electromyography of frontalis muscle. Results suggest that both self-efficacy and incentive value partially determine autonomic reactivity manifested in situations of active coping, exerting their effect interactively. It also appears that incentive value modulates the functional relationship between self-efficacy and autonomic reactivity. However, these cognitive variables appear to determine somatic activity (in this study, represented by frontalis electromyography) in a non-interactive manner.

incentives depend upon prior learning, are specific to particular reinforcers, occur in particular situations, and lack any discernible physiological basis. A question arises as to how much of the total motivation in a given situation could be attributed to drive, and how much to incentive. **Bolles** (1967) indicated that in comparison with incentive, drive is relatively unimportant.

Basically, incentive is a learned form of motivation in which certain external stimuli acquire motivating properties, because the organism associates them with reinforcement. In the reward training experiment (see instrumental conditioning), if the rat is rewarded with food for pressing the lever, then presentation of a lever on a future occasion may increase the animal's motivation to obtain food. On the other hand, if the rat receives an electric shock on pressing the lever, subsequent presentations of the bar will probably have a negative incentive effect. Similar effects are observed on humans.

CLASSIFICATION OF MOTIVES

Human behavior is animated by a great variety of motives: hunger and thirst, fear and anger, love and hate, desire to know and master the environment, self-interest and loyalty to family, friends, cause, and country. R.S. Woodworth has divided motives into the following categories:

Organic Needs: These are those motives that are aroused by the bodily conditions, e.g. hunger and thirst.

Emergency Motives: These are those motives, which are aroused when the condition of the environment demands a strong and quick reaction, e.g. the motive to escape.

Objective Motives: The objective of these motives is impressive behavior with people and objects in the environment. This class of motives is quite comprehensive.

Other psychologists have classified the motives under primary and secondary needs, while some have given biogenic and psychogenic needs, and still others have classified them as physiological, social and psychological.

Biogenic or Biological Motives

These motives are not learned, they are natural, i.e. innate. They are primary, vital, physiological and biological needs, which the person brings with him upon entry into the world. Their fulfillment is indispensable and of prime importance. They are also necessary for the protection of life. The equilibrium of the body and mind is disturbed if they remain unsatisfied and it can be restored only when these needs are satisfied.

Arousal of Biological Motives

Homeostasis: This is the specific organic need, in which the body tries to keep the condition of blood under control, because the equilibrium of the body is disturbed if the quantity or proportion of water, salt, oxygen, carbon dioxide, acid, sugar, protein, fat and glandular excretion is in any way altered. The body tends to maintain the normal balance. This balance needs water, oxygen, etc. from the environment. Thus, homeostasis is the origin of many activities, in which the nervous system takes part. Many psychological motives are also conceived in homeostasis. The individual knows the means of satisfaction of some needs while knowledge of other means is supplied by experience and learning. (*For details, refer to the above discussion and Chapter 2 on Biological Foundations of Behavior.*)

PSYCHOLOGY NUGGET

Classification of Human Needs and Motives

*There have been many attempts to classify human needs and motives. One very old classification identifies three categories of needs (**Prescott** 1938).*	
Physiological	Needs for essential materials and conditions, for a certain rhythm of activity and rest, and for sexual activity.
Social	Needs for affection, belonging and likeness to others.
Ego-integrative	Needs for contact with reality, harmony with reality, progressive symbolization, increasing self-direction, a fair balance between success and failure, and attainment of selfhood.
*Another classification lists fifteen 'manifest needs' as being present in varying strengths in everyone (**Edwards** 1959).*	
Achievement	To do one's best, to be successful, to accomplish tasks requiring skill and effort, to be recognized authority, to accomplish something important, to do a difficult job well.
Deference	To get suggestions from others, to find out what others think, to follow instructions and do what is expected, to praise others, to accept leadership of others, to conform to custom.
Order	To keep things neat and orderly, to make advance plans, to organize details of work, to have things arranged so they may run smoothly without change.
Exhibition	To say clever and witty things, to have others notice and comment upon one's appearance, to say things just to see the effect upon others, to talk about personal achievements.
Autonomy	To be able to come and go as desired, to say what one thinks about things, to be independent of others in making decisions, to do things without regard to what others think.
Affiliation	To be loyal to friends, to participate in friendly groups, to form strong attachments, to share things with friends, to write letters to friends, to make as many friends as possible.
Intraception	To analyze one's motives and feelings, to understand how others feel about problems, to judge people by why they do things rather than by what they do, to predict others' behavior.
Succorance	To have others provide help when in trouble, to seek encouragement from others, to have others be kind and sympathetic, to receive a great deal of affection from others.
Dominance	To argue for one's point of view, to be a leader in groups to which one belongs, to persuade and influence others, to supervise and direct the actions of others.
Abasement	To feel guilty when one does something wrong, to accept blame when things do not go right, to feel that personal pain and misery do more good than harm, to feel timid and inferior.
Nurturance	To help friends when they are in trouble, to treat others with kindness and sympathy, to forgive others and do favors for them, to show affection and have others confide in one.
Change	To do new and different things, to travel, to meet new people, to have novelty and change in daily routine, to try new and different jobs, to participate in new fads and fashions.
Endurance	To keep at a job until it is finished, to work hard at a task, to work at a single job before taking on others, to stick at a problem even though no apparent progress is being made.
Heterosexuality	To engage in social activities with the opposite sex, to be in love with someone of the opposite sex, to be regarded as physically attractive by those of the opposite sex.
Aggression	To attack contrary points of view, to tell others off, to get revenge for insults, to blame others when things go wrong, to criticize others publically, to read accounts of violence.

Regulation of Temperature: This is another specific need of the body. The hypothalamus in the brain is an automatic mechanism, which regulates the body temperature so that there is never any substantial difference.

Humans and other mammals are homoeothermic, able to maintain a relatively constant body temperature despite widely ranging environmental temperatures. When the body is too hot, it decreases heat production and increases heat loss. One way of increasing heat loss is through peripheral vasodilatation, the dilation of blood vessels in the skin. When these vessels dilate, large quantities of warmed blood from the core of the body are carried to the skin, where heat loss may occur via radiation, convection and conduction. Evaporation of fluids from the body also causes heat loss. Humans constantly lose fluids from the skin and in exhaled air. The unconscious loss of fluid is called insensible perspiration.

Although the body has no active control over insensible perspiration, the sympathetic nervous system controls the process of sweating and can stimulate secretion up to 4 liters (4.22 liquid quarts) of sweat per hour. In order for the sweat to evaporate and cool the body, the environmental air must have a relatively low humidity.

When the body is too cold, it increases heat production and decreases heat loss. Vasoconstriction, the constriction of the vessels of the skin, helps prevent heat loss. Shivering, which is a rhythmic contraction of skeletal muscles, produces heat. Heat can also be produced by non-shivering thermogenesis, an increase in the metabolic heat production.

Hormones such as epinephrine, norepinephrine and thyroid hormone increase the metabolic rate by stimulating the breakdown of fat. Humans also change posture, activity, clothing or shelter to adjust for fluctuations in temperature. The goose bumps that arise on the skin in the cold are another sign the body is trying to prevent heat loss. They are due to piloerection, the erection of the hair follicles on the skin. This is a vestige of the time when humans were covered in hair: piloerection would trap air and retain heat.

Body temperature is regulated by a system of sensors and controllers across the body. The brain receives signals regarding body temperature from the nerves in the skin and the blood. These signals go to the hypothalamus, which coordinates thermoregulation in the body. Signals from the hypothalamus control the sympathetic nervous system, which affects vasoconstriction, metabolism, shivering, sweating and hormonal controls over temperature. In general, the posterior hypothalamus controls responses to cold, and the anterior hypothalamus controls responses to heat (Fig. 9.2).

Hypothermia, or low body temperature, is a result of prolonged exposure to cold. With a decrease in body temperature, all metabolic processes begin to slow. Hypothermia can be life-threatening.

Hyperthermia describes a body temperature that is higher than normal. One example of hyperthermia is fever. A fever is generally considered to be a body temperature over 38 degrees Celsius (100.4 degrees Fahrenheit). A fever is the body's natural defense to an infection by a bacterium or virus. Fevers are one of the body's mechanisms for eliminating an invading organism. Fevers may even make the immune system work more effectively. Heat exhaustion and heatstroke are other examples of hyperthermia. These occur when heat production exceeds the evaporative capabilities of the environment. Heatstroke may be fatal, if untreated.

Sleep: This is the specific need of the organism, the importance of which cannot be denied. Sleep is the natural reaction of the organism to fatigue in an absence of stimuli. Its centre, too, is the hypothalamus, which induces sleep, when acted upon chemically. It will be wrong to say that during sleep, an organism is completely inactive. Every 12 minutes or so, the posture is altered during sleep. Sleep is deepest during the first few hours. It gradually becomes lighter as time passes. If a person wanting sleep carries on with activities, there is a decline in performance. (*For details, refer to Chapter 5 on Sleep, Dreams, Hypnosis, Meditation and Drugs.*)

Hunger: The tendency to seek and eat food is the hunger drive. We get hungry in many circumstances. All of the following can make us want to eat: the smell or sight of food, the sound of a dinner bell, even passing

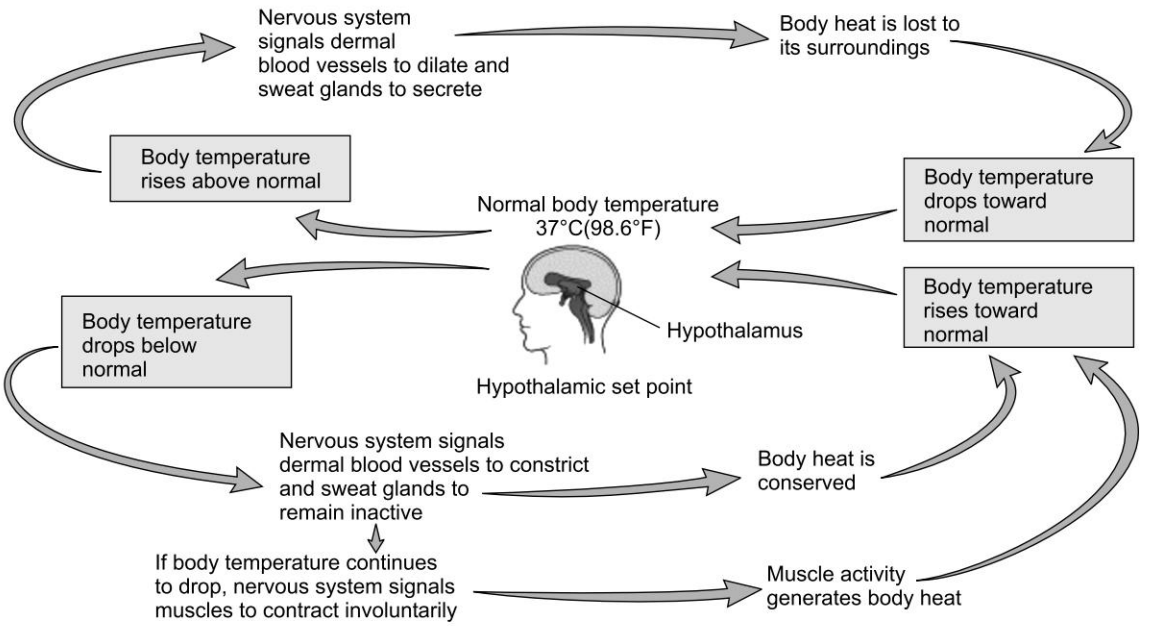


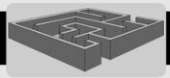
Fig. 9.2 Homeostasis and Temperature Regulation in Human

our favorite restaurant. Psychologists are interested in the mechanisms underlying the hunger drive. What happens internally that makes us desire food?

Hunger normally refers to the desire to eat. It is identified with unpleasant sensation in the stomach associated with the need for food, and believed to be associated with contractions of the stomach wall. These are referred to as hunger pangs. However, **Cannon** and **Washburn** (1912) and **Davis**, **Garafold** and **Kveim** (1959) in separate studies have contradicted this view. In another study done by **Tsang** (1938), these contradictions find support against the local stimulus theory of hunger.

According to some psychologists such as **Carlson** and **Luckhardt** (1914), the hunger drive is chemical in nature. In studies done by **Janowitz** and **Ivy** (1949), **Goodner** and **Russell** (1965), it has been found that the level of sugar in the blood acts on the centers in the brain that can excite the major nerve leading to the stomach, which in turn causes strong stomach contractions. In a study by **Friedman** and **Stricker** (1976), it was found that the change in metabolic functions of the liver when fuel supplies are low provided the body stimulus for hunger. It has been proposed that the liver can in some way signal a part of the brain known as the hypothalamus that more fuel (food) is needed, thus triggering hunger motivation. The hypothalamus, as proposed, regulates feeding, (**Eliot Stellar** 1954; **Grossmann** 1972, 1975; **Logue** 1991) by the interaction of its ventromedial nucleus or 'satiety center' with its lateral nucleus or 'hunger center'. Activity of the 'hunger center' initiates eating while activity in the 'satiety center' inhibits eating.

The function of the hypothalamus is assumed to be a quantitative one, as if this part of the brain adjusts energy intake to energy expenditure. The medial hypothalamus is believed to take part in reactions of satiety, while the lateral portions are responsible for appetite. After destruction of the lateral regions, animals fail to eat; in some cases the failure is absolute, in others it is only relative. (**Anand, Dua** and **Schoenberg** 1955; **Teitelbaum** and **Stellar** 1954) Medial lesions, by contrast, lead to overeating and obesity in all species studied, including man. When the lateral mechanism is stimulated in unanesthetized animals, feeding occurs



PSYCHOLOGY IN EVERYDAY LIFE

Eating Disorders

The prevalence of the eating disorders anorexia nervosa and bulimia nervosa in weight-conscious cultures shows that cultural factors can have a negative influence on hunger and body weight. Anorexia nervosa is characterized by extremely low body weight and a distorted body image. Bulimia nervosa is characterized by bouts of binging, followed by compensatory behaviors such as purging, fasting, or heavy exercise to rid the body of food. Both disorders can be life-threatening.

(**Bruigger** 1943; **Larson** 1954 and **Anand et al.** 1955). Stimulation of the medial region, as well as that of certain other portions of the brain, induces what appears to be satiety; **Olds** (1955) has observed this, and others have confirmed his results. The interaction of these two hypothalamic regions may account for most of the quantitative aspects of regulation of food intake, since the cerebral cortex may very well affect the appetite by way of these hypothalamic mechanisms. It is conceivable that the lateral hypothalamus or appetite mechanism serves to facilitate feeding reflexes, while the medial hypothalamus or satiety mechanism acts to inhibit the reflexes. However, the simplicity of the dual-center hypothesis has been challenged. It has also been found that in the absence of the hypothalamus, other centers take over the feeding behavior, provided the organism can be kept alive by forced feeding until the other centers take over.

Another factor that influences hunger is learning. Responses of single cells in the primate hypothalamus and amygdala have emphasized the importance of learning in food selection. Cultural factors (**Rozin** 1996) and cognitive factors (**Rozin et al.** 1998) are also found to influence hunger. **Rozin et al.** (1998), in a study, found that memory plays an important role in hunger. Due to difficulties with retention, amnesia patients eat frequently, if given food.

Thirst: Thirst is a regulatory device that serves to control the intake of water into the body in such a manner as to maintain constant water content. Exactly what all the factors in thirst are - just how a lowered water level activates the thirst drive – is still only partially understood by physiologists and psychologists.

Thirst is a subjective sensation aroused by a lack of water, which subsides shortly after water consumption. Apart from oral factors involved in thirst, the concentration of salt and other chemical substances in the body fluids, as well as the total amount of fluid present in the body helps to determine thirst.

Cellular dehydration, a loss of water from inside the cells of the body, is a powerful stimulus for drinking, and is thought to be monitored by a specialized population of cells within the brain. These *osmoreceptors* reside in the pre-optic area of the hypothalamus, and lesions in this region decrease drinking, even in response to stimuli producing dehydration, while small injection of hypertonic saline in this region stimulates drinking (**Anderson** and **McCann** 1955).

Depletion of the extra-cellular fluid volume (in particular the blood volume) is also a powerful stimulus for drinking, which may indirectly result in the increase of *antiotensin* in the blood, via the kidney. Intravenous or intracerebral injections of antiotensin are known to elicit drinking, and receptors for this *vasoactive peptide* may reside in structures around the ventricles of the brain. For example, cells in the *subfornical* organ respond to local application of angiotensin, while lesions of this structure abolish drinking in response to intravenous injections of angiotensin.

Sex: The sexual drive is only second to the hunger drive in its implications for social living. While our society as a whole does not place many elaborate restrictions upon the food taking behavior, sexual expression is very

EXPERIMENTAL PERSPECTIVE

Sexual Drive and Long-Distance Relationship

In an interesting study done by **Lisa Dawn Hamilton** and **Cindy M. Meston** (2010), they examined whether women's testosterone levels are influenced by being with a sexual and romantic partner after a period of sexual abstinence. Women in long distance relationships (n = 15) provided five saliva samples: at least 1 week before seeing their partner (and at least 2 weeks since their last visit), the day before seeing their partner, when they were with their partner but prior to engaging in sexual activity, the day after their first sexual activity, and 3 days after they were separated from their partners. Salivary testosterone was lowest when participants had been away from their partners for at least 2 weeks and highest the day before they were to see their partners and the day after sexual activity. Results from this study indicated that women's testosterone increased both the day before they were with their partners and the day after they first engaged in sexual activity. However, something about initially reuniting with their partners returned their testosterone to baseline levels, which may be an effect of being in the same location as a partner, or just a state fluctuation due to nervousness or other psychological state.

closely governed. Because of limits imposed on sexual behavior, awareness of sex urge is more persistent and insistent than that of other drives, which are not so likely to go unsatisfied. Because of the conflict between expression of sexual drives and cultural restrictions, sex becomes one of the most powerful forces in influencing human behavior. Although sex is a must for reproduction, its absence does not have implications on human survival as compared to other biological drives.

The sexual drive, as compared to hunger and thirst drives, is not due to lack of some substance in the body and, therefore, not triggered by homeostatic imbalance. The nervous system plays a complex role in controlling sexual behavior through the interaction of neuronal and hormonal activity. The hypothalamus initiates and regulates sexual behavior by controlling the pituitary glands production of *gonadotrophic* hormones, which stimulate the sex organs (gonads). Thus, in many species hormones produced by the gonads play a decisive role in sexual motivation (**Rissman** 1995). However, the amount of sex hormones produced

PSYCHOLOGY NUGGETS

Sexual Drive

Sex and the Brain

Psychological influences are clearly powerful motivators for sex, and the brain is highly involved in sexual arousal. People who have lost all sensation in their genitals because of spinal injuries, for example, are still capable of sexual desire.

Role of Testosterone

Sexual drive is related to testosterone level in both men and women, but the relationship is a complex one. Sexual activity increases testosterone levels, and testosterone levels increase sexual drive.

by gonads at the sequential stages of sexual behavior is monitored by the hypothalamus via feedback through the blood. Although these hormones play an important role in the activation of such behavior, the nervous system controls its form and direction.

The hypothalamus does not act alone with the nervous system in controlling sexual behavior. The limbic system, and particularly the *amygdale,* is important for the discrimination of environmental and social factors, which dictate the appearance of sexual behavior and its appropriate expression. The amygdala achieves this control by inhibiting the hypothalamic influence on the *pituitary gland*. In cases where the amygdala has been removed in man and animals, inappropriate sexual behavior is elicited.

In humans and higher primates, external stimuli primarily trigger the sexual drive and its expression depends very much on learning. Habit and experiences play a much larger role in the expression of the sexual drive in humans and higher primates than in the lower animals.

Sociogenic or Social Motives

Learned Goals, Drives and Needs

Learning has a more significant role in motivation. Many of the goals we strive do not innately satisfy biological needs directly, if at all; these goals are learned. These are generally called learned or secondary goals. Learning goals is basically a simple process. It occurs when some neutral stimuli which is not yet a goal is paired with a goal that meets a biological need – a *primary goal*, as it is called. The primary goal can be either something the individual approaches and trying to reach, which may be a positive goal or something to be escaped from or avoided, i.e. a negative goal. Humans and animals will learn to work for stimuli that have been paired with positive secondary goals. Organisms will also learn to get away from stimuli that have been paired with negative primary goals; they thus learn negative secondary goals.

Learned Drives And Needs: Situations or stimuli can come to arouse drive states through learning. The influence of learning on drive does not create new drive states. What happens is that a previously ineffective stimulus arouses a drive; this is what is usually meant by the term learned drives.

The term 'learned needs' is often used when motive states are actually created through learning. Prime example are social needs, or as they are sometimes called, the *social motives.* They are termed 'social' because they are learned through the social interaction.

Many motives are the results of social effects. A developed individual fulfils his needs in accordance with the laws of the society. This results in socialization of his needs, an activity in which the individual develops many needs and motives, the physiological causes of which are difficult to trace.

The social motives are the complex motive states or needs. They are the wellsprings of many human actions. They are termed social since they are learned in social groups, especially in the family as children grow up, and because they usually involve other people. These peculiar human motives can be looked upon as general states that lead to many particular behaviors.

Table 9.1 lists out major social motives.

Praise and Blame: The tendency to win praise and avoid blame motivates human behavior in nearly all societies. Generally, the thought of right and wrong is linked with praise and blame. Experiments have shown that praise is comparatively more effective than blame.

Mastery Motives: **Alfred Adler** has accepted that the mastery motive is the most important motive of human life. According to him, man tries to master others in every field of life. In other words, we can call this the power want - the desire to control other persons or objects, to obtain their obedience, to compel their actions, to determine their fate.

TABLE 9.1 Major Social Motives (Murray et al. 1938)

Abasement	To submit passively to others, to seek and accept injury, blame and criticism.
Achievement	To accomplish difficult tasks, to rival and surpass others.
Affiliation	To seek and enjoy cooperation with others, to make friends.
Aggression	To overcome opposition forcefully, to fight and revenge injury, to belittle, curse, or ridicule others.
Autonomy	To be free of restrains and obligations, to be independent and free to act according to impulse.
Counteraction	To master or make up for failure by renewed efforts, to overcome weakness and maintain pride and self-respect on a high level.
Defense	To defend oneself against attack, criticism or blame, to justify and vindicate oneself.
Deference	To admire and support a superior person, to yield eagerly to other people.
Dominance	To control and influence the behavior of others, to be a leader.
Exhibition	To make an impression, to be seen and heard by others, to show off.
Harm Avoidance	To avoid pain, physical injury, illness and death.
Infavoidance	To avoid humiliation, to refrain from action because of fear of failure.
Nurturance	Top help and take care of sick or defenseless people, to assist others who are in trouble.
Order	To put things in order, to achieve cleanliness, arrangement and organization.
Play	To devote one's free time to sports, games and parties, to laugh and make a joke of everything, to be lighthearted and gay.
Rejection	To remain aloof and indifferent to an inferior person, to jilt or snub others.
Sentience	To seek and enjoy sensuous impressions and sensations, to enjoy the arts genuinely.

Aggressiveness: This is an expression of the mastery motive. There is a great diversity in this tendency, which is the result of the different existing ideals and rules in a society. The aggression tendency, like the mastery tendency, cannot be accepted to be innate and universal; they are acquired tendencies whose existence depends upon social conditions.

Self-Submission: Some people have accepted the tendency of self-submission as natural, as opposed to that of self-assertion, being helpless before their elders. Though these childhood expressions are important and lasting, it is not right to call the submission tendency a learned one just because it is learnt in the family or the society. This tendency depends on the social pattern. It varies in degrees in various persons, and it may even be completely absent.

Gregariousness: This tendency makes a person want to live in a group with the rest of the tribe. It is neither internal nor universal, and also not self-generated. It is not found in every person. In reality, this tendency is learnt, which includes the advantages of society.

Imitation: Though imitation is seen very much in the human beings, it is not compelling. Even if the existence of any such instinct is given credence, its field is very limited. Imitation is important in humans and is very important in human learning. In fact, the human child begins his learning through imitation.

Sympathy: This is an experience of another person's emotional responses. Seeing another person in serious trouble, a sympathetic person experiences a similar, though less intense, feeling. This is not found in every individual, some may express joy in place of sympathy. A major part of it is a conditioned response while the remainder too is in some way a learned motive.

Psychological Motives

Man seems to have certain basis psychological needs, which he expresses through the basic pattern of his particular culture. He needs security, he needs to respond to others through the exchange of love and esteem, he needs to accept himself and at the same time to strive to better himself, he needs to seek new experiences, he needs to be accepted and approved by those around him. Although these needs are sometimes overwhelmed by other needs, and by obstacles in the environment, their satisfaction is nonetheless essential to the individual's healthy development.

Security and Adequacy: The desire for security is essentially an anticipation of future organic needs. Economic and political security assumes shelter, comfort and nutrition at some distant date.

The need for security develops with and is closely related to the need of adequacy. We soon learn that failure to meet biological and psychological needs leads to unpleasant results. Consequently, we strive to maintain whatever conditions can be counted upon to assure present and future need gratification. Feelings of insecurity may have widely differing effects on behavior, but pervasive and chronic feelings of insecurity typically lead to fearfulness, apprehension and failure to participate fully in one's world. The more adequate we feel, and the greater our level of competence, the less aware are we of our need for security, and the more we may value the exploration of unfamiliar paths and freedom for self-direction.

Curiosity: Human beings are inherently curious, and strive to understand and achieve a meaningful picture of their world. Such a frame of reference is essential for evaluating new situations and guiding adjustive actions. Unless we can see order and predictability in our environment, we cannot work out an intelligent response to it. Social customs, rules and laws are in part a reflection of this need for order and predictability.

Self-Esteem, Worth and Identity: Closely related to feelings of adequacy and social approval is the need to feel good about oneself and worthy of the respect of others.

Self-esteem has its early foundations in parental affirmation of worth and in the mastery of early developmental tasks. It receives continual nourishment from the development of new competencies and from achievement in areas deemed important. Intermediate with feelings of self-esteem and worth, is one's sense of self-identity. This is influenced heavily by significant others and by the person's status and role in the group.

Love, Belonging and Approval: To love and to be loved are crucial to healthy personality development and adjustment. The need for close ties to other people continues throughout life and becomes especially important in times of severe stress or crises. Bard, in a study, found that the need for affiliation and human contact is the greatest in old age.

Value, Meaning and Hope: Values are a guide in making decisions and achieving a meaningful way of life. Closely related to our needs for values and meanings, are our goals and plans, for we live in the future as well as in the past and the present. Thus, our goals and plans serve as a focus for both, our strivings and our hopes. When we feel uncertain and anxious about the future, personal adjustment and effectiveness are likely to be impaired. In extreme cases, hope may give way to hopelessness and lead to apathy and even death. Values, meaning and hope appear to act as catalysts; in their presence energy is mobilized, competencies are developed and used, and satisfactions are achieved. Without them, life seems futile and the individual is bored and deprived of vigor.

Achievement: The need for achievement includes the desire to excel, to complete difficult tasks, to meet high standards, and to outperform others. People who are high in their need for achievement, called high-need achievers, differ from low need achievers in a variety of ways. One of the first researchers who displayed an interest in achievement motivation was **Henry Murray** (1938). The achievement need was first defined

largely upon the basis of subjective clinical methods of observation by **Murray**, (1938). His definition of need for achievement was: 'To accomplish something difficult. To master, manipulate or organize physical objects, human beings or ideas. To do this as rapidly and as independently, as possible. To overcome obstacles and attain a high standard. To excel one's self. To rival and surpass others. To increase self-regard by the exercise of talent.' While this definition was broad and covered a wide range of human behavior, newer definitions are smaller. **Cassidy** and **Lynn** (1989) define achievement motivation in general as the personal striving of individuals to attain goals within their social environment. According to **Spinath** (2001), it comprises such dimensions as need for or pursuit of excellence, work ethic, setting and meeting goals, competitiveness and status aspiration. According to **McClelland**, **Atkinson**, **Clark** and **Lowell** (1953); **Schultheiss** and **Brunstein** (2005) the psychological kernel of the achievement motive is the capacity to derive satisfaction from the autonomous mastery of challenging tasks.

Guilford (1959) has however remarked that its existence as a sharply defined unique trait has not been verified by the statistical method of factor analysis (**Guilford** 1959). In general, all studies conclude that the need for achievement is learned. The child seeks to overcome the anxiety created by his parent's demands and to avoid their disapproval by working hard to achieve the independent action they require. As the years pass, achievement is rewarded many times, and eventually the child's need to achieve by his own effort becomes autonomous, acting as a powerful motivating force in many areas of life. It may even become so strong as to be disruptive, if the individual becomes anxious over possible failure to achieve.

Need for Achievement (*n-ach*)

Over the years, behavioral scientists have observed that some people have an intense need to achieve; others, perhaps the majority, do not seem to be as concerned about achievement. Amongst the most eminent of these is **David C. McClelland** who in his book, *The Achieving Society* (1961), has detailed out various types of motivational needs and prominent among which is the *need for achievement* (n-ach). According to him, the n-ach person is 'achievement motivated' and therefore seeks achievement, attainment of realistic but challenging goals and advancement in the job. Achievement-motivated individuals set goals which they can influence with their effort and ability, and as such the goal is considered to be achievable. There is a strong need for feedback (**Brunstein** and **Schmitt** 2004) as to achievement and progress, and a need for a sense of accomplishment.

PSYCHOLOGY NUGGET

Characteristics and Attitudes of Achievement—Motivated People

- Achievement is more important than material or financial reward.
- Achieving the aim or task gives greater personal satisfaction than receiving praise or recognition.
- Financial reward is regarded as a measurement of success, not an end in itself.
- Security is not prime motivator, nor is status.
- Feedback is essential, because it enables measurement of success, not for reasons of praise or recognition (the implication here is that feedback must be reliable, quantifiable and factual).
- Achievement-motivated people constantly seek improvements and ways of doing things better.
- Achievement-motivated people will logically favor jobs and responsibilities that naturally satisfy their needs, i.e. offer flexibility and opportunity to set and achieve goals, e.g. sales and business management, and entrepreneurial roles.

McClelland's laboratory experiment illustrates the affect of achievement on people's motivation. McClelland asserted, via this experiment, that while most people do not possess a strong achievement-based motivation, those who do, display a consistent behavior in setting goals. People high on achievement motivation prefer to work on a problem rather than leave the outcome to chance. They take the middle ground, preferring a moderate degree of risk because they feel their efforts and abilities will probably influence the outcome. Another characteristic of achievement-motivated people is that they seem to be more concerned with personal achievement than with the rewards of success. They do not reject rewards, but the rewards are not as essential as the accomplishment itself. They get a bigger 'kick' out of winning or solving a difficult problem than they get from any money or praise they receive. As mentioned above, for those high on achievement motivation there is a strong need for feedback as to achievement and progress. The nature of the feedback is of prime importance. This feedback is closely related to their concern for personal accomplishment. However, not any kind of feedback will do. As recent studies by **Brunstein** and **Hoyer** (2002) and **Brunstein** and **Maier** (2005) have documented, achievement-motivated individuals prefer feedback with reference to an individual norm that tells them how well they are doing now relative to how well they did previously. They remain generally uninterested in how well they are doing relative to a social norm, that is, relative to other people's performance, except under certain, very specific circumstances (**Brunstein** and **Meier** 2005; **Veroff** 1969). Further achievement-motivated individuals prefer to work on tasks of medium difficulty, on which the chances of success are neither too high nor too low and that demand their full concentration and effort (**McClelland** 1987). If they cannot choose and solve such tasks on their own terms, but are given explicit advice and direction on how to do it, they are likely to leave the field and invest no effort into the task (**Spangler** 1992).

People with a high achievement motivation generally do not like working in situations where everyone receives the same across the board raises regardless of their performance (**Turban** and **Keon** 1993). Finally, persons high on achievement tend to excel under conditions in which their achievement motive is activated (**McClelland** 1995), i.e. situations in which they are challenged to do their best are confronted with difficult goals, or in which they compete against other high achievement persons.

Studies have shown a positive relationship of achievement motivation with success in school (**Collins et al**. 2004; **Gillespie et al**. 2002; **Spangler 1992**). Achievement motivation is also found to be highly correlated with success in running own business (**Andrews** 1967; **Raynor** 1970). There is also ample research evidence suggesting that there is a significant relationship between achievement-related attitude and economic growth (**Furnham**, **Kirkcaldy** and **Lynn** 1994), i.e. the stronger these attitudes the higher the achievement motivation and thereby higher the rate of economic growth.

Conclusion

McClelland found, through his research, that early life experiences determine whether people acquire these needs. The need to achieve as an adult is influenced by the reinforcement of behavior received as a child when a child is encouraged to do things independently. If a child is reinforced for warm, human relationships, then the need for affiliation as an adult develops. If a child gains satisfaction from controlling others, then the need for power will be evident as an adult (**Daft** 1997).

Intrinsic and Extrinsic Motivation

According to **Deci** and **Ryan** (1985), intrinsically motivated learning is learning that meets people's need to be competent and self-determining. In the self-determination theory, **Deci** and **Ryan** (1985) distinguish between two types of motivation. They differ according to different reasons or goals that influence behavior.

The most basic distinction they make is between intrinsic and extrinsic motivation. *Intrinsic motivation* causes us to participate in an activity of our own enjoyment, rather than for any tangible reward that it will bring us. In contrast, *extrinsic motivation* causes us to do something for a tangible reward. Thus, intrinsic motivation refers to doing something because it is inherently interesting or enjoyable, meanwhile extrinsic motivation refers to an activity as a means to an end; activity that leads to some other outcomes. Although intrinsic motivation is considered as the most favorable and important type of motivation, we can hardly say that most of our activities are intrinsically motivated. This may be to some extent true for early childhood, but with the years our conduct is more and more marked by social demands. Thus, it is important to note that Deci and Ryan differentiate between various types of extrinsic motivations, which represent different stages of agency that describes the degree to which our behavior is autonomous. One of the main components of intrinsic motivation is high personal interest in the task or activity. Similar to other constructs in motivation, interest is also multifarious and should not be understood as simply liking or not liking a particular task or domain. Interest theorists have distinguished between personal or individual interest and situational interest (**Hidi** 1990; **Hidi** and **Harackiewicz** 2000; **Krapp** 1999). Personal interest reflects an individual's interest in a particular topic or domain (**Hidi** and **Harackiewicz** 2000), and is thought to be relatively stable over time and is partially a function of individuals' preferences as well as aspects of the task. In contrast, situational interest is based entirely on the features of the learning context and may be short-term or long-lasting (**Hidi** and **Harackiewicz** 2000).

CONFLICT OF MOTIVES

Everyone is motivated by a variety of drives and needs. In a given situation, one specific drive or need may be dominant, and the behavior of the individual will be relatively straightforward. Many occasions however are there, when two drives or needs elicited place the individual in a state of conflict. The conflict can range from the mild (a dieter choosing between pie or no dessert after dinner) to the severe (a destitute person choosing between going hungry and stealing). Social psychologists **Kurt Lewin** (1935, 1972) has described four basic types of conflict.

1. Approach-Approach Conflict

An approach-approach conflict occurs when we are motivated to seek two equally desirable but mutually exclusive goals (Fig. 9.3). To illustrate, consider a person who has strong needs for achievement in her career as well as strong motives to start and raise a family. Such a conflict might be severe. Most cases of approach-approach conflict, however, are not serious and are usually resolved without much difficulty. In fact, many people relish the situation in which they have to choose between equally desirable alternatives.

2. Avoidance-Avoidance Conflict

A situation in which a person must choose between two equally undesirable goals or needs is known as an avoidance-avoidance conflict (Fig. 9.4). For instance, college students may have to choose between studying for a boring course or failing the final exam. Avoidance-avoidance conflicts can result in serious psychological disorders. Because both alternatives in this type of conflicts are not pleasant, many people avoid making a choice by procrastinating their decision (**Dhar** 1997; **Tversky** and **Shafir** 1992). Psychiatrist **Gregory Bateson** (**Bateson**, **Jackson**, **Haley** and **Weakland** 1956) has suggested that this conflict may contribute to some cases of schizophrenia - a type of psychosis. He described the case of a girl whose mother would badger her for details of her personal life. When the girl finally told her mother these details, the mother

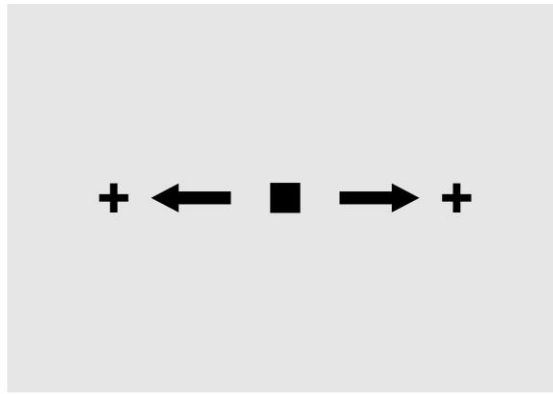


Fig. 9.3 Approach-Approach Conflict

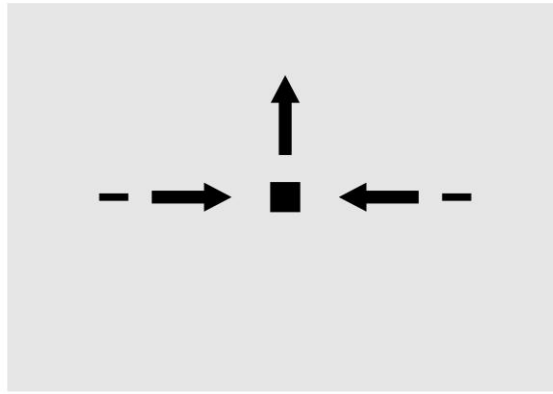


Fig. 9.4 Avoidance-Avoidance Conflict

would promptly tell the father, who would then punish his daughter severely. Thus, the girl was placed in a no-win situation. She could withhold information and incur her mother's wrath or give it and incur that of her father.

One way in which people often try to deal with this conflict is to avoid the situation altogether, either physically or psychologically. Students may try to find a way to withdraw from a course at the last moment, or a person in a situation like that of the schizophrenic girl may retreat into an internal world and simply cease responding.

3. Approach-Avoidance Conflict

A single goal that has both desirable and undesirable qualities produces an approach-avoidance conflict (Fig. 9.5). For example, a person may want to be a performer but may fear getting up in front of a crowd. Such anxiety or fear is generally involved in approach-avoidance conflicts.

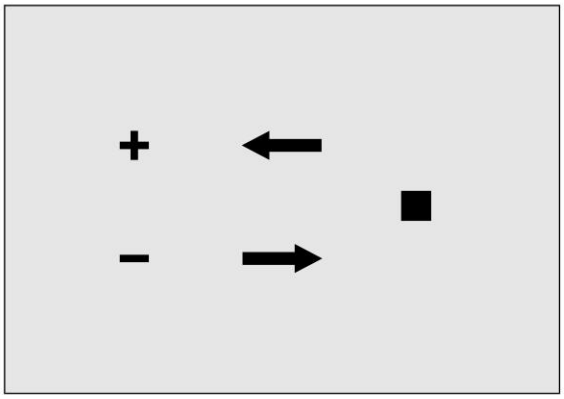


Fig. 9.5 Approach-Avoidance Conflict

Neal Miller (1959) has developed the concept of goal gradient to describe this form of conflict. A gradient can be defined as the strength of the motive to either approach or avoid a particular goal in relation to the distance from the goal. As the person approaches the goal, the strength of the avoidance gradient increases more rapidly than the approach gradient. When the person is some distance from the goal, the approach gradient will be stronger than the avoidance gradient, inducing the person to move closer to the goal. As he or she gets close to the goal, the strength of the avoidance gradient becomes stronger, so the person will retreat (Fig. 9.6). When the person reaches the point where the gradients cross, he or she is likely to be uncertain as to which course of action should be taken because the two gradients are of equal strength. The point of crossing is called the *vacillation point*.

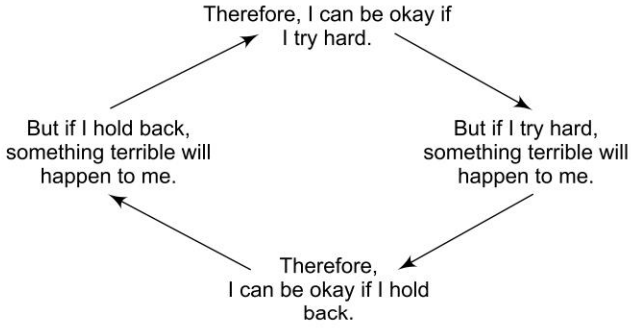


Fig. 9.6 An Example of Approach-Avoidance Conflict

As an example, suppose you want to ask your boss for a raise. You feel that you deserve it and you certainly could use the extra money. Your boss, however, is an intimidating figure, and you are anxious about

approaching him. Sunday night your approach gradient will be quite high, and you will be determined to speak to your boss first thing in the morning. When you wake up on Monday, your approach gradient is still strong, but now your avoidance gradient is showing some strength. You begin to worry about your boss's reaction, and when you reach the office, your approach gradient is only slightly higher than your avoidance gradient. You are still determined to ask for the raise, but you are feeling very nervous. You are near the vacillation point. As you walk towards your boss's door, your avoidance gradient suddenly becomes stronger than your approach gradient. You now believe your boss will be angry with you for asking, and you humbly walk back to your desk. That night, when you are removed from the goal once again, you berate yourself for being so timid, and you resolve to ask for the raise the next day.

This type of conflict is a component of many minor psychological disorders. People have needs or goals that they cannot achieve because of their fearfulness—or, in Miller's terms, their avoidance gradients.

Double Approach-Avoidance Conflict

Double approach-avoidance conflicts present themselves to us every day. They involve situations in which we must select one of two alternatives, each of which has positive and negative elements (Fig. 9.7). To illustrate, imagine that when you graduate, you are one of the fortunate few who are offered two jobs. One is with a large company that offers security and a good starting salary. Opportunities for advancement, however, are severely limited. The second job is with a small company that offers you the opportunity to grow with it. If the company is successful, you will be in the top levels of management within a few years. You are concerned, however, about the modest starting salary and by the knowledge that if the company is a failure, you could be out of a job within a few years. In short, there are both desirable and undesirable elements to consider in pursuing either position.

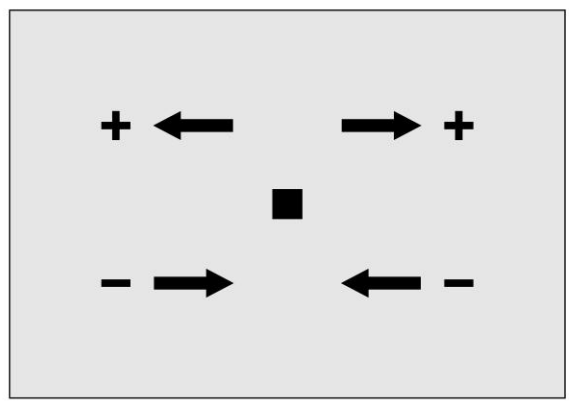


Fig. 9.7 Double Approach-Avoidance Conflict

People react to this type of conflict similarly to the way they react to other forms. They are likely to vacillate between two goals without being able to make up their mind. Some individuals may become emotional and have feelings of anxiety or distress. When people finally do make up their mind, they may accentuate the desirable aspects of the goal they select and the negative aspects of the goal they reject.

THEORIES OF MOTIVATION

The actual nature of the basic needs and their effect on behavior has been considered in terms of various theoretical concepts. Often, the change in the state of the organism is interpreted as a disturbance of energy or homeostatic equilibrium. This physiological state or stimulation is the origin of the drive, which triggers behavior until an appropriate object has been found; through the consumer reaction to this object, the homeostatic equilibrium to the organism is re-established, or the unpleasant, internal stimulus, such as hunger, eliminated. The needs, which are defined in the concepts of physiological states, tissue needs, are termed primary needs. All the psychosocial needs and all specifically human needs are frequently termed secondary needs, as are those, which result from primary needs.

We will now extensively examine the various theoretical models, both past and contemporary.

Drive-Reduction Theory

Most modern psychological theories of motivation are based on the 'local' theories of motivation or drive stimulation proposed by **Cannon** (1934) and earlier workers. One of the more explicit examples of such an approach is **Hull's** (1943) suggestion that the survival of the individual and of the species requires the maintenance of optimal environmental conditions and that specific and persistent 'drive stimulations' (Sd) arises when a deviation from the optimal conditions produces a 'need'. Such needs are believed to stimulate specific sensory receptors and elicit afferent, neural impulses towards central ganglia; these ganglia act as a kind of automatic switchboard, directing the impulses to the muscles or glands whose action is necessary to reduce the particular need. Satiation or drive reduction, in this system, depends exclusively on the cessation of drive stimulation, and is presumably brought about by the restoration of optimal conditions in the external or internal environment.

Most physiological needs create aroused psychological states that drive us to reduce or satisfy needs. The aim of drive reduction is internal stability, or *homeostasis* (homeostasis is the maintenance of some optimal level of internal biological functioning by compensating for deviations from its usual, balanced, internal state). Thus, drive reduction motivates survival behaviors, such as eating and drinking (Fig. 9.8).

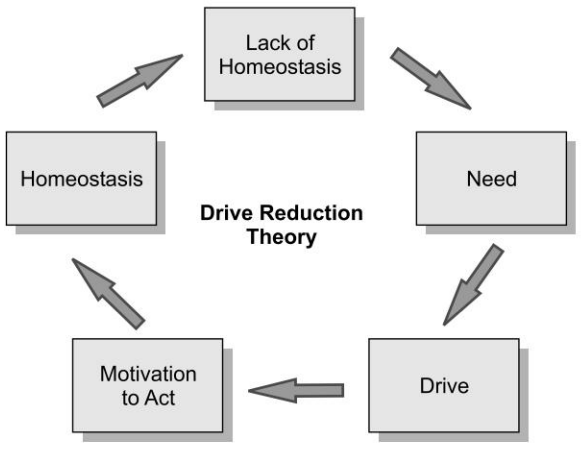


Fig. 9.8 Drive Reduction Theory

The question which needs to be answered is what exactly homeostasis has to do with motivation. According to **Clark Hull** (1943), any deviation from homeostatic balance produces a *need*. An individual living alone is deprived of food for a long interval of time has a need for food. This need, in turn, creates a drive; in this case a hunger drive. This drive motivates him to cook a meal and have it or go to a restaurant and satiate his hunger. Eating the food soon restores him to a state of homeostasis. This is what Hull called *drive reduction*. Drive reduction, according to his theory, is when given positive reinforcers (such as food), there is also an increase in the probability of a response. For example, the rat in the Skinner box (see operant conditioning in Chapter 5) begins to press the lever rapidly once he learns that it is rewarding.

It is however to be noted that needs not only result from a *lack* of something. Pain or any strong stimulus is assumed to produce a deviation from homeostasis. The result is a drive to escape the stimulus as in the case of escape training (*see escape training in Chapter 5*). The cessation of pain is a highly effective primary reinforce.

This theory has been bitterly criticized. Though the simplicity of such hypotheses is appealing, but experimental evidence indicates that the notion of specific drive stimulation may be an over-simplification of a complex problem. The most telling argument against specific drive stimulation derives from experiments showing that:

1. Denerivation or removal of the stomach fails to interfere with hunger motivation or the regulation of food intake.
2. Removal of the genital organs does not eliminate sexual motivation.
3. Artificial induction of specific drive stimulation fails to elicit motivation.

All these experiments may have failed to deal with the appropriate source of afferent signals- drive stimulation may arise from the lower portion of the gastrointestinal tract rather than from the stomach in the case of hunger. Additional research is needed to clarify the role of specific peripheral neural mechanisms. However, it is doubtful that only a single neural system, which is essential to either the elicitation or the cessation of motivation, will be discovered.

Briefly, we can say that according to the convenient notion of early theorists in this field, motivated or emotional behavior simply occurred as a direct consequence of drive stimulation, and the subjective aspects of motivation were regarded as non-essential by-products of this process. Nobody was greatly concerned about the need for integrating these motivational influences with other, ongoing processes in the CNS beyond assigning such functions to the cortex. We have become much too sophisticated to accept such notions at face value.

In conclusion, it however needs to be mentioned that though the early drive theorist focused primarily on biological needs, their production, satisfaction and internal stability, or *homeostasis* for which they have been criticized but in recent times, psychologists extended this model to other forms of behavior not so clearly linked to basic needs, such as drives for stimulation, status, achievement, power and forming stable social relationships (**Baumeister** and **Leary** 1995).

Arousal Theory

Rather than reducing a physiological need or tension state, some motivated behaviors *increase arousal*. Curiosity-driven behaviors, for example, suggest that too little as well as too much stimulation can motivate people to seek an optimum level of arousal. Many studies have indirectly offered support to the arousal theory. It has been found by **Weiner** (1989) that there is a close relationship between ones performance and his level of arousal (Fig. 9.9). However, performance can be positively benefited only with optimal levels of arousal. If the arousal goes beyond that optimal level, it can adversely affect performance in some tasks if not all. The *Yerkes-Dodson Law* (1908) suggests that the more difficult a task, the lower is the level of arousal at

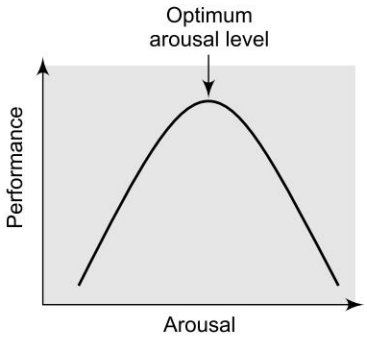


Fig. 9.9 Relationship Between Performance and Arousal

which deterioration in performance begins to occur. The application of this law must have been experienced by us personally many a times with differences existing between individuals as far as the variables of task difficulty and arousal levels are concerned. Amongst us, there are people who seek thrill in doing death-defying stunts – an indication of high level of activation (**Zuckerman** 1990). On the other hand, there are those who shy away and prefer to keep their arousal levels low. These types of extremities in arousal levels within individuals thus make it difficult to predict its exact impact on motivation and behavior as a whole but surely the fact remains that a minimal level of arousal positively activates action.

There has been a lot of research indicating the correlation suggested by Yerkes and Dodson exists (**Broadhurst** 1957; **Duffy** 1957; **Anderson** 2000), but a cause of the correlation has not yet been fully established (**Anderson**, **Revelle** and **Lynch** 1989). Although the Yerkes-Dodson law is quite old, it has held up in time through numerous studies. Just because something is old, does not make it invalid. In fact, because it has held up for so long, it has gone from being a theory to a law.

Incentive Theory

Not only are we pushed by our internal drives, we are also pulled by external incentives (here incentive is reward in motivational terms). Depending on our personal and cultural experiences, some stimuli (for example, certain foods or erotic images) will arouse our desire.

While other theories of motivation support the belief that the cause of responses is internal, the incentive theory says that in fact the environment brings out behaviors. The basic concept behind the incentive theory is goals. When a goal is present, the person attempts to reach that goal. The goal may be anything from relaxing to feeling stimulated to losing weight.

In comparison to the arousal theory which focuses on internal stimuli, the instinct theory holds that certain external stimuli act as incentives, pulling us toward some behavior. Incentives are pleasing external stimuli that can serve as goals toward which our behavior is directed. Cognitive factors are thought to be important relative to incentives. *Rotter's expectancy-value theory* (1954) proposes that a particular stimulus exerts a pull based on its value to us and our expectation of achieving it through some course of action. We evaluate behavior based upon two considerations: firstly on the expected outcome of our action and secondly the value we place on that outcome. Thus, this theory places cognitive variables between stimulus and response.

Our behavior is not influenced entirely by the history of reinforcement (as Skinner proposed). Rather, our expectation of reinforcement guides us in making estimates of the outcome in terms of loss or gain.

Incentive theorists tend to distinguish between *wanting* and *liking*, where *liking* is a passive function evaluating a stimulus, but *wanting* adds an active process 'attracting' the person towards the stimulus. 'Wanting' is the degree of attraction a stimulus holds when it is not present; 'liking' is the extent of pleasure associated with the stimulus when it is experienced. There are apparently different brain areas active in each case. The grass is always greener: wanting seems to be more motivating than liking.

The distinguishing factor of the instinct theory from other theories of motivation is the direction of the motivation. As seen above in incentive theory, stimuli 'attract' a person towards them. This attraction is in sharp contrast to renewal of homeostasis (drive theory) which pushes an organism towards the stimulus. Looking at the incentive theory from the behaviorist view point, it involves positive reinforcement in the sense that a stimulus is conditioned to make the individual (organism) happier. For example, a individual knows that eating food, drinking water, or gaining social capital will make him happier. This is opposite to the drive theory concept, which involves negative reinforcement in the sense that a stimulus has been associated with the removal of the punishment—the lack of homeostasis in the body. For example, a person has come to know that if they eat when hungry, it will eliminate that negative feeling of hunger, or if they drink when thirsty, it will eliminate that negative feeling of thirst.

Even though it appears to be very appealing, the incentive theory is not without its limitations. It ignores the role of the push factor i.e. and over emphasizes on the role of pull factor – incentives. Incentives may be preferable but cannot always motivate the individual for action. A particular incentive may be valuable for one but not for another, hence its effect cannot be generalized. The motivational effect of incentives for a particular individual changes over a period of time – what today is an incentive may no longer be valued with the passage of time. Apart from individual variations towards incentives, there are variations amongst sex as well. Males and females perceive and respond in different manners to similar incentives.

Expectancy-Value Theories

Achievement motivation theorists attempt to explain people's choice of achievement tasks, persistence on those tasks, vigor in carrying them out and performance on them (**Eccles**, **Wigfield** and **Schiefele** 1998; **Pintrich** and **Schunk** 1996). There are a variety of constructs posited by motivation theorists to explain how motivation influences choice, persistence and performance. One long-standing perspective on motivation is expectancy-value theory. The cognitive approaches to motivation, exemplified by expectancy-value theory, suggest that people's thoughts, understanding and interpretation of the world underlie their motivation. Theorists in this tradition argue that individuals' choice, persistence and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity (**Atkinson** 1957; **Eccles et al**. 1983; **Wingfield** 1994; **Wingfield** and **Eccles** 1992).

Expectancy-value theory is directly linked to the uses and gratifications theory (Fig. 9.10). This theory is based on the works of many (**Tolman** 1932; **Lewin** 1936; **Rotter** 1954; **Vroom** 1964; **Martin Fishbein and Ajzen** 1975, **Ajzen Icek** and **Martin Fishbein** 1980) and has been presented in different manners with the core concept remaining the same. It has been used to understand motivations underlying individuals' behaviors. Focus has been placed on intent, as the immediate precursor to a particular behavior. This theory proposes that if one can determine the elements that impact intention, then one can more accurately predict whether an individual will engage in a particular behavior. Likewise, it proposes that by changing an individual's perceptions of potential outcomes, one can alter the individual's intent. The basis of the theory is that 'individuals choose behaviors based on the outcomes they expect and the values they ascribe to those expected outcomes' (**Borders**, **Earleywine** and **Huey** 2004). The level of one's willingness to perform a particular behavior is dependent on **a**) the extent to which the individual believes a consequence will follow, and **b**) the value the individual places on the consequence (**Mazis**, **Ahtola** and **Kippel** 1975). The more attractive a particular outcome is to the individual, the more likely the person will engage in the behavior. Similarly, as the number

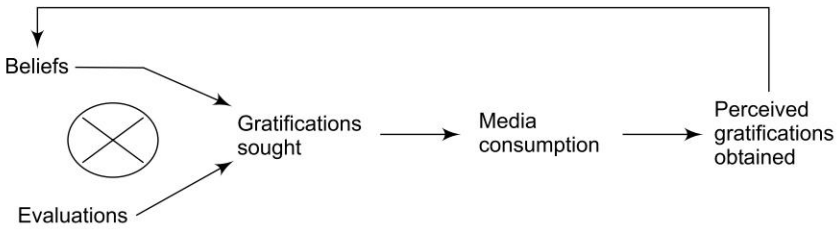


Fig. 9.10 Expectancy-Value Model

of positive outcomes increase, the motivation to engage in the behavior will increase. Expectancy itself is defined as 'the measurement of the likelihood that positive or negative outcomes will be associated with or follow from a particular act' (**Mazis et al**. 1975). Thus, the individual's outcome expectations affect one's attitudes towards the behavior. In addition to the expected outcome, the value the individual places on the outcome influences the individual's intentions.

Applying the expectancy-value theory (EVT), **Geiger** and **Cooper** (1996) reported various outcomes that impact students' motivations in college. Many of these outcomes were seen as short-term goals, including the perceptions of successful course completions. Students were more willing to increase their efforts in a course if they valued increasing their grades. For instance, if students recognized that a higher grade would increase their grade point average and they valued this increase, they would be more likely to heighten their effort in courses. Other factors that heightened efforts included increases in self-esteem, academic success and job opportunities after graduation.

Even though the expectancy-value theory has been used to predict the intentions that will impact behavior, there are a number of limitations to the theory. One of the main weaknesses of the theory is the focus on limited cognitive processes. **Borders**, **Earleywine** and **Huey** (2004) found that individuals choose from a variety of alternatives and thus must examine a variety of expectancies before choosing to engage in behaviors. Among the potential alternatives of decisions that can be made, some appear more attractive than others. For example, it appears individuals are likely to intend behaviors that have been positively reinforced by successful outcomes and by other individuals in social networks (**Bandura** 1977).

The Theory of Reasoned Action (**Ajzen** and **Fishbein** 1975) enhances the predictive and explanatory nature of the basic eTheory by including attitude and normative beliefs that can affect intention. Attitude beliefs relate to how the individual views the behavior itself and are weighted by perceived importance. In determining whether to engage in a particular behavior, individuals also weigh a number of factors including the beliefs of their family members, friends and instructors. These beliefs are weighed by motivations to comply and create a normative belief index. When an individual rationalizes a particular behavior, they are considering both the attitude beliefs and normative beliefs.

Goal Setting Theory

Goal setting is a cognitive theory of motivation based on the premise that people have needs that can be thought of as specific outcomes or goals they hope to obtain (**Locke** 1968). It makes the assumption that human behavior is purposeful (**Locke** and **Latham** 1990), and that goals direct and sustain (**Ryan** 1970) the

individuals' energies towards performing a particular action. Goals have two primary attributes or dimensions: *content* and *intensity* (**Locke** and **Latham** 1990). Goal content refers to the features of the goals themselves (e.g. the difficulty and specificity of the goal). Goal intensity is the process by which a goal is set and accomplished (**Lee**, **Locke** and **Latham** 1989; **Locke** and **Latham** 1990). It relates to factors such as individual commitment, and the cognitive processes involved in attaining and setting goals.

In summary, the goal-setting theory states that the *expectancy*, *instrumentality* and *valence* of outcomes will be high if goals are difficult (challenging), as well as specific and attainable (**Austin** and **Klein** 1996; **Locke** and **Latham** 1990, 2002). The theory also states that goals should be specific (e.g., increase productivity by 5 percent in the next year), rather than general (i.e., 'do your best'). However, in complex jobs, 'do your best' goals are likely to be more effective (**Latham** and **Seijts** 1999; **Locke** 1996). The theory further asserts that people's commitment is important to maximize the relationship between goal and performance. Moreover, commitment can be enhanced by two categories of factors that (1) make the goal attainment important, and (2) enhance individuals' belief that they can attain the goal (high self-efficacy). Finally, the theory asserts that consistent and timely feedback is needed for successful pursuit of goals (**Locke** and **Latham** 1990, 2002).

Theory of Sequential Need Development

Abraham Maslow (1943) developed the *hierarchy of needs* theory. He identified a set of needs that he prioritized into a hierarchy based on two conclusions (**Daft** 1997; **McCoy** 1992; **Quick** 1985):

1. Human needs are either of an attraction/desire nature or of an avoidance nature.
2. Because humans are 'wanting' beings, when one desire is satisfied, another desire will take its place.

On the basis of this, he proposed a theory of the specific order of the development of wants in terms of the individual history of want satisfaction. According to him, the human wants develop in the following sequential order from 'lower' wants to 'higher' wants. Maslow uses the term 'need' to refer to what we call wants.

The sequence of development follows this hierarchical order: physiological needs (hunger, thirst); safety needs (security, order); Belongingness and love needs (affection, identification); Esteem needs (prestige, success, self-respect) and lastly the need for self-actualization (the desire for self-fulfillment). Figure 9.11 illustrates it more clearly.

Maslow argues that a 'lower' need must be adequately satisfied before the next 'higher' need can emerge in the development of the individual. As said by Maslow, 'It is quite true that man lives by bread alone when there is plenty of bread. However, what happens to man's desires when there is plenty of bread, and when his belly is chronically filled? At once other, higher needs emerge, and these rather than the physiological hungers, dominate the organism and when these in turn are satisfied, new and still higher needs emerge, and so on.'

Once a person has moved from a lower level of wants, because of their adequate satisfaction, to a higher level, the lower level wants assume a less important role in his total system of wants. They may, of course, become temporarily dominant again as a result of deprivation. After a person has passed through the various levels of psychological growth, he possesses a personality structure in which the various wants form a hierarchical system. The lower wants in the hierarchy are no longer insistently domineering; the individual is freed to realize his higher desires and potentialities. With the increased richness of his cognitive life, his 'catalogue' of wants and goals increases in number and variety as he ascends the ladder of wants from belly to brain. His private universe of wants and goals come to extend the limits of his physical universe.

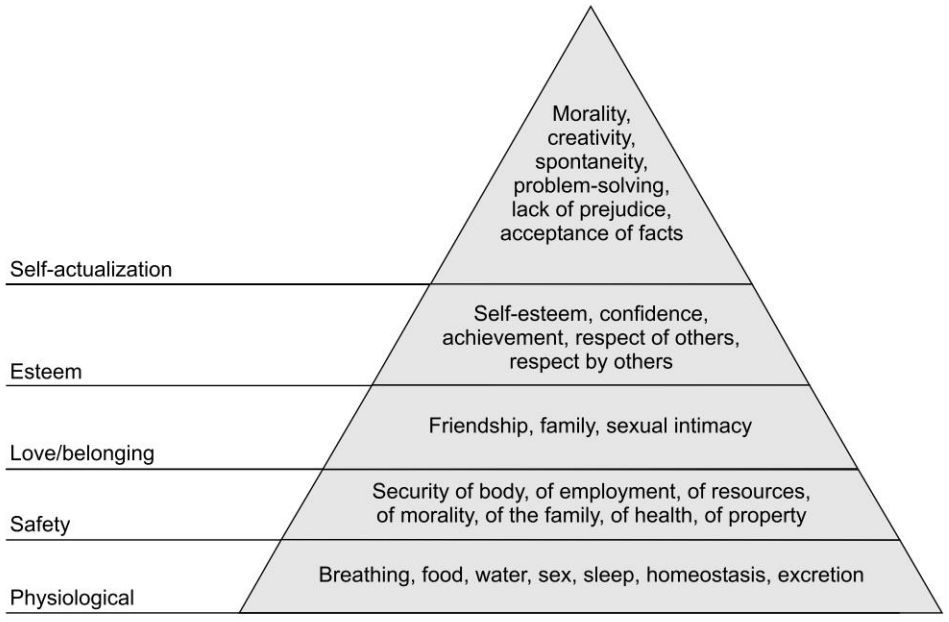


Fig. 9.11 Maslow's Hierarchy of Needs

Maslow's Conclusions

Maslow has drawn the following conclusions:

1. Integrated wholeness of the organism must be one of the foundations of motivation theory.
2. Higher drive or any other physiological drive was rejected as an acting point or a model for a definitive theory of motivation. Any drive that is somatically based and localized was shown to be typical rather than atypical in human motivation.
3. Such a theory should stress and centre itself upon the ultimate or basic goals rather than partial and superficial ones, upon ends rather than means to these ends. Such stress would imply a more central place for an unconscious than conscious motivation.
4. There are usually available various cultural parts to the same goal, therefore conscious specific desires are not as fundamental in motivation theory as the more basic unconscious goals. Any motivated behavior must be understood to be a channel through which many basic needs may be simultaneously expressed or satisfied. Typically, an act has more than one motive.
5. Practically all organismic states are to be understood as motivated and as motivating.
6. Human needs arrange themselves in hierarchical order of prepotency. In addition, no need or drive can be treated as if it were isolated or discrete. Every drive is related to the state of satisfaction or dissatisfaction of other drives.
7. Lists of drives will get us nowhere for various theoretical and practical reasons, furthermore, any classification of motivation must deal with the problem of level of specificity or generalization of the motives to be classified.
8. Classification of motives must be based upon goals, rather than instigating drives or motivated behavior.

9. Motivation theory should be human control rather than animal centered.
10. The situation or the field in which the organism reacts must be taken into account, but the field can rarely serve as an exclusive explanation for behavior. Furthermore, the field itself must be interpreted in terms of the organism. Field theory cannot be a substitute for a motivation theory.
11. Not only the integration of the organism must be taken into account, but also the possibility of isolate, specific partial or segmental reactions.
12. Motivation theory is synonymous with behavior theory. The motivations are only one class of determinants of behavior, while behavior is almost motivated.

In addition to the five basic needs that compose the hierarchy, Maslow (**Maslow** 1971; **Maslow** and **Lowery** 1998) describes **cognitive needs** (such as the needs to know and to understand) and **aesthetic needs** (such as the needs for order, symmetry or harmony). While not part of the basic hierarchy, these two classes of needs play a critical role in the satisfaction of basic needs. Maslow maintains that such conditions as the freedom to investigate and learn, fairness, honesty and orderliness in interpersonal relationships are critical because their absence makes satisfaction of the five basic needs impossible. (Imagine, for example, trying to satisfy your belongingness and love needs or your esteem needs in an atmosphere characterized by dishonesty, unfair punishment and restrictions on freedom of speech.)

Figure 9.12 shows application of Maslow's theory.

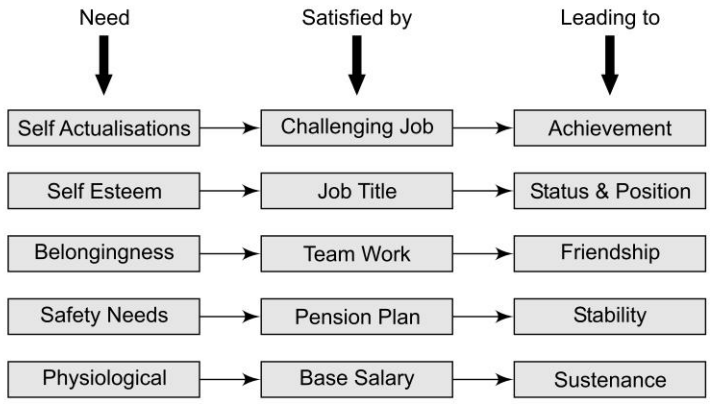


Fig. 9.12 Application of Maslow's Theory

Rectified Final Version of Maslow's Theory

The hierarchy of human needs outlined by **Maslow** (1943, 1954) is one of his most enduring contributions to psychology. Maslow has posited that human needs are arranged in a hierarchy: This formulation still stands as a strong statement regarding the structure of human motivation. By the time of Maslow's death, many studies had been published about the needs hierarchy (**Roberts** 1972). The hierarchy attracted scholarly attention following Maslow's death (**Lester**, **Hvezda**, **Sullivan** and **Plourde** 1983) and continues to attract research attention today. For example, **Chulef**, **Read** and **Walsh** (2001) found broad support for Maslow's theory in their research into the hierarchical structure underlying human goals. Many texts books in psychology perpetuate this version of the model, with self-actualization at the top of the hierarchy (e.g. **Atkinson**, **Atkinson**, **Smith**, **Bem** and **Nolen-Hoeksema** 1996; **Hall**, **Lindzey** and **Campbell** 1998; **Larsen** and **Buss**

PSYCHOLOGY NUGGETS

Abraham Maslow's Whole Characteristics of Self-actualizing People—A Bird's Eye View

1. They have more efficient perceptions of reality and are more comfortable with it.
2. They accept themselves and their own natures almost without thinking about it.
3. Their behavior is marked by simplicity and naturalness and by lack of artificiality or straining for effect.
4. They focus on problems outside themselves; they are concerned with basic issues and eternal questions.
5. They like privacy and tend to be detached.
6. They have relative independence of their physical and social environments; they rely on their own development and continued growth.
7. They do not take blessings for granted, but appreciate again and again the basic pleasures of life.
8. They experience limitless horizons and the intensification of any unself-conscious experience often of a mystical type.
9. They have a deep feeling of kingship with others.
10. They develop deep ties with a few other self-actualizing individuals.
11. They are democratic in a deep sense; although not indiscriminate, they are not really aware of differences.
12. They are strongly ethical, with definite moral standards, though their attitudes are conventional; they relate to ends rather than the means.
13. Their humor is real and related to philosophy, not hostility; they are spontaneous less often than others, and tend to be more serious and thoughtful.
14. They are original and inventive, less constricted and fresher than others.
15. While they tend towards the conventional and exit well within the culture, they live by the law of their own characters rather than those of society.
16. They experience imperfections and have ordinary feelings, like others.

2002; **Mischel** 1999; **Myers** 2003; **Pervin** and **John** 2001). However, this description is not Maslow's final statement concerning the motivational hierarchy.

Maslow had gone a step beyond self-actualization since he had developed doubts about its suitability as a motivational capstone. These doubts were first related to the phenomena of peak experiences and their attendant cognitive activity. Maslow described peak experiences, which include such phenomena as mystical experiences, aesthetic experiences, emotional experiences involving nature and so forth; he considered peak experiences in several papers in the late 1950s and early 1960s, some of which appeared in his hugely popular collection *Toward a Psychology of Being* (**Maslow** 1959/1999a, 1961/1999b; 1959/1999c; **Maslow** 1962a, 1962b, 1963, 1964). Maslow addressed the motivational significance of peak experiences in a series of lectures in the early 1960s, later published as *Religions, Values and Peak Experiences* (**Maslow** 1964/1970). He called the special cognitive activity that attends such phenomena 'Being-cognition' or 'B cognition' for short.

Maslow (1966a) noted that some individuals have gone beyond even self-actualization as a salient motivation. Such individuals arrive at the top of Maslow's new hierarchy of motivation with a strong motive toward ***self-transcendence***. That is, such individuals seek a benefit beyond the purely personal and seek communion with the transcendent, perhaps through mystical or transpersonal experiences; they come to identify with something greater than the purely individual self, often engaging in service to others. As Maslow put it in his unpublished October 1966 paper, '*the good of other people must be invoked'* (**Maslow** 1996). **Battista** 1996; **Fadiman** and **Frager** 2002; **Zimbardo** and **Gerrig** 1999; and in addition, some texts

describe *self-actualization as embracing self-transcendence* (**Ryckman** 2000). By far, however, self-transcendence is not described in textbooks as a separate motivational step in the hierarchy and without which his need hierarchy theory is incomplete. The rectified version of Maslow's hierarchy of needs is given in Table 9.2, along with a brief explanation and notes. It is also up to the student to decide whether to include this rectified version in the examination answers. However, I feel, accepted or not accepted at large by the psychologist fertility, it can obviously find mention as a later development to the theory and which has supportive evidences.

TABLE 9.2 Maslow's Hierarchy of Needs: Rectified Version

Motivational Level	Description of Person at this Level
Self-transcendence	Seeks to further a cause beyond the self[a] and to experience a communion beyond the boundaries of the self through peak experience.[b]
Self-actualization	Seeks fulfillment of personal potential.
Esteem needs	Seeks esteem through recognition or achievement.
Belongingness and love needs	Seeks affiliation with a group.
Safety needs	Seeks security through order and law.
Physiological (survival) needs	Seeks to obtain the basic necessities of life.

Note The earliest and most widespread version of Maslow's hierarchy (based on **Maslow** 1943, 1954) includes only the bottom five motivational levels (thus excluding self-transcendence). A more accurate version of the hierarchy, taking into account Maslow's later work (especially **Maslow** 1969a) and his private journal entries (**Maslow** 1979, 1982), includes all six motivational levels.

[a] This may involve service to others, devotion to an ideal (e.g., truth, art) or a cause (e.g., social justice, environmentalism, the pursuit of science, a religious faith and/or a desire to be united with what is perceived as transcendent or divine.

[b] This may involve mystical experiences and certain experiences with nature, aesthetic experiences, sexual experiences and/or other transpersonal experiences, in which the person experiences a sense of identity that transcends or extends beyond the personal self.

In conclusion, we can say that the inclusion of self-transcendence in Maslow's hierarchy allows for a richer conceptualization of the meaning-of-life worldview dimension. Others have also noted the importance of self-transcendent goals in forming a sense of the purpose of life (**Emmons** 1999). By making our models of worldview more comprehensive, we in turn gain a better articulation of theory in personality and social psychology.

Atkinson's Theory of Need Achievement Motivation

What determines a person's achievement orientation towards a specific task? **Atkinson** and **Feather** (1966) developed a theory that explains orientation as the result of two separate tendencies: the *tendency to achieve success* and the *tendency to avoid failure*.

The tendency to achieve success is determined by three things:

1. The motive to succeed or need achievement.
2. The person's estimate of the likelihood of success in performing a particular task.
3. The incentive for success, that is, how much the person would like to succeed in that particular task.

The tendency to avoid failure is determined by three similar circumstances:

1. The motive to avoid failure, which, like the motive to achieve success, varies among individuals.
2. The person's estimate of the likelihood of failure at the particular task.
3. The incentive value of failure at that task, that is, how unpleasant it would be to fail.

The relative strengths of the tendencies to succeed and to avoid failure determine the level of task difficulty people prefer. When the tendency to succeed is stronger, as it is for people who have a high need to achieve, the preferred tasks are those intermediate in difficulty, in which the likelihood of success is reasonable, and the pride in accomplishment fairly high. When the tendency to avoid failure is dominant, however, people prefer either very simple task in which the probability of failure is low or very difficult tasks where the shame in failing is low.

Maehr and **Nicholls** (1980), **Dweck** (1986) found that the levels of achievement motivation will vary between performers according to the reasons they are taking part in the activity (achievement goals) and the different meanings that success/failure has for the performer.

Later on, Atkinson expanded this theory to take account of changes in achievement behavior over time (**Atkinson** and **Birch** 1970; **Atkinson** 1977). One such change is that people progressively choose more and more difficult tasks (**Kuhl** and **Blankenship** 1979).

Atkinson's point about tendency to avoid failure has in the recent past, been taken into account and related with learning experiences by **William Glasser**. In the *Control Theory in the Classroom* (1986) and *The Quality School* (1990), Glasser argues that for people to succeed at life in general, they must first experience success in one important aspect of their lives. For most children, that one important part should be school. But the traditional approach to evaluating learning (presently in schools of CBSE in India) that emphasizes comparative grading (commonly called 'grading on the curve') allows only a minority of students to achieve A's and B's and feel successful. The self-worth of the remaining students (who may be quite capable) suffers, which depresses their motivation to achieve on subsequent classroom tasks (**Covington** 1985).

Table 9.3 compares the characteristics of people who are motivated to achieve and those who are motivated to avoid failure.

TABLE 9.3 Performer Characteristics—A Simple Comparison

Characteristics of a Performer Motivated to Achieve.	Characteristics of a Person Motivated to Avoid Failure.
Seeks challenges	Avoids challenging tasks/seeks easy option/extremely hard tasks
Seeks challenges	Dislikes 50:50 situations
Persists for longer	Gives up easy
Values feedback	Does not like feedback
Enjoys evaluation sessions	Dislikes evaluation situations (shame) Performs worse in evaluation situations
Not afraid of failure Takes responsibility for own actions Attributes performance to internal factors/controllable Factors, eg. success=effort, failure=lack of concentration	Avoids personal responsibility Attributes failure to external factors (e.g. luck, factors out of their control)
Optimistic	Pessimistic
Confident (high self-efficacy)	Low in confidence
Looks to complete the task quickly and effectively	Takes a long time over the task
Task goal-orientated	Outcome goal-orientated

Self-Determination Theory

Self-determination theory (SDT) is an empirically-based theory of human motivation, development and wellness. The theory focuses on types, rather than just amount, of motivation, paying particular attention

to autonomous motivation, controlled motivation and a motivation as predictors of performance, relational and well-being outcomes. SDT outlines three basic psychological needs---*autonomy*, *competence* and *relatedness*-- -as the central constituents for healthy psychological development. Relatedness concerns feelings of connection and belongingness with others (**Baumeister** and **Leary** 1995; **Deci** and **Ryan** 2000), competence refers to feeling effective in one's actions and capable of meeting the challenges of everyday life (**White** 1959), and autonomy concerns a sense of volition and a willing engagement in one's behavior (**Deci** and **Ryan** 1987; 2000). Although the expression of autonomy, competence and relatedness needs may vary at different points in development and may vary from culture to culture, a rich body of evidence has shown that satisfaction of these needs within varied contexts, domains, and relationships is salient across the lifespan (**La Guardia** and **Ryan** 2000; **Ryan** and **La Guardia** 2000). The SDT also examines people's life goals or aspirations, showing differential relations of intrinsic versus extrinsic life goals to performance and psychological health.

SDT has been developed and researched through a set of five mini-theories, which together comprise the theory's formal framework. Each mini-theory was initially introduced to explain phenomena that emerged from experimental and/or field research on factors affecting human motivation and optimal functioning. We briefly list and define each of these in order of their introduction into SDT.

1. **Cognitive evaluation theory (CET)** concerns *intrinsic motivation*, motivation that is based on the satisfactions of behaving 'for its own sake'. Prototypes of intrinsic motivation are children's exploration and play, but intrinsic motivation is a lifelong creative wellspring. The CET specifically addresses the effects of social contexts on intrinsic motivation, or how factors such as rewards, interpersonal controls and ego-involvements impact intrinsic motivation and interest. The CET highlights the critical roles played by competence and autonomy supports in fostering intrinsic motivation that is critical in education, arts, sport and many other domains. For instance, CET explains why some reward structures, for example, financial incentives, actually detract from subsequent motivation, a phenomenon that is often called 'the undermining effect of rewards' (Deci, **Koestner** and **Ryan** 1999).
2. **Organismic integration theory (OIT)** addresses the topic of extrinsic motivation in its various forms, with their properties, determinants and consequences. Broadly speaking, extrinsic motivation is behavior that is instrumental—that aims toward outcomes extrinsic to the behavior itself. Yet, there are distinct forms of instrumentality that include external regulation, introjection, identification and integration. These subtypes of extrinsic motivation are seen as falling along a continuum of *internalization*. The more internalized the extrinsic motivation, the more autonomous the person will be when enacting the behaviors. The OIT is further concerned with social contexts that enhance or forestall internalization—that is, with what conduces toward people either resisting, partially adopting or deeply internalizing values, goals or belief systems. The OIT particularly highlights supports for autonomy and relatedness as critical to internalization. Considerable research across the globe shows that greater internalization of cultural practices is associated with greater wellness and performance (**Ryan** and **Deci** 2000).
3. **Causality orientations theory (COT)** describes individual differences in how people orient to different aspects of the environment in regulating behavior. When autonomy-oriented, a person orients to what interests them and acts with congruence. When control-oriented, a person primarily regulates behavior by orienting to social controls and reward contingencies, and when impersonally oriented a person focuses on their lack of personal control or competence. The COT is also used to explain how primes or prior stimuli activate certain orientations in people, affecting subsequent motivation.
4. **Basic psychological needs theory (BPNT)** elaborates on the concept of basic needs by connecting them directly with wellness. The BPNT posits that each need exerts independent effects on wellness, and moreover that the impact of any behavior or event on well-being is largely a function of its relations

with need satisfaction. Research on BPNT shows that aggregate need satisfaction predicts individual differences in health and wellness as well as within person fluctuations in wellness across time.

5. **Goal contents theory (GCT)**. Research has shown that materialism and other extrinsic goals such as fame or image do not tend to enhance need satisfaction, and thus do not foster well-being, even when one is successful at attaining them (**Kasser** and **Ryan** 1996; **Niemiec et al**. 2009). In contrast, goals such as intimate relationships, personal growth or contributing to one's community are conducive to need satisfaction, and therefore facilitate health and wellness. The GCT has also been applied to how goals are framed. Evidence suggests that goals framed toward intrinsic aims are better adhered to than those focused on extrinsic outcomes (**Vansteenkiste et al**. 2006).

Together, these five mini-theories constitute SDT and provide specific propositions in multiple domains open to test and refinement. Given its broad scope, SDT has spawned research, and controversy, in numerous areas. One issue has been the impact of rewards, which SDT argues can powerfully exert control over behavior, but often at the cost of subsequent intrinsic motivation or internalization. Another controversy is the cross-cultural generalizability of SDT. The SDT suggests that whether collectivist or individualist, male or female, people function most effectively and experience greater mental health when their behavior is autonomous rather than controlled. This cross-cultural hypothesis has been actively tested (**Chirkov**, **Ryan**, **Kim** and **Kaplan** 2003).

DEVELOPMENT OF MOTIVATION

Starting from the fundamental needs, many concrete motivations are developed as functions of widely varying cultural and individual circumstances and under the influence of many different processes. In addition to the learning processes and conditioning, channeling and socialization which are primarily active in this development, many other processes must be mentioned, such as the conscious or unconscious mechanisms supposedly discovered by psychoanalysis and other theories of depth psychology. Identification, displacement, reaction formation, sublimation and many other factors may help a need to be satisfied in a concrete attempt to reach a specific category of objects or situations. Repression may cause motivational indifference towards an object, which exercises an attraction on most other people. This link between an aspiration towards a specific object and a given need may remain dark (unconscious attraction of an object) in which case we speak of unconscious motivation.

On the other hand, the cognitive processes change most human needs into concrete tasks and projects. Recognition of the possibilities of achieving an aim is the concrete form in which needs control human behavior. What is commonly referred to as *will* is simply the cognitively processed motivation, which the individual ego prefers to other motivations, so that 'my will' is the motivation favored by the conscious ego, freely or otherwise. The driving forces of the will are identical with those of other concrete motivations.

The motives and projects, which exist on the basis of the developmental processes of motives in adult humans, must not be considered merely as developments of forms of infantile needs. Both infantile and adult forms of motivation are embodiments of basic needs that are dependent in their concrete form on the level of development of the psychological functions in general. It is evident that each higher stage of development is influenced by the earlier stages.

G.W. Allport's (1937) theory of the development of motivation also makes a distinction between current motives and primary motives as well as those of childhood. It stresses the fundamental autonomy of all drives in the sense that behavior patterns, which were originally motivated by specific needs gradually, find a spontaneous drive i.e. become functionally autonomous. This opinion is reflected in **Woodworth's** (1918) theory that '*mechanisms become drives'*. It remains to be determined whether the autonomous forms of behavior can be motivated by other needs, which gradually find their channel, i.e. their form of embodiment, in them.

EXPERIMENTAL PERSPECTIVE

Religion, Motivation and College Cheating

A natural experiment was conducted by **David A. Rettinger** and **Augustus E. Jordan** (2005) for studying the relations between cheating, motivation, religiosity, and attitudes toward cheating among students. Students enrolled in a dual religious/college curriculum were surveyed regarding their cheating behavior, attitudes toward cheating, religiosity, and learning/grade motivations toward classes. Business and liberal arts college students were represented. Results strongly support the following conclusions. First, grade orientation is associated with increases in self-reported cheating. Second, among these religious students, more religiosity correlates with reduced reports of cheating in all courses. This result appears to be due to the unique effect of religion on self-reported cheating rates and, depending on course content, on a reduction of grade orientation in religious students. Third, business students report more cheating than their liberal arts counterparts, even when taking the same courses. They have less critical attitudes toward cheating and greater grade orientation, both of which statistically contribute to this difference, but other factors are involved as well.

KEY TERMS

Homeostasis
Psychoanalytic theory
Social learning theory
Need deprivation
Drive
Incentives
Motives
Need for achievement
Drive-reduction theory
Arousal theory
Incentive theory
Goal-setting theory
Self-determination theory

EVALUATE YOURSELF

Multiple Choice Questions

1. Motivation results in
(a) Goal-directed behavior
(b) Undirected behavior
(c) Excited behavior
(d) Problem-solving behavior

2. Motives cannot be
(a) Inferred from behavior
(b) Observed directly
(c) Used to explain behavior
(d) Used to predict behavior

3. Homeostasis is largely maintained by the
(a) Reticular activating system
(b) Medulla
(c) Thyroid gland
(d) Hypothalamus

4. Which of the following statements is not true?
(a) Incentives are external stimuli acting on organisms.
(b) Incentives are not motivators of behavior.
(c) Incentives direct behavior.
(d) Incentives arouse the organism.

5. The drive-reduction theory of motivation explains behavior in terms of
   (a) Restoration of physiological balance in the body
   (b) Internal drive pushing the organism into activity
   (c) External stimuli acting as motivators of behavior
   (d) Both (a) and (b) but not (c)
6. People with high need for achievement prefer tasks that are
   (a) Not difficult (b) Very difficult
   (c) Moderately difficult (d) Impossible
7. Going from the lowest needs to higher order, the needs in Maslow's hierarchy (rectified) are
   (a) Physiological, safety, belongingness, understanding, self-actualization, self-transcendence
   (b) Physiological, belongingness, safety, esteem, self-transcendence, self-actualization
   (c) Physiological, safety, belongingness, esteem, self-actualization, self-transcendence
   (d) Self-transcendence, self-actualization, esteem, belongingness, safety, physiological
8. Social learning theory focuses on
   (a) Patterns of behavior learned in coping with the environment
   (b) To foresee probable consequences of behavior
   (c) Social relationships for being motivated
   (d) None of the above
9. Which one of the following basic psychological needs is not outlined by the self-determination theory?
   (a) Autonomy (b) Competence
   (c) Relatedness (d) Sympathy
10. An individual experiences a conflict when
   (a) His strong needs remain unfulfilled
   (b) He wants to do many things all at the same time
   (c) He has to continue with the work despite loss of interest
   (d) He has to choose between two strong and contradictory motives

Descriptive Questions

1. Define the term 'motivation' and elaborate upon its kinds.
2. How are need, drive and incentive related with human motivation? Discuss.
3. Discuss briefly the various types of motives.
4. What do you understand by need for achievement? Discuss this need in the light of recent research studies.
5. What is meant by conflict? Describe its basic types with the help of examples.
6. What is Maslow's major contribution to motivational theory? Discuss it in the light of researches done by him and others.
7. Outline the characteristics of self-actualizing people proposed by Maslow.
8. What is the need achievement theory proposed by Atkinson and Feather? Discuss it in detail.
9. Briefly outline the mini-theories which compromise the self-determination theory.
10. Write a short note on 'development of motivation'.

Critical Thinking Questions

1. List the situations when we sweat. Can you analyze the reasons for each of the situations when we sweat?
2. What do you think is the greater factor—a reward or gratification—when one works harder at work?
3. How are motivational factors same/different in human and animals?
4. Certain motivations can be learned and are related with things we want to possess. Examine how.
5. We often do not act in our own best interest by trying to maintain the same rate of reward for each of our actions. Examine this statement.

PRACTICAL EXERCISES

1. Give a picture of a successful film personality, a dreaded criminal, a common unknown housewife, a common man, a tribal person and a beggar. Ask the class to plot them on the Maslow triangle. Share the results
2. Divide the class into two groups. Ask them to take sides on the debate: "Mahatma Gandhi and Osho Rajneesh were self-actualized people."
3. What do you mean by the following?

Instinct:_____

Drive:_____

Need:_____

Incentive:_____

Expectancy:_____

Optimal Arousal:_____

Opponent-Process:_____

Answers to Multiple Choice Questions

1. (a) **2.** (b) **3.** (d) **4.** (b) **5.** (d) **6.** (c) **7.** (c) **8.** (a) **9.** (d) **10.** (d)

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Chapter 10

EMOTIONS

CHAPTER OBJECTIVES

After reading this chapter, you will learn:

- Different aspects of emotions as conscious experience and emotions as energizers.
- About the variety of emotions: fear, surprise, anger, mirth or amusement, joy, grief, sex excitement, love and hate.
- The indicators of emotional responses—external physical changes and expressions and their interpretation.
- About the physiology of emotions as well as the various physiological changes that happen during emotion.
- The various theories of emotion.
- The relationship between emotional expression and recognition.
- Critical analysis of cognition vis-à-vis emotion.
- Multi-dimensional perspective on emotion.

INTRODUCTION

The word 'emotion' is derivative of the Latin term '*emovere'* which means *to 'shudder'*. Thus, emotion is that state of the individual that deprives him of his equilibrium. In fear, his teeth are clenched together, his body shudders and signs of perspiration can be seen on his forehead. Emotions shake a man violently. Even when the object of his anger is no longer present, the person's arms twitch uncontrollably. Emotions stimulate the energies of the creature and assist him in dealing with emergencies. In an emotional condition, he performs actions he is incapable of performing in a normal state. But sometimes, though comparatively infrequently, a person is absolutely stupefied and fails to perform even the ordinary activities. These mutually contradictory results bear testimony to the fact that it is difficult to define emotion. There is no clear-cut distinction between emotional and non-emotional behavior, nor there are any sharp lines of demarcation between one

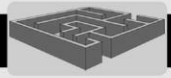
emotion and another, for the human emotions blend into one another like the colors of spectrum. Moreover, the basic emotions often combine in various degrees to produce complex emotional patterns. Even pleasant and unpleasant emotions are often mixed.

A further problem in defining emotion is the generalized nature of an emotional response, which literally involves the entire organism. It is difficult, if not impossible, to observe and measure all the physiological and psychological changes that make up an emotional response.

However, **P.T. Young** (1943) has defined emotion thus: '*Emotion is acute disturbance of the individual as a whole, psychological in origin, involving behavior, conscious experience and visceral functioning*.'

In **R.S. Woodworth's** (1940) opinion, an emotion is a disturbed state of the body. '*It is a disturbed glandular and muscular activity, each emotion is feeling and each is at the same time a motor set'*.

Whatever be the difficulty in defining emotions, it is but a well-researched and acknowledged fact that emotions have several important functions which play a vital role in our daily life (**Frederickson** and **Branigan** 2005; **Frijda** 2005; **Gross** 2006; **Siemer**, **Mauss** and **Gross** 2007). These important functions include *preparing us for action*, *shaping our future behavior* and *helping us interact more efficiently with others*.



PSYCHOLOGY IN EVERYDAY LIFE

Why Do We Have Emotions?

Have you ever wondered whether 'emotions make us human' or that 'they help us feel'? How much truth lies behind such a thought of ours? If we analyze this minutely based upon facts, we come to the conclusion that such thinking on our part is only partly correct. It is for sure that emotions do define us as humans and we do 'feel' when we have emotions. However, one fact must not be overlooked that emotions are subjective internal experiences that involve both a 'mental state' as well as a 'physiological state'. The expression 'mental state' means the internal cognitive label we use. Anger, excitement, love and anxiety define this mental state vividly. On the other hand, by 'physiological state', we mean the associated physical sensations or feelings in our body. The feeling of our heart pumping and pressure increasing when we are angry or the racing of the heart and butterflies in the stomach when we feel anxious are good examples of such a state. It thus becomes evident that for one to experience an emotion, both these 'states' need to be present. Imagine yourself standing at the very edge on the roof of a very tall building. If you have a fear of heights, you will begin to feel anxious but this feeling will be destitute of any emotional warmth unless and until it is accompanied by the physiological state of emotion—in this case, the racing of the heart and shortness of breath. However, if this same physiological state occurs when we are exercising, then we do not feel anxious. This is so because our mental state does not perceive any danger associated with it. In this manner, we can say that joy, excitement and love are 'good' emotions, whereas anger, sadness and anxiety are 'bad' emotions. However, if you are describing some emotions as being 'bad', you are likely setting yourself up for even more negative emotions. For example, it is fairly common for some people to feel depressed as well as guilty because they tell themselves: 'Why should I feel depressed when I have my health, a good job, I am secure financially and my kids are doing well?' By judging depression as being 'bad' (i.e., I should not feel depressed, what is wrong with me), feelings of guilt are the result. In this example, the individual now feels both depressed and guilty. When depression is already unpleasant enough and takes effort to overcome, so why judge your feelings and add an additional unpleasant emotion? In order to regain control over your feelings, never judge your emotions. In fact, psychologist would ask you to see all emotions as being good, but either pleasant or unpleasant.

ASPECTS OF EMOTION

Although a person's feelings cannot be observed directly by another, they must be inferred from his overt behavior and from his verbal report of his introspection. Further, no one can doubt the reality of emotion as a conscious experience.

Emotions as Conscious Experience

To produce an emotion, a stimulus situation must be perceived and evaluated as significant. This means that the present situation must be related to past experience and seen as having implications for the future. Our evaluation and subsequent emotion are strongly influenced by our estimate of our own capabilities. Such evaluation may also involve cultural factors such as family, church and political philosophy. It can occur with great suddenness and according to some psychologists on a subconscious basis. The emotions aroused depend not as much on the events themselves as on how they are evaluated.

The method of introspection has been employed extensively by psychologists to identify and analyze the basic components of emotional experience—the internal bodily sensations felt and their intensity and localization, as well as the other conscious elements. On the basis of introspective reports, psychologists have arranged emotions along a dimension of pleasantness-unpleasantness. They call this the affective scale. However, introspection has its limitations, of course, and information obtained by this method must be recorded carefully and interpreted with caution.

Emotions as Energizers

Emotions play a vital role in our motivational pattern. A life without emotion would be virtually a life without motive. The similarity between these two words is no accident. Both are derived from the Latin word meaning 'to move'. Often, we speak of a person as 'moved to anger' or 'deeply moved' by sorrow. Like the biological drives, emotions may arouse, sustain and direct activity in the organism and thus play an energizing role in the individual's life. Like other motives, too, the emotions may serve to direct behavior either toward some desired object or condition or away from some object or situation. Yet, they differ from the biological drives in two important ways.

First, an emotion starts with a cognitive reaction to an external stimulus, whereas a biological drive is a pattern of stimulation and/or chemical conditions associated with certain basic needs of the organism. *Second*, the arousal and satisfaction of biological drives may come to follow rather automatic sequences, whereas emotions, especially negative ones, usually arise in emergency situations where habitual, organized responses are not appropriate or adequate.

When emergencies arise that must be met with immediate and direct action, emotion helps the individual cope with situation in at least three ways:

1. In a state of strong emotions, a person is capable of action over a long period of time which might not be possible if he was entirely calm.
2. Strong emotions also enable an individual to exert maximum strength momentarily.
3. Strong emotions render an individual less sensitive to pain.

DIFFERENT TYPES OF EMOTIONS

Though fear or anger is usually mentioned as the standard example of an emotion, there are other stirred-up states which are very different, for example, the state of a person who is laughing heartily, as of one who

is radiantly happy at a piece of good news. What makes a person feel happy, hilarious, angry or afraid? It is difficult to answer this question in general terms so as to identify the stimulus for each kind of emotion. However, the variety of emotions if studied in depth can provide some sort of an explanation to the above question.

EXPERIMENTAL PERSPECTIVE

The High Bridge Study

In a study conducted by Donald G. Dutton and Arthur P. Aron, two groups of males were approached by an attractive female experimenter and were asked to fill out a survey. One group was approached on a solid, railed in footbridge, which was five feet off the ground, while the other was crossing a 'five-feet wide, 450-feet long bridge', which had 'a tendency to tilt, sway and wobble' and featured 'a 230-feet drop to rocks and shallow rapids below'.

The men dangling hundreds of feet above certain death were just as likely to stop for the hot lady asking them to do paperwork. Also, they tended to provide more sexual answers to the open-ended questions on the forms they filled out. What's really weird is that their confused terror boner did not go away. After the survey, an interview was done. The female experimenter gave her telephone number to both the groups to clear any doubts which came to their mind at a later time. Actually, passing down of the this telephone number was part of the experiment as the number of telephone calls received from the participants after the experiment was the dependent variable. It was assumed that the guys on the suspension bridge were five times as likely to call her the next day since they were more aroused by the height of the bridge, and were likely to confuse their feelings for being 'love struck' and looking for a date.

In the above study, the number of willingly surveyed participants and subsequent number of phone calls received by the interviewer were assessed as measures of sexual attraction. In addition, sexual imagery in survey responses was also measured. The results of the study largely confirmed the researchers' hypothesis. Across measures, the female interviewer elicited higher scores of sexual attraction from participants in the experimental precarious bridge condition (compared to the control condition and both conditions in the case of the male interviewer).

However, before we proceed to discuss about the various emotions, there appears to be a debate on their categorization. Some psychologists are of the view that no set of emotions should be singled out as most basic and that emotions are best understood by breaking them down into their component parts. Yet, other psychologist look at emotions in terms of a hierarchy, dividing them into positive and negative categories and then organizing them into increasingly narrower sub-categories (**Manstead**, **Frijda** and **Fischer** 2004; **Dillard** and **Shen** 2007). However, there is another group which feels that a list of basic emotions would include, at a minimum, happiness, anger, fear, sadness and disgust. Others have included surprise, contempt, guilt and joy to the list (**Ekman** 1994a; **Shweder** 1994; **Tracy** and **Robins** 2004). Whatever be the categorization of emotions, they for surely one and all play important roles in our lives. We will now briefly discuss some of the common emotions.

Fear: Along with anger, determination and eagerness, fear also is an emergency emotion. A dangerous situation tends to arouse the internal state of fear as well as the external movements of escape.

Surprise: When one is set for a certain situation and for carrying on a certain activity and something happens for which one is not set, there is a momentary emotional disturbance. It is like a brief gust of fear, even though after the momentary disturbance one recovers his equilibrium and perhaps has a pleasant, rather than an unpleasant surprise.

Anger: The emergency here is not danger as much as interference or frustration, when the individual is thwarted in his desires, especially when he can put the blame on some person or thing. 'A bad workman quarrels with his tools' placing the blame for his failure on his tools rather than on his own awkwardness. But sometimes he gets angry with himself. As compared to fear, anger is a more vigorous and outgoing emotion, and less unpleasant. Some people even seem to enjoy being angry and go out of their way to pick a quarrel – the angry young man image.

PSYCHOLOGY IN EVERYDAY LIFE

Anger and Catharsis

During the course of our lives, we experience a great variety of emotions such as joy, sorrow, fear and happiness. There are hardly any such moments in our lives when we do not experience emotions but then the very next moment they are gone and new emotions arise. There are also times when we do not feel emotions with the intensity they should be felt with. The reasons may vary from individual to individual and situations to situations. However, one reason is universal—we feel with less intensity because we block the same. In technical terms, it is referred to as repression. We hide or ignore our feelings. We do so because the emotion in question may be just too unpleasant or painful to us. Another reason may be that it does not fit into current situation, or into our self-image. In that case, we might unconsciously repress them and refuse to acknowledge them. We might deny even their existence. However, these emotions do not just disappear. They remain within us. They lessen our ability to feel or experience anything new. They take up a lot of our energy, which is needed to constantly hide and repress them. Slowly, our hearts will fill up and then there would not be any room for new feelings and experiences. And finally those repressed emotions will form an impenetrable wall, and we lose our ability to feel anything at all. We will become depressed, and we lose meaning of our lives.

Catharsis is a way to open all those emotions again and experience them properly. It means the cleansing of emotions. There are many methods that can be used to open up locked emotions. All these will bring hidden and repressed emotions back to the surface again. Only way to be free of these emotions is to experience all of them again. Other means can work only temporarily; in the end you will have to face those feelings.

Mirth or Amusement: The emotional state that goes with smiling and laughing must not be overlooked. No reaction is more clear-cut than that of hearty laughter and the emotion is certainly very different from fear and anger. But what, in general terms, is the stimulus that gives rise to amusement and laughter? What is common to all the amusing situations? Many theorists have attempted to answer this difficult question in different ways.

Joy: While pleasurable like mirth, it is not the same emotional state. Victory is not amusing. The typically joyful situation is the winning of success after a hard struggle; the achieving of the goal after intense effort.

Grief: With it, crying or weeping is the emotion of one who is helpless in the face of loss or difficulty. The lengthening of the face, contraction of the chest, tears, catching of the throat, fainting, sobbing, etc. are some of the signs of grief.

Sex Excitement: It is not the same as other forms of excitement, for the situation is distinctive. The behavior likewise and the strong accompanying emotion has its own particular characteristics.

Love: It is a complex emotion, a mixture of pity, sympathy, affection, love and prominently sex. Some people believe it to be lust. **McDougall** (1926) believed it to be the emotion aroused by sexual instinct. It is sometimes manifested as a permanent emotional tendency as in the case of a mother's love for a child.

PSYCHOLOGY NUGGET

Why do we Exhibit Altruism

Tina, my former classmate from college, met with a car accident seven months ago while driving in Marine Drive, Kochi. She was doing the speed limit in a light rain when her car skidded on an oil spot. She spun out of control, sailed across the median, through a lane of traffic and hit a concrete divider. Her airbag went off and she survived with few bruises.

Even before she had time to get out of the car, three people pulled over to offer help. One person had already called the highway patrol and another offered her cell phone so that Tina could call her family. A couple and their children actually went with her to get her car repaired at a local garage and waited with her until her car was fixed.

One gets touched by the kindness of these strangers. Yet, though the kindnesses they gave her were inspiring, they were not astonishing. Human beings are kind to one another and we sometimes help others at great personal cost.

Why do we do this?

This may be naive but it seems to me that there are basically two groups of researchers and philosophers who are interested in why we are kind to one another:

1. Those who believe in altruism
2. Those who do not

One theoretical tradition ('universal egoism') suggests that every 'kind' act is ultimately done to benefit the self. A second tradition believes that people are, in fact, able to act with the ultimate goal of benefiting someone else. Psychologist **Daniel Batson** and colleagues (2002) offer the following commentary on universal egoism vs altruism:

'Those arguing for universal egoism have elegance and parsimony on their side in this debate. It is simpler to explain all human behavior in terms of self-benefit than to postulate a motivational pluralism in which both self-benefit and another's benefit can serve as ultimate goals. Elegance and parsimony are important criteria in developing scientific explanations, yet they are not the most important criterion. The most important task is to explain adequately and accurately the phenomenon in question.'

Acting with kindness offers the following 'selfish' benefits:

1. Doing something kind reduces the tension created by our experience of empathy and inaction.
   It can be physically and psychologically painful to see someone in need of support (e.g. a homeless person shivering during winter, a friend who lost a parent and a child being verbally abused by a parent). Helping relieves this tension.
2. A kind act allows us to avoid social sanction or personal guilt for failing to help.
   Failure to help people in need, for the case of robbery, can lead to prosecution and a plausible jail term in western countries. Such laws actually do exist in a few states (although fines are more likely than jail time). A much more common sanction for failing to help when needed is the disapproval of our friends, co-workers, family members and romantic partners. Selfish, insensitive, heartless, mean are some labels one wishes to shun.
3. Kindness confers social and personal rewards.
   We earn the approval of others and feel good about ourselves for doing the 'right' thing. A theory or 'reciprocal altruism' suggests that kind acts are most often directed toward individuals who are likely to repay us in the future (**Trivers** 1971). If you offer to collect the mail of your neighbors when they are on vacation, then they will likely do the same for you. Geoffrey Miller, an evolutionary psychologist, noted that 'a truly anonymous act of kindness is the exception'. For example, most 'anonymous' donations are no secret to the giver's immediate family. Miller does not deny that most people have pure intentions when they donate money or time; but he does question why feelings of empathy and a proclivity to help evolved in the first place. He suggests that they evolved because acting with kindness and generosity confers social rewards.

At this stage, it is generally transformed into a sentiment. Selfishness and selflessness may be found in love in different degrees, as both are commonly present in it. Being a complex emotion, the external changes in love are extensive and they depend on the nature of the person, the intensity of love and the surrounding conditions.

Hate: McDougall calls hate, which is a complex emotion, a compound emotion. According to him, hate includes anger, fear and apathy.

Many other shadings of emotion can be listed. These are shame and jealousy on the unpleasant side, enthusiasm and warm affection on the pleasant side. There are combinations and refinements of more elemental emotions and combinations of emotion with agreeable or disagreeable sensations and ideas.

EXPERIMENTAL PERSPECTIVE

Research on Everyday Emotions: A Complex Picture

Scherer et al.'s influential work examined the incidence of emotions in ordinary 'everyday' life, the potential risk factors and the typical appraisal and reaction patterns. The study employed a population survey methodology in which data were canvassed from more than 1,000 German- and French-speaking adults. There were two waves of the study, conducted four years apart. Participants were asked to report an emotional event that happened yesterday as well as to verbally label the experience. The extent of emotional complexity among their respondents was expressed by the fact that respondents used 775 different words and phrases to describe their emotions on the previous day. In fact, this work demonstrated that there are numerous ways in which people interpret and understand their emotional responses. **Scherer et al.** (2004) stated that there were as many emotions as there are 'appraisal combinations' or interpretations. Along these lines, **Ben-Ze've** (2000) and **Katz** (2004) have also highlighted the complexity and enormous diversity of human emotion in normal day-to-day life.

Nevertheless, despite the vivid assortment of emotions reported by participants in Scherer et al.'s study, both sweeps, four years apart, produced very similar distributions of emotional descriptions and frequencies. This work mapped a wide array of emotional activity but also revealed structural regularity. Moreover, individuals were better able to manage and adapt to significant world events than one might have expected.

Ben-Ze've (2000) distinguishes between five main types of everyday affective phenomena: emotions (such as fear, envy, anger, and guilt), sentiments or enduring emotions (enduring grief or love), moods (such as being cheerful, gloomy, down), affective traits, (such as trait anger or shyness etc) and affective disorders (such as depression and anxiety). Although there is considerable overlap between the various 'types,' the distinction between them is important as it represents the possible reasons why an individual might respond to stimuli in a certain way; someone who is fearful of crime when being followed at night is different to someone who is arbitrarily scared of crime due to a psychiatric condition.

According to **Turner** and **Stets** (2005), everyday emotions are influenced by a range of factors, all of which should be taken into consideration. Emotions involve certain elements. These include: 1) biological reaction of key body systems such as the nervous system in the brain or hormonal influences (raised heart rate, tears etc); 2) socially constructed cultural definitions and checks on what emotions 'should' be experienced and expressed in a given situation (social desirability); 3) the application of common linguistic labels provided by culture and an individual's semantic ability to describe an event or feeling; 4) the external expression of emotions through facial, vocal and/ or linguistic actions and 5) perceptions and appraisals of contextual objects or events. In short, being in a state of fearing crime should be a considered multi-dimensional event. However, the authors Emily Gray, Jonathan Jackson and Stephen Farrall also suggest that not all of these elements need to be present for emotions to exist. For example, people have unconscious emotional memories which trigger biological actions, which may later prompt physical cues to themselves and others. At other times, individuals may repress their emotions with the result that they do not experience the emotion or signal it to others at any level.

(*Extract taken from research article 'Researching everyday emotions: towards a multi-disciplinary investigation of the fear of crime' by Emily Gray, Jonathan Jackson and Stephen Farrall*)

INDICATORS OF EMOTIONAL RESPONSES: EXTERNAL PHYSICAL CHANGES

The physical expression of emotion plays an important part in an interaction with the world around us. The overt responses of body parts, face, and vocal mechanisms are directly involved in manipulating the environment. In anger, for example, we may hit an enemy or, if he is too dangerous, withdraw. With smiles, frowns and gestures we influence other members of our social group.

Expressions and Interpretation

Empathy—the ability to understand and to some extent, share the experience of other person's feelings - depends greatly upon the ability to interpret an individual's expressive behavior. This, in turn, seems to depend upon a genuine interest in, and concern for that person.

In normal social interaction, we have several clues by which we judge the effects that our words have on the other person. The more such clues we can put together, the more successfully we can interpret his emotional behavior. Let us now briefly examine the clues available to us.

1. **Facial Expression:** A person's face is usually a barometer of his emotion. When under the influence of emotion, the facial expression of the person is the first to be altered. It is quite easy to read the emotion of love or hate from the face. No amount of effort can successfully disguise the facial contortions in strong emotion, from an experienced observer. In an emotional state, the muscles of the face expand or contract. In pleasant emotion, it is said that the face lights up with delight, this lighting up refers to the muscularly expansion. Similarly, it is said that the face hangs down. The reference is to the contraction of the muscles. Prevalent saying, such as blushing with shame or averting the eyes, expansion of eyes in fear, elevation of the eyebrows in anger are used to describe the changes in facial expressions in emotion. Many psychologists have experimented in order to determine the meaning of a variety of facial expressions. Some experiments seem to indicate that the facial expressions by themselves are insufficient to enable a distinction to be made between the emotions, but the data collected from these studies is insufficient. Studying facial expressions as indicators of emotions is difficult because of the following reasons:
   (i) It is difficult to get normal emotion in an artificially created situation in the laboratory.
   (ii) In different cultures, the mode of expression of the various expressions is not uniform.
   (iii) Even if the normal emotion is produced in the laboratory, it is necessary to photograph it at high speed.
   (iv) In the recognition of emotions, experience and instruction are indispensable.

   However, in reality, it cannot be said with any degree of certainty that it is not possible to recognize emotion from the facial expression. Even after the effect and impressions of the culture, there is a degree of similarity in the facial expression of emotions of the members of each society (**Ekman** 1994b; **Izard** 1994; **Matsumoto** 2002). It is easy to recognize the conflicting expressions of pleasure and pain in the sketches of the face originally drawn by *Leonardo Da Vinci* (Fig. 10.1). Figure 10.2 shows a great variety of facial expressions related with different types of emotions.

   The importance of facial expressions in emotions is illustrated by an intriguing notion known as the ***facial-feedback hypothesis***. This hypothesis states that facial expressions not only reflect emotional experience but also help determine how people experience and label emotions. When facial expressions change due to stimulation, it provides a muscular feedback to the brain which in turn helps produce an emotion congruent with that expression (**Izard 1990**; **Davis**, **Senghas** and **Ochsner** 2009).

Sad Happy

Fig. 10.1 Sad and Happy Face Expressions

Fig. 10.2 Variety of Facial Expression

PSYCHOLOGY NUGGET

Darwin on Expression of Emotion

According to a new archival research by Peter Snyder, a neuroscientist at Brown University, Charles Darwin conducted one of the first studies on how people recognize emotion in faces. These documents related with Snyder's findings rely on biographical documents, which were never published before. However, they now have appeared in the *Journal of the History of the Neurosciences*.

While going through letters written by Darwin at the University of Cambridge in England, Snyder came across multiple references to a small experiment on emotion that Darwin had performed in his house. Taking the help of the library staff, Snyder procured the relevant documents, which consisted of research notes and tables filled with the illegible scrawl of Darwin's elderly hands and the neater writing of his wife Emma. Although Darwin's fascination with emotional expression is well documented, no one had pieced together the details of his home experiment. Now, a fuller narrative emerges.

Snyder comments that 'Darwin applied an experimental method that at the time was pretty rare in Victorian England. He pushed boundaries in all sorts of biological sciences, but what isn't as well known are his contributions to psychology.'

In *The Expression of the Emotions in Man and Animals*, which was published in 1872, Darwin has argued that all humans, and even other animals, show emotion through remarkably similar behaviors. Darwin putting forth a view which was unpopular at that time stated that emotion had an evolutionary history that could be traced across cultures and species. This view though not accepted at that time today finds agreement amongst many psychologists. They all agree that certain emotions are universal to all humans, regardless of culture: anger, fear, surprise, disgust, happiness and sadness.

In his work *Expression*, Darwin corresponded with numerous researchers, including French physician Guillaume-Benjamin-Amand Duchenne, who believed that human faces expressed at least 60 discrete emotions, each of which depended on its own dedicated group of facial muscles. In contrast, Darwin thought that facial muscles worked together to create a core set of just a few emotions.

To study emotions Duchenne had applied electrical current to the faces of his subjects, sending their muscles into a state of continual contraction. By stimulating the right combination of facial muscles, Duchenne mimicked genuine emotional expression. He produced more than 60 photographic plates of his subjects demonstrating what he believed were distinct emotions.

However, Darwin disagreed with this finding. In this regard, Snyder comments, 'I started to look at the actual folio of photographic slides that Darwin had received from Duchenne and Darwin wrote these faint notes on it saying—*I don't believe this. This isn't true*.'

2. **Vocal Expressions**: The adult human voice is even richer than the face in varieties of emotional expression. Change in inflection, loudness, pitch or timbre may be used to express various types of emotional experience. A rising inflection, for instance, generally conveys a feeling of surprised doubt or incredulity: 'What! Is it time to go already?' The rising, then falling inflection shows sarcasm: 'What a smart idea that was!' A slow, dragging monotone expresses defeat and dejection: 'I failed the examination'. Loud, hoarse speech with much variation in pitch—characteristic of the sports broadcaster— suggests excitement.

   Patterns of emotional expression present in childhood become increasingly clear-cut as the vocal apparatus matures. While these patterns appear to have an innate basis, they are complicated by learning and social imitation. That is, the precise 'tone of voice' associated with a particular emotional reaction is determined in past by social convention, although the higher pitch and strident tones associated with anger, for example, are undoubtedly inborn. The increase in body tension causes more tension in the vocal cords, thus 'raising' the voice. Quavering and stuttering are evidently native expressions of fear and are frequently imitated by the actor who wants to convey a feeling of fear to the audience.

3. **Postural Expression:** In an emotional condition, the posture is affected too. These changes are not similar in all societies and in all the members of society. When frightened, a person is seen either running or standing still. In love, embracing, kissing, etc. may be observed, but these show substantial changes in different societies due to the effect of culture. When angry, some people use foul language, others pace about in frenzy and still others attack. Rubbing hands, clenching fists, standing erect, sitting with a bowed head, hiding, flinging the arms about, etc. all indicate emotion, but identification of emotion depends upon the person and the society to which he belongs and is possible only after adequate research.

   A second type or kind of change is a rapid, automatic motor response. A sudden loud noise or any intense and unexpected stimulus produces a predictable pattern of involuntary actions called the startle pattern. The head moves forward, the eyes blink and the mouth may open, the muscle of the neck stand out, and the arms and legs may jerk.

   Third are voluntary behavioral actions. People express their feelings by clapping or 'jumping for joy' or by running away from something they are afraid of. The most interesting and complex of these behavioral indicators are those that result from anger.

PHYSIOLOGICAL CHANGES DURING EMOTION

Of all the indicators of emotion, the most easily measured are the internal physiological activities that occur throughout the organism. Indeed, many psychologists maintain that these physiological responses are the emotion. Whereas awareness of an emotion may be suppressed and most external responses can be voluntarily inhibited by the individual, visceral responses are not usually subject to voluntary control. Measurement of physiological changes is thus the most sensitive and objective method of studying emotion and is the source of most experimental data.

Glandular Responses: When a person experiences a strong emotion such as anger, the *medulla* of the *adrenal gland* pours into the blood stream an excessive amount of the hormone *adrenaline* and a second hormone, *nonadrenaline*. The first is responsible for many characteristics of strong emotional experience. Under its influence, the liver releases stored sugar into the blood and chemical changes occur which cause the blood to clot more quickly.

The reactions include the following:

1. The rate and depth of breathing increases.
2. There is an increase in heart rate and in the amount of blood pumped out with each beat (not applicable for hunger).
3. Blood pressure goes up.
4. Less blood goes to the internal organs, more to the muscles.
5. The liver releases extra blood sugar to supply energy.
6. Production of saliva in the mouth and of mucus in the respiratory passage decreases.
7. The pupils of the eyes dilate, letting in more light.
8. GSR changes in the electrical resistance of the skin goes up. The GSR is related in a complex way to the functioning of the sweat glands in the skin. The fact that many of these changes are quite easy to measure provides the basis for the ordinary lie detector or polygraph. This device generally measures heart rate, breathing rate, blood pressure and GSR.

Many of the bodily changes that occur with fear also accompany anger, but there are some physiological differences between the two emotions. *Epinephrine* is secreted with anger as well as with fear, but anger

involves an additional adrenal hormone, *norepinephrine*. This hormone also increases blood pressure but it does so by constriction of the blood vessels and not by increasing the supply of blood to the muscles. In fact, an injection of norepinephrine slows the heart. Attempts to differentiate other emotions on the basis of different physiological responses have been less successful.

Do the Physiological Changes Constitute the Emotion?

Just what part the physiological responses play in our conscious experience of pleasant or unpleasant emotions such as anger or fear or elation is a question which has long puzzled psychologists. A few have followed the early psychologist **William James**, who expressed the rather extreme view that bodily changes directly follow our perception of an exciting fact and that our awareness of these bodily changes is the emotion. As James put it, three quarters of a century ago, '*common sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, are angry and strike*.' But he maintained this simple sequence is not correct, so that, '*the more rational statements is that we feel sorry because we cry, angry because we strike, afraid because we tremble ...*' (**James** 1890)

An elaboration of this view called the *James–Lange theory of emotion* exerted a strong influence on psychologists and led to a great deal of research on the patterns of physiological change involved in the different emotions in an attempt to find identifiable differences. Surprisingly, few differences in visceral responses were found—not enough to account for the wide range of felt emotions. In fact, just doing mental arithmetic, with no experience of emotion, can cause as much of the heart action as immersing the foot in a bucket of ice-water, an emotion arousing emergency situation (**Knapp** 1963). Thus, some investigators have concluded that cognitive factors must play a major role in determining whether physiological arousal is part of an emotional state and if so, which one.

An experiment endeavored to test objectively the role played by cognitive as opposed to physiological factors when subjects had been given a shot of adrenalin and thus were undergoing the physiological changes common in strong emotion (**Schachter** and **Singer** 1962). This experiment indicated the importance of cognitive factors in emotion. In a follow up study, however, in which there was no contradiction between the perceived situation and the felt internal changes, it was demonstrated that the degree of physical arousal is also important in determining the intensity of felt emotion. In another study involving lie detection, emotional activity induced by cognitive factors was clearly demonstrated (**Gustafsen** and **Orne** 1965).

Philippot (1992) has reviewed the evidence so far. Eighteen studies were identified that had contrasted several physiological parameters between at least two relatively pure emotional states. Usually, the results of these studies led their authors to conclude that the emotions observed could be differentiated on the basis of the physiological parameters measured. However, the specific differences reported by each particular study are generally not replicated by the other studies. For instance, while some studies found heart rate to be faster in joy as compared to sadness, other studies did not find this contrast or they even observed the opposite. Actually, for each of the 10 physiological parameters considered, Philippot was unable to identify any cross-study consistency in the contrasts of the four emotions reviewed: joy, anger, fear and sadness. Hence, the specific differences observed by each individual study should be attributed to factors alien to discrete emotion differentiation such as the specific characteristics of the stimuli or procedures used to induce emotions in the laboratory. In a review comparing the physiology of fear and anger, **Stemmler** (1992) reached the same conclusion and so did **Zajonc** and **McIntosh** (1992) in a review of six physiological studies using Ekman's facial action paradigm. We can thus conclude, on the basis of these reviews, that there appears to be no strong empirical evidence supporting the idea that basic emotions are differentiated at the physiological level.

It, so far, seems apparent that physiological arousal is an essential factor in emotion but that it is guided or steered by cognitive factors. Present cognitions, including evaluations based on past experiences, provide a framework within which the individual can understand and label his feelings (**Schachter** 1964).

Contemporary Neuropsychology Perspective

There is also the other side of the coin as latest neuropsychology researches on emotions indicate a revision of earlier views that physiological responses associated with emotions are undifferentiated. These researches have provided evidence that specific patterns of biological arousal are associated with individual emotions (**Franks** and **Smith** 2000; **Vaitl**, **Schienle** and **Stark** 2005; **Woodson** 2006). Researchers have also found that specific emotions activate very different portions of the brain (**George et al.** 1995; **Hamann**, **Ely**, **Hoffman** and **Kilts** 2002; **Prohovnik**, **Skudlarski**, **Fulbright**, **Gore** and **Wexler** 2004).

Research on the neural circuitry of emotion (**LeDoux** 1994, 1996, 2000) has provided strong evidence for the role of several cell groups within the *amygdala* in emotion. **LeDoux** (2000) has provided evidence for circuitry that would allow sensory input to trigger emotion directly (without higher cortical processing). The *amygdale* located in the brain's temporal lobe plays an important role in the experience of emotions as it provides a link between the perception of an emotion-producing stimulus and the recall of that stimulus later. Since the neural pathways connect the amygdale, the visual cortex and the *hippocampus* it has been argued that emotion-related stimuli can be processed and responded to almost instantly because of this interconnectivity. They argue that this response comparatively occurs faster than the higher-order, more rational thinking, indicating its initial dominance in the feeling of emotion. However, this is just the initial phase and the delay is caused because the thoughtful response to emotion-evoking stimuli, emotion related sensory information is in the very beginning evaluated at a slow pace and then sent to the amygdale. It seem that the quicker system thus offers an immediate response to emotion-evoking stimuli, whereas the slower system helps confirm a threat and prepare a more thoughtful response (**Dolan** 2002).

PSYCHOLOGY IN EVERYDAY LIFE

How Often do we Experience Emotions?

Wilhelm (2001) and **Myrtek's** (2004) works conclude that most people experience some kind of emotion on a daily basis. Similarly, **Scherer et al**. (2004) found that one in two individuals is likely to experience at least one strong emotion on any given day. The most frequent emotions were happiness (9.1%) and anger (8.6%), which reflect results in similar studies. The most pertinent results to those of us in the fear of crime arena indicate the low frequency of 'basic' emotions, thought to be central to everyday thinking. Fear was a relatively rare emotion; 1.2% of the respondents reported experiencing fear on the previous day, although anxiety was more common (6.5%). Scherer et al. noted that while it is possible that less intense experiences of fear did occur, they could not have been consciously remembered or perceived. They conclude: 'Serious fear situations are few and far between in the normal course of events' (2004). Indeed, **Averill** (2004) has also reflected that fear is an infrequent emotion and rarely experienced outright. Similarly, other 'basic emotions' registered low frequencies: love was 0.8%, hate 0.2%, jealously 0.2%, hope 0.1%, envy 0.1%, shame 0.1% and contempt in at less than one-tenth of one percent. While these emotions may be considered normal 'expressive' fodder in popular culture and to have a strong motivational force on our daily behavior, they may actually be much less common than we think. Other commentators have mused that we may expect certain emotions to be more prevalent than they actually are because of their symbolism and significance.

'Fear, love, hate, jealousy, hope, envy, shame and contempt are perceived to be frequent since they appear to have tremendous impact upon our behavior. While these emotions seem to shape our behavior in many circumstances, the findings of the study under discussion (**Scherer et al**, 2004) indicate that they may have less impact than we think. Similarly, aeroplane accidents are perceived to be more frequent than their actual occurrence because their immediate impact—the death of so many people at one time—is so great and attracts large media attention. Accordingly, we consider their impact upon our life as more profound than it actually is' (**Ben-Ze've** and **Revhon** 2004).

Perhaps this low occurrence of 'basic emotions' (including fear) signifies the growing importance of other social and cultural emotional considerations. It has been purported that basic emotions were some of the most important, both qualitatively and quantitatively due to their function in individual and evolutionary development. However, the environment we now live in has posed new emotional stimuli, emotional processes—particularly complex social, political and philosophical ones. As Ben-Ze've (2000) comments, 'Social comparative concerns have become as crucial as the self-preservative biological concerns and cannot be reduced to them.' However, Scherer et al. remind us that despite being a rare event, the significance of fear as an emotion should not be underestimated. Fear is described as a 'phylogenetically continuous emotion', which produces important biological, emotional responses essential for the maintenance of health and the avoidance of imminent danger. 'The fact that it is apparently a relatively rare event, at least in modern western democracies, does not detract from its important role in the emotion repertoire of humans' (**Scherer et al**, 2004).

(*Extract taken from research article "Researching everyday emotions: towards a multi-disciplinary investigation of the fear of crime" by Emily Gray, Jonathan Jackson and Stephen Farrall.*)

THEORIES OF EMOTION

Peripheral Theories of Emotion

1. James Theory of Emotion

Emotional reactions are always accompanied by complex changes in a variety of physiological functions; such changes are integrated by the *autonomic* and *somatic nervous systems,* as well as the endocrine glands. **William James** (1884, 1890) recognized this relationship in his celebrated theory of emotion. James comments, '*the bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur is the emotion'*.

Figure 10.3 reproduces a map of the neural pathways involved in this theory. Environmental stimuli excite sensory receptors (R) such as the ear and eye. Impulses from these receptors follow classical pathways to the sensory receiving areas of the *cortex*, whereupon the stimulus is perceived (path 1). Next, somatic as well as *autonomic impulses* initiated in the cortex excite *skeletal muscles* and *viscera* (path 2). This induces changes in such physiological functions as muscle tension, blood pressure, heart rate, and pilomotor and sudomotor activity. These changes, in turn, excite interceptors and initiate further impulses which return to the cortex via paths 3 and 4. The perception of these changes adds an emotional quality to the original perception of the stimulus.

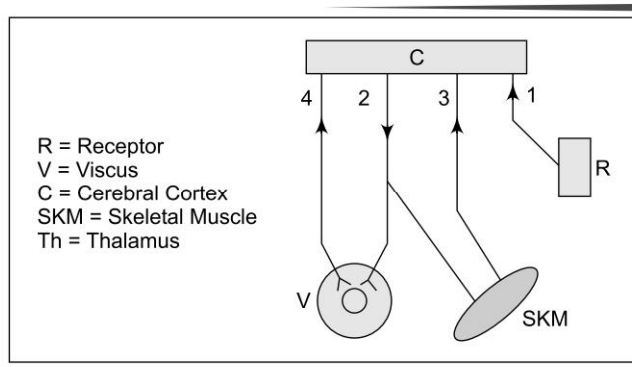


Fig. 10.3 Map of Neural Pathways

2. Lange's Theory of Vascular Change

A model of emotion similar to, albeit, more limited than James was independently proposed by Danish physiologist **Carl Lange** (1885/1912). The two are often collectively labelled the James-Lange theory of emotion. In contrast to James, Lange emphasized on physiology and dismissed the importance of consciousness in shaping emotions (**Lange** 1994).

Lange actually did not claim that the feelings of bodily change produced the emotions. He stated that Vasomotor disturbances, varied dilation of blood vessels and consequent excess of blood in the separate organs are the real, primary effects of the affections whereas the other phenomena—motor abnormalities, sensation paralysis, subjective sensations, disturbances of secretions and intelligence are only secondary disturbances which have their cause in anomalies of vascular innervations. In other words, vasomotor changes are the emotion in Lange's theory.

Arguments for The James-Lange Theory

1. *Perception causes bodily changes without arousing the emotion*: According to James, if we see a mobile black image in the jungle, our heart stops beating and we start trembling before any clear idea of danger is conceived. Apparently, in this case the perception and bodily changes precede the emotion.

2. *An emotion cannot be imagined in the absence of physical expression*: According to James, if we imagine an emotion and then try to remove the signs of its physical experiences from our consciousness, we do not find any such thing which may constitute an emotion. Whatever is left is only an immutable state of feelingness intellectual perception.

3. *The suppression of physical expression results in the suppression of related emotion*: If the emotion is not permitted to express itself, it is destroyed.

4. *The artificial creation of physical expression creates the related emotion*: Presenting the examples of actors, James said that while acting, they experienced the emotions the physical expression of which they were acting.

5. *Some bodily abnormalities cause emotions*: Giving an example of this, James says that the troubles of the liver cause loss of appetite and touchiness while mental disease causes fear and despair. In James's opinion, objectless emotions are the result of bodily infirmity.

In this way, their theory does not distinguish between emotion and physical sensations. Ward says that in this theory, emotions are a group of physical sensations and these sensations are emotions, they are not only complementary but inseparable too.

Cannon's Objections To Peripheral Origin Theories

W.B. Cannon (1927, 1931) suggested five major areas of objection to the notion that the experience and expression of emotion is based on the perception of secondary sensation from the viscera.

1. *Emotional reactions are possible even in the absence of the physical correlates*: Sir **Charles Sherrington** (1900) operated upon many dogs and severed the connections of the extremities and the brain by operating upon the spinal cord. But this did not affect their emotions in any way. Cannon and his assistants proved a similar thing in the case of cats. **Dr Dana** (1921) proved it too, by observing the case of a forty-year-old lady who exhibited and felt emotion even though she could not receive any sensations from the sympathetic nervous system.

2. *The same visceral changes occur in diverse emotional states and in non-emotional states*: Many clinical and experimental evidence have demonstrated that specific physiological functions such as heart rate or

blood pressure may show similar, if not identical, changes in a variety of apparently diverse emotional situations and in such non-emotional states as physical exertion, rest and exposure to heat or cold. James had suggested that emotion was not dependent on particular responses in individual organs, but rather on the total feedback from peripheral structures.

Some studies have, however, raised hopes that we may be able to distinguish different emotional situations on the basis of precisely these patterns of physiological change.

3. *The viscera are relatively insensitive structures*: Cannon correctly pointed out that visceral organs are relatively poorly supplied with nerves and that we are consequently unaware of normal physiological processes in these structures. However, this alone does not constitute adequate proof that the existing supply of nerves is incapable of performing the functions James assigned to them.

4. *Visceral changes are too slow to be a direct source of emotional feeling*: Smooth muscles have a comparatively long latency, to which the time it takes for impulses to travel through the various stages suggested by James must be added. Considerable additional time would have to lapse before sufficient muscular tension could be built up to produce a noticeable change from the prevailing state of rest. It is well established that the expression of emotion can follow appropriate stimulation after very brief intervals. The specific equation with regard to the James-Lange theory is, however, whether the feeling of emotion occurs before the feedback from peripheral structures to complete.

Newman et al. (1930) suggested that some kind of emotional experience appeared almost immediately upon the presentation of emotion-provoking stimuli; however, there seemed to be 'an additional feature, a developing experience that comes only from three to fifteen seconds after the exposure of the material'. They concluded that a 'complete emotional experience' develops only slowly because it depends on feedback from the viscera. It seems quite reasonable that emotional feelings should appear more complete after the development of physiological changes that one has learned to expect in similar situations. However, the fact that an appropriate emotional experience could be reported after intervals much too short to provide feedback from peripheral structures suggested that the role of these visceral changes may not be essential. **Lehmann** (1914) has presented an exhaustive summary of experimental studies which demonstrate that specific autonomic changes always occurred after the reported emotion.

5. *The 'artificial' induction of visceral changes known to occur in specific emotions fails to produce these emotions*: Epinephrine acts as a humoral transmitter of neural impulses at most *postganglionic sympathetic synapses*. It also has a pronounced, direct effect of smooth muscles that are innervated by the sympathetic nervous system. Cannon argued, therefore, that the James-Lange theory would have to predict experience of emotion if epinephrine were injected—at least to the extent that the physiological responses to epinephrine are comparable to responses occurring in a specific emotional situation. Such an analysis fails to take into account the total patterns of sympathetic, para-sympathetic and somatic responses which, according to James, may be operating to produce a particular emotion. Para-sympathetic and somatic functions are only slightly, if at all, affected by the injection of a sympathetic transmitter substance and Cannon's objection loses much of its cogency.

Review of Cannon's Objections

James was no longer alive and was unable to respond to Cannon and Bard's assault on his theory of emotion. However, there were critics of the Cannon–Bard model in that era (**Newman et al**. 1930) and many of Cannon's assertions were ultimately called into question (**Carlson** 2007; **Damasio** 2004; **Fehr** and **Stern** 1970). However, as emotion theorist **George Mandler** (1975) noted: '. . ..[the] historical importance [of Cannon's criticisms] is not so much that they destroyed the James–Lange theory, but rather that they were

influential in producing an extensive research tradition in the psychophysiology of emotion'. In particular, Cannon's argument that emotions are not discriminable based on their visceral responses generated a durable research paradigm that spans seven decades.

Conclusion to Cannon's Objections

After a review of the objections put forth by Cannon, we can only conclude that except for the first one, the other four, although well taken and in need of consideration do not adequately provide evidence against a theory. It has been found that there appears to be considerable co-variation of emotion and peripheral autonomic and somatic events. The perception of peripheral stimuli undoubtedly contributes to the subjective experience of emotion. Cannon's first objection demonstrates fairly conclusively, however, that such feedback from peripheral sources is not an essential component either of the experience or of the expression of emotional responses.

Some Supportive Researches For The James-Lang Theory

Some evidence seems to provide support for the James-Lange theory. A psychologist, **Hohman** (1966), interviewed a group of patients who had suffered serious spinal cord injuries and were unable to feel any sensations in the parts of their bodies below level of the injury. Some of these people had spinal injuries at the neck-cervical level and therefore could not feel anything from the neck down; in others the injury was at the lower part of the spine-sacral; the rest were somewhere in between. These patients were asked how the emotions they felt since their accident differed from the emotions they remembered feeling before they were injured. Were they the same as before or less intense?

According to Hohman's research, the greater the degree of spinal injury, the greater the decrease in feelings but those with cervical injuries reported a significant decrease in feelings of such emotions as fear or anger. Figure 10.4 shows the results graphically.

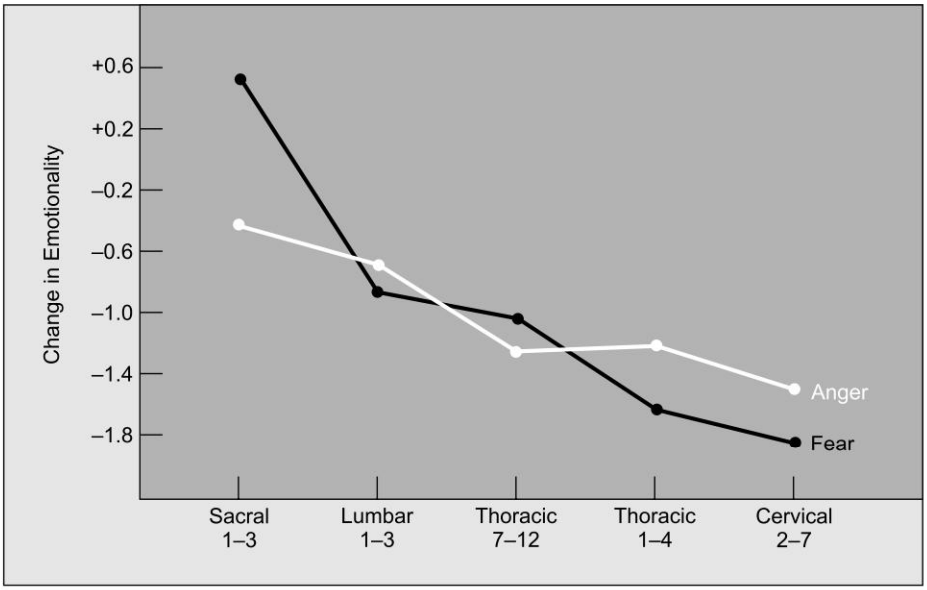


Fig. 10.4 Results of Hohman's Research

However, some research reports on the emotional feelings of patients who had varying degrees of afferent (sensory) impulse blockage have yielded mixed results, with some cases showing blunting of affect (**Dana** 1921; **Hohman** 1966) and others not (**Lowe** and **Carroll** 1993). Numerous flaws in these case studies have also been noted, most salient of which is that afferent feedback is not completely eliminated by the spinal cord transactions described in these patients (**Damasio** 2004).

Contemporary support for the James-Lang theory comes from the **somatic marker hypothesis** also. This model holds that affective peripheral feedback can influence decision making in complex, uncertain situations **(Damasio** 1996; **Bechara et al.** 2000). The model is based on evidence drawn from studies of patients with ventromedial prefrontal cortex damage (**Bechara et al**. 2000; **Dunn et al**. 2006). Damasio and co-workers interpret these findings as evidence that autonomic activity, manifested in skin conductance responses, provides a somatic marker signal that restrains poor decisions in complex situations (**Bechara et al**. 1996). This model is consistent with James–Lange theory in that somatic feedback associated with emotion precedes awareness and guides behavior (**Dunn et al**. 2006).

The overall conclusion drawn from the various studies is that in order to experience strong emotions, it is necessary to get some feedback from the body—some indication of the physiological reactions going on. When the sensation produced by these reaction are absent or little, the emotions may be felt less intensely.

Critical Analysis of The James- Lange Theory

James acknowledgment of the importance of cognition in emotion is generally neglected, resulting in a one-dimensional depiction of the temporal relations among the various elements of affective processes. The theory has generated considerable debate in its time. Notable supporters included **Dewey** (1894) and **Baldwin** (1894), but the theory also had numerous prominent critics including **Wundt** (1891). The temporal aspects of James's theory have been difficult to test experimentally and the results have been mixed. Consistent with James, some studies have shown that somatic muscle activity can modulate emotional feelings (**Adelmann** and **Zajonc** 1989; **Laird** 1974; **Rutledge** and **Hupka** 1985; **Strack et al**. 1988). In contrast, others have not replicated this effect (**Tourangeau** and **Ellsworth** 1979) and low levels of shared variance between physiological and self-report measures have been reported (**Lang** 1994; **Rachman** and **Hodgson** 1974). Hence, no reliable trend has emerged from the patchwork findings in this area. However, recent neuro-scientific data confirms that peripheral psycho-physiological changes can precede the subjective experience of emotion self-generated via recall of a personal episode (**Damasio et al**. 2000).

Emergency Theory of Emotion

Changes in a variety of physiological functions occur during emotional stimulation but do not seem essential to either the experience or the expression of emotion. Similar, if not identical changes, occur in apparently emotionless situations and widely different stimuli may produce comparable reactions. Particular autonomic and somatic responses are not characteristic of specific emotions but instead reflect a general increase in physiological activity.

Cannon (1932, 1939) suggested that the sympathetic changes which accompany emotions '*may reasonably be regarded as preparatory for struggle*'. According to this hypothesis, the secretion of epinephrine cooperates with sympathetic nerve impulses to:

1. Free stores of glycogen from the liver for consumption by muscles (as glucose).
2. Aid in the conversion of lactic acid to glucose by stimulation of the respiratory mechanisms.
3. Redistribute blood from the viscera to the heart, brain and extremities.

The 'emergency' theory of emotion suggests that by exciting the sympathetic nervous system and simultaneously inhibiting the parasympathetic system, emotion, 'as exemplified by anger and fear', facilitates the

body's general capacity to respond vigorously. This theory explains why we should see the same physiological changes in various emotional and non-emotional situations; it is supported by the fact that animals without the sympathetic nervous system cannot endure very strong emotional stimulation and will 'die of fright'.

However, Cannon's hypothesis is contradicted by several experimental observations (**Major** and **Mann** 1932; **Somogyi** 1951; **Gellhorn** 1943; **Luco** 1939).

Lindsley's Arousal Theory of Emotion

Lindsley's (1951) theory attempts to explain emotional reactions as well as motivation in general terms of relative cortical arousal. It proposes that both visceral and somatic sensory impulses converge on the reticular formation of the lower brain-stem. When the input through the system is low, the organism is relaxed and the electrical activity of the brain resembles that of sleep. As this input increases, the organism alerts and orients itself towards the source of stimulation.

Lindsley concluded that cortical arousal may be a prerequisite for all behavior but it does not itself explain the variety of emotional behavior. However, it has been found that gross behavioral changes do not affect the general cortical EEG once alpha blocking has occurred. Even stimuli that elicit violent rage reactions do not significantly alter the EEG if the animal is alert before the presentation of the stimulus.

Cannon-Bard Thalamic Theory of Emotion

The theory of emotions that **Cannon** proposed (1927) and that **Bard** (1934) elaborated was based on what was known about the brain at that time. Cannon placed the source of emotion in the thalamus that is located in the centre of the brain. According to Cannon-Bard theory, this is what happens when an emotionally arousing stimulus is perceived: The thalamus sends out impulses to the sympathetic nervous system producing the physiological reactions—and at the same time sends out impulses to the cerebral cortex—producing the conscious feeling of emotion. This means that the bodily changes and the emotional feelings occur simultaneously. Figures 10.5 and 10.6 show a comparison of the Cannon-Bard and James–Lang theories.

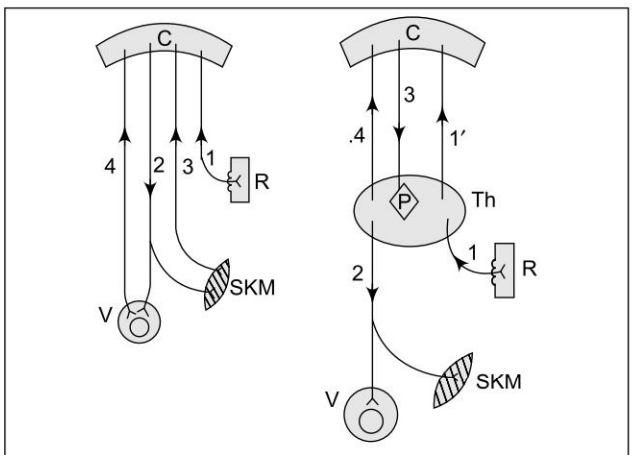


Fig. 10.5 Pictorial Comparison of James and Cannon's Theories

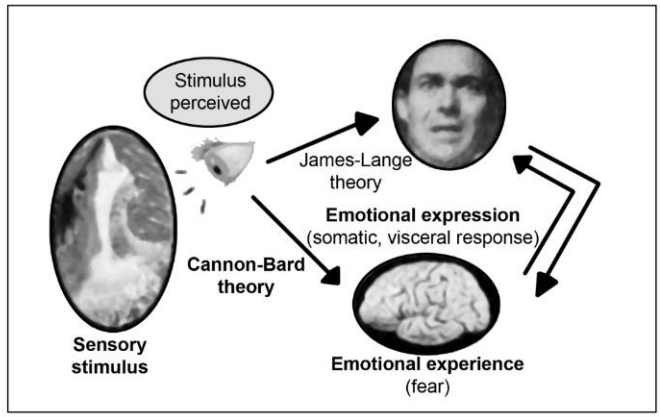


Fig. 10.6 Comparison of Cannon–Bard And James–Lange Theories

Critical Review

Cannon highlighted the role of brain in the generation of both physiological responses and feelings in emotion. Enormous advances have ensued in elaborating the specific central nervous system structures involved in emotion, and this has undeniably been a prolific area of research. Modern neurophysiology has not substantiated the importance of the thalamus to emotion. The parts of the brain that are now thought to play the major role are the *hypothalamus* and the *limbic system*. Lesions in certain parts of these areas produce permanent changes in emotional behavior in these animals. They become more passive and unreactive or they become over reactive and fly into rage with little or no provocation, depending on the location of the brain injury. Neuro-physiologists have also investigated the limbic system by implanting electrodes in the brain of animals and giving tiny electric shocks to various areas. Depending on where the electrode is placed, the shock may produce fear, rage, passivity or even pleasure. Although Cannon's view of unitary autonomic arousal across emotions is at odds with contemporary views of ANS activity (**Levenson** 1992; **Wolf** 1995), varying degrees of overlap in autonomic response patterns do likely exist across emotions (**Cacioppo et al**. 1993, 2000).

Papez's Theory of Emotion

The first cortical theories of emotions were based primarily on the intimate anatomical relationship between thalamic and hypothalamic centers which seem to be involved in the regulation of emotional behavior and certain cortical structures. **Papez's** theory (1937, 1939) deserves special attention because it represents the first organized attempt to delineate specific cortical mechanisms which may participate in the regulation of emotion.

Papez's was greatly influenced by Bard's experiment demonstrating the importance of hypothalamic mechanisms in rage behavior and he was convinced that the expression of emotion depended entirely on the integrative action of the hypothalamus. He suggested, however, that emotional expression and emotional experience may be dissociated phenomena and that the subjective experience of emotion requires participation of the cortex.

The heart of Papez's theory can best be stated in his own words: '*The cortex of the cingular gyrus may be looked upon as the receptive region for the experiencing of emotion as the result of impulses coming from the hypothalamic region, in the same way as the area striata is considered the receptive cortex for photic excitations coming from the retina. Radiation of the emotive process from the gyrus cinguli to other regions in the cerebral cortex would add emotional coloring to psychic processes occurring elsewhere*.'

Papez suggested that there are primative sensory centers in the *subthalamus*. These relay stations are believed to receive afferents from the *optic tract*, the *acoustic nerve*, the *spino-thalamic* and *trigeminothalamic tracts* and the *medial lemniscus*. From these nuclei, the sensory information may be relayed via diffuse fiber connections to the anterior and medial portions of the hypothalamus which 'regulate visceral activities and emotional expression'. From here the information is projected to the *mammillary bodies* which also gather additional afferent input from the cortex via the medial forebrain bundle, the *fornix* and the *mammillary peduncle*. This cortical input (path 1) allows for the excitation of hypothalamic mechanisms by 'psychic activity' which is believed to originate in the *hippocampal formation*. The composite pattern of hypothalamic activity is then transferred from the mammillary bodies via the *mammillo-thalamic tract* to the anterior nuclei of the thalamus; these nuclei relay the impulses via the *medial thalamocortical radiations* to the cortex of the *cingulate gyrus* which gives rise to the appropriate emotional experience. Figure 10.7 depicts this theory pictorially.

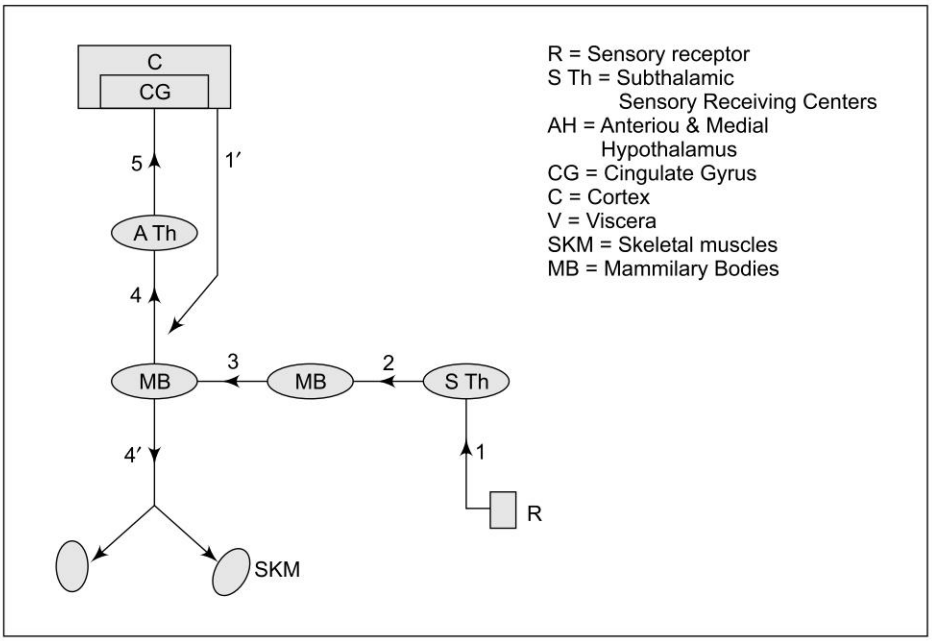


Fig. 10.7 Papez's Theory of Emotion

Papez further suggested that additional afferent impulses may reach the cortex via the internal capsule. A third system is thought to relay impulses of 'a more global nature' from the *dorsomedial nuclei* of the thalamus to the *frontal lobes* and to serve 'the global organization of the process of thinking and comprehending' which are presumably part of any subjective emotional reaction. **Papez** (1939) emphasized that these three systems must 'be combined in the cortex to yield integral psychological products'.

Critical Review

Papez's theory has not received much attention in psychological circles, partly because his interesting speculations were not supported by behavioral data. **Johannes Pantel** (2003) comments about Papez's

contribution, explaining that though Papez 'proposed that a circulatory consortium of neural components and their connections participate in concert harmoniously to elaborate emotional awareness….[and he]… was influenced by new data derived from brain transection and stimulation experiments, developments in comparative neuroanatomy, clinical observations and an evolving neuroanatomical philosophy (postulating reciprocating cortical to subcortical circuits as central processes elaborating consciousness).' …. and his general idea turned out to be sound, yet the anatomical specifics of his circuit did not prove to be correct. Later studies (**Brady** 1958); **Maclean** (1949) developed it further and the **Papez-MacLean theory** is now much more than a theory. In a general description of what experiment has established, namely, that the limbic system is the central system in emotion.

MacLean's Theory of Emotion

There are some differences in the details of the theories put forth by Papez and MacLean. These differences, however, are relatively inconsequential and mostly concern the as yet unknown basis of emotional experience. Both ascribe to the limbic system as a whole the mediation of emotional experience and expression. Both ofcourse point out the significant connections of the system with the hypothalamus and its role in the expression of emotion. Both stress the strategic location of the limbic system for the correlation of feelings particularly those arising from the internal organs of the body.

Papez writes '*the hypothalamus may be the effector mechanism of emotional expression and that only the cerebral cortex is capable of appreciating all the various affective qualities of experience and combining them into such states as fear, anger, love, and hate'*. MacLean argued that these integrative processes must take place in the primitive *allocortical* and *juxtallocortical* portions of the cerebrum because they alone contain the cortical representation of visceral functions which are an integral part of the normal expression of emotion. Vasomotor, sudomotor, cardiac and respiratory functions have little or no neocortical representation. They are, however, affected by stimulation or ablation of large portions of the limbic system (or 'visceral brain').

MacLean emphasized in his hypothesis the role of the *hippocampal formation* and its close association with the *amygdala*. He suggested that the *dentate* and *hippocampal gyri* may have primarily sensory functions. He further suggests that the afferent connections of the amygdala may be predominantly parasympathetic and subserve such functions as feeling, digestion, elimination and sleep. The hippocampal outflow, on the other hand, is thought to be predominantly sympathetic and to participate in the regulation of fight, flight and arousal. As a whole, the hippocampal formation is believed to, '*provide the kind of analyzer that can derive universally from the particulars of experience and relate them symbolically in the experience of emotion'*.

MacLean departs from the views of Papez primarily in de-emphasizing the role of the *cingulate gyrus*. He stated that '*in the light of subsequent experimental findings, Papez's delimination of this region in the experiencing of emotion strikes one today as a considerable tour de force'*. In MacLean's own theory, it is the hippocampus, aided by the *amygdaloid complex* that is most directly connected or concerned with the subjective experience of emotion. He suggested that '*the hippocampal gyrus may serve as affectoceptor cortex and the hippocampus as affectomotor cortex somewhat analogous to the somatic sensory and motor gyri of the neocortex'*. These mechanisms, MacLean writes, '*suggest a possible explanation of how intense emotion could paralyze both thought and action'*.

Critical Review

MacLean's revision lacks the elegance and completeness of Papez's original theory. No attempt is made to follow explicitly the course of events from the reception of an emotion-provoking stimulus to the expression and experience of emotion but this is in line with the experimental evidence that has accumulated since the

late 1930s. The cortical mechanisms that participated or participate in the regulation of emotion appear to be much more complex than Papez's theory suggested.

Subsequent developments have further complicated the problem. Today, it appears that most, if not all, of the *allocortical* and *juxtallocortical* structures are involved in the regulation of emotional behaviors, and no single mechanism which mediates a particular class of responses such as rage or fear can be pointed out. Anatomically distinct structures in the cortex may contribute selective aspects of a general regulatory function which integrates specific subcortical mechanisms; this notion is elaborated and in spite of some remaining contradictions, the majority of the available evidence suggests that restricted lesions within a rather large portion of the lateral limbic system reduce emotional reactivity, especially with respect to fear and rage.

Despite its criticism perhaps the most influential conceptualization of the 'emotional brain' over the last century has been the limbic system (**MacLean** 1949), an anatomical framework that outlines how emotions and moods are embodied in neural architecture. A core theoretical aspect of the limbic system framework is that emotion experiences arise from the integration of sensations from the external world with information from the body, specifically feedback from the viscera (**MacLean** 1949, 1975: **Dalgleish** 2004). The notion that emotion experience emerges from feedback from the body in tandem with higher level representation of the world partially echoes the seminal theories of emotion put forward by James and Lange. These controversial models argued that emotion experience arises directly from the perception of change in the body (**Adelmann** and **Zajonc** 1989; **Mandler** 1990; **Laird** and **Bresler** 1990; **Izard** 1990; **Lang** 1994; **Ellsworth** 1994; **Reisenzein et al**. 1995; **Damasio** 2004; **Prinz** 2004).

Arnold's Excitatory Theory of Emotion

Arnold (1950) attempts to trace the sequence of events in an emotion arousing situation from the perception of an external stimulus to experience and expression of the consequent emotion. According to her, any response presupposes the focusing of the 'autogenic activity' of the cortex on the stimuli that elicit it in a process of attention. This focusing occurs by means of the activation of *transcortical* or the *corticothalamic fibers*. These fibers modify the sensory input at either the cortical or thalamic level in accordance with our 'expectations'. The resulting emotional attitude then initiates nerve impulses from the cortex to centers in the thalamus-hypothalamus; these impulses touch of the appropriate pattern of emotional expression as well as the corresponding peripheral changes. The autonomic effects thus produced are then reported back to the cortex via afferent sensory pathways. This cortical perception of organic changes may again be evaluated as to 'how it affects me'. A complete emotional experience includes the whole sequence: 'evaluation, emotional attitude resulting in emotional expression, autonomic changes and their cortical perception and re-evaluation'.

Arnold suggests that the physiological reactions to various emotions may be mediated by different cortical systems. She proposes that fear and anxiety may be characterized by sympathetic stimulation which is regulated by centers in the posterior part of the hypothalamus and that these emotions are under the excitatory control of mechanisms located in the frontal lobes. Excitement is accompanied in this scheme by moderate parasympathetic stimulation. Anger or rage is on the same continuum but represents intense parasympathetic discharge. Arnold suggested that the parasympathetic division of the autonomic nervous system may be regulated by centers in the anterior hypothalamus. These are under cortical excitatory control which is exercised by the cingulate gyrus and hippocampus.

Critical Review

Shorn of its peculiar language, this theory provides a compromise between earlier notions. Arnold's contributions are the proposal that the cortical control is excitatory rather that inhibitory as conjectured by Cannon and the postulation that specific cortical area regulates particular types of emotions.

In everyday life, seemingly trivial events can trigger distinct emotional feelings because they evoke memories of past emotional experiences. From their own observations, most people would admit that memories of past experiences are an important determinant in the attribution of an emotional meaning to a given situation. With very few exceptions (e.g., **Arnold** 1950; **Mandler** 1984), this common sense evidence has not received much attention from emotion theorists **(Philippot** and **Schaefer** 2001). Although Magda B. Arnold is widely recognized as the pioneer of cognitive emotion theory in modern (i.e. post-behaviorist) psychology, the range and complexity of Arnold's theorizing as well as her direct and indirect influence on subsequent theorists is greatly underestimated. There is so far no systematic attempt to reconstruct Arnold's theory of emotion. Nor is there a systematic study of the historical influences on Arnold or of the influence that she, in turn, had on subsequent theorists.

Schachter and Singer Theory of Emotion

This theory also popularly known as the *Jukebox Theory*, the term *jukebox* coined by **Mendler** (1962), is based on an experiment performed by **Schachter** and **Singer** (1962). (See box, Experimental Perspective: The Jukebox Experiment).

This experiment had some variation in the sense that the stooge showed feigned anger and aggression instead of euphoria. In this case also, the same results applied related with emotional expression. Thus, the conclusion drawn was that the same drug produced different emotions depending upon the understanding of the situation. This leads to the understanding that though physiological arousal can set the basis for an emotion, but it is not sufficient – understanding and interpretation of the situation play an important role. In a jukebox, the insertion of the coin will activate it but the song played will depend upon which button is pressed. It is because of this jukebox example that this theory is called the jukebox theory.

EXPERIMENTAL PERSPECTIVE

Jukebox Experiment

Subjects were divided into three groups and injected with *epinephrine* which produces symptoms of fear. All subjects were told that it was a new vitamin compound and the study was related with its effects on visual perception. However, different information was given about the side-effects of the injection to the three groups. Group one was told the truth that the injection may produce a slight hand tremor, increased heart rate and a flushed feeling in the face. Group two was misled and told that it would cause numbness in the feet, itching sensations and a slight headache. The third group was told nothing. The subjects of each group after being injected were sent to another room to wait, with a second subject until the compound 'took effect'. This second subject was actually the experimenter's co-worker or stooge and the waiting period was in fact the experiment itself, since epinephrine acts very quickly.

In the room during the waiting period, the stooge began to act in a weird manner like making paper planes and flying them all around the room or making paper balls and playing basketball with them. He even hula-hooped with a piece of equipment kept in the room. He also invited the real subject to join him in his weird play. Whether this invitation was accepted or declined depended upon the group the subject belonged to i.e. the nature of the instructions received about the effect of the injection. Those who were correctly informed did not participate while those who were misinformed or not informed often participated in the weird play and behaved foolishly like the stooge.

This theory can be summed up as, '*Emotion-producing stimuli have two effects – a cognitive awareness of the meaning of the stimuli, plus a variety of physiological responses. In order for emotion to be deeply*

felt, the physiological response must occur and must be perceived. But these responses are rather vague and generalized, and can be attributed to virtually any emotion. The emotion they are attributed to is the emotion that is appropriate to the person's cognitive awareness of the situation'. Figure 10.8 depicts Schachter and Singer's Theory pictorially.

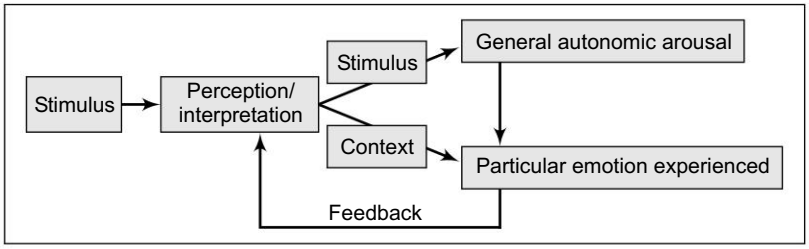


Fig. 10.8 Schachter and Singer's Theory

Critical Review

In the years ahead **Zillman** (1971), **Cantor**, **Zillman** and **Bryant** (1975) in separate studies have though found consistencies with Schachter and Singers theory but the theory has not remained without criticism.

Numerous methodological and conceptual flaws in this theory were subsequently articulated by psychophysiologists, who were particularly troubled by the naive physiological assumptions upon which it was based. In a carefully constructed critique, **Plutchick** and **Ax** (1967) systematically dismantled the study by cataloguing its errors: (a) the various conditions evoked different physiological arousal levels; (b) the placebo groups were not consistently different from any of the other groups (i.e., informed or uninformed) on various affective indices; (c) the self-report measures were deficient; (d) the study was not conducted in a double-blind manner; and (e) there was gross overgeneralization (i.e. to a global model of affective processing) based on a limited number of conditions, emotions and types of subjects. Further problems related to the validity of using an epinephrine injection to induce emotion have been noted (**Fehr** and **Stern** 1970). In retrospect, the methodology of **Schachter** and **Singer** (1962) has been characterized as 'exquisitely bad' (**Levenson** 1986). Moreover, there have also been several conspicuous failures to replicate **Schachter** and **Singer's** (1962) findings, leading to a heated debate in the literature (**Marshall** and **Zimbardo** 1979; **Maslach** 1979; **Schachter** 1979; **Reisenzein** 1983). Nevertheless, the study gained wide acceptance in the aura of the cognitive transformation that enveloped psychology in the 1960s and 1970s and the notion of ANS specificity fell into decline (**Levenson** 1992).

Opponent-Process Theory

The opponent-process theory was formulated by **Solomon** and **Corbit** (1973, 1974) and is compatible with mostly all the theories discussed so far in the sense that it does not attempt to specify where emotion comes from or what it consists of. Instead, it explains motivation which is behind such hard to understand human behaviors such as thrill-seeking, masochism and addiction.

The basic assumptions about emotional states of this theory are as follows:

1. Whenever a stimulus causes an emotional reaction, it also causes another emotional reaction that is opposite to or the opponent of, the initial reaction – hence the name of this theory.
2. The opponent process is aroused more slowly and decays more slowly, than the initial reaction.

3. With repeated experience, the initiating and the opponent states slowly change character.
4. With repeated experience, the opponent state gets stronger but the initiating state does not.

The above four assumptions explain very simply a common sequence of emotional reactions. Let us take the example of James's bear which he met in the jungle. When the eliciting stimulus (bear) was present, he had a very strong emotional reaction (stark, petrified, fear). With every passing second, the emotion reduced a bit but remained steady (plain old fear). This reduction in the peak of emotion has been explained by Solomon and Corbit because of the opponent process (relief, in this example) as it slowly gets activated, subtracting from the initiating state, thereby reducing it. When finally the initiating stimulus is withdrawn (the bear leaves), one experiences a completely different emotion from the one he had just been experiencing. This, they explain, is due to the rapid disappearing of the initiating state (fear) when the stimulus is withdrawn giving rise to the opponent state (relief). This finding of theirs has been experimentally tested by many psychologists and has proved worthy.

Another implication of this theory is also of importance and that is its reverse is also true – pleasant initial reactions will be followed by an unpleasant opponent process. This can be seen in various kinds of addictions where after a period of pleasurable high there are the different hangovers depending on the drug consumed.

Their explanation to masochism (self-punishing) is somewhat based on similar application of the above. According to them, an individual submits to painful or unpleasant abuse in order to experience the positive process afterwards. However, this opponent process of pain leading to pleasure is considered abnormal or deviant behavior when it is associated with masochistic behavior of any kind.

Mechanisms Underlying the Opponent Processes

The mechanisms that underpin opponent processes have not been characterized definitively. Potentially, opponent processes evoked by adverse events and opponent processes evoked by positive event might correspond to distinct mechanisms. For example, opponent processes elicited by adverse events might represent forms of emotional regulation that become automatic over time (**Bargh** and **Williams** 2007). After an adversity such as a failure, individuals might attempt to focus on the positive implications of this episode. Repeated attempts to focus on positive implications might become automatic with time and thus might be elicited more rapidly and persist effortlessly. Opponent processes evoked by positive events, however, might evolve from other mechanisms. Individuals might learn that desirable events do not always culminate in persistent positive emotions, because other complexities often intervene (affective forecasting). Over time, they might associate positive events with negative consequences.

Implications and Evidence of Opponent Process Theory

There have been many studies done which lend support to the opponent process theory. **Bowling**, **Beehr**, **Wagner** and **Libkuman** (2005) believe that the emotional response of parachute jumpers, characterized by **Epstein** (1967), can be ascribed to opponent process theory. They found that when a parachute jumpers makes his initial jumps, he experiences intense negative emotions, representing primary processes, followed by negligible, if any, positive emotions, representing limited opponent processes. On the other hand, jumpers who are experienced experience less intense negative emotions followed by pronounced positive states. That is, with experience, the opponent processes, which foster positive states, are elicited rapidly and maintained appreciably.

The opponent process theory has also been tested in the context of electric shocks, opiate use and romantic love in separate studies done by **Ettenberg**, **Raven**, **Danluck** and **Necessary** 1999; **Hoffman** and **Solomon** 1974; **Ley** 1994; **Myers** and **Siegel** 1985. The conclusions of all these studies was that over time, aversive

events eventually become more likely to elicit positive emotions. In addition, desirable events, over time, become more likely to evoke negative emotions. Studies done in the organizational settings show that emotional responses to changes in the work context are often transient, consistent with opponent process theory. In a study done by **Williams**, **Suls**, **Alliger**, **Learner** and **Wan** (1991), they found that conflicting roles at work initially evoke negative emotions--emotions that gradually abate over weeks.

In conclusion, it can be said that this theory allows the organism to damp down emotional reactions, to keep them from becoming too strong or too removed from neutral. According to **Thompson** and **Spencer** (1966), since severe emotional reactions can be deliberating and can interfere with new learning, such type of emotional damping systems appear to have adaptive survival value.

PSYCHOLOGY NUGGET

Disciplinary Views on Emotion

- Different disciplines deal with different aspects of emotions.
- Human sciences study the role of emotions in mental processes, disorders and neural mechanisms.
- In psychiatry, we analyze emotions as a part of the discipline's study and treatment of mental illnesses in humans.
- In linguistics, the expression of emotion may change to the meaning of sounds.
- Nursing studies emotions as part of its approach to the provision of holistic health care to humans.
- In education, the role of emotions in relation to learning is examined.
- Psychology examines emotions from a scientific perspective by treating them as mental processes and behavior and they explore the underlying physiological and neurological processes. In neuroscience sub-fields such as social neuroscience and affective neuroscience, scientists study the neural mechanisms of emotion by combining neuroscience with the psychological study of personality, emotion and mood.
- In sociology, emotions are examined for the role they play in human society, social patterns and interactions, and culture.
- In anthropology, the study of humanity, scholars use ethnography to undertake contextual analyses and cross-cultural comparisons of a range of human activities. Some anthropological studies examine the role of emotions in human activities.
- In the field of communication sciences, critical organizational scholars have examined the role of emotions in organizations, from the perspectives of managers, employees and even customers.
- In economics, the social science that studies the production, distribution and consumption of goods and services, emotions are analyzed in some sub-fields of microeconomics in order to assess the role of emotions on purchase decision-making and risk perception.
- In criminology, which is a sociological approach to the study of crime, scholars often draw on behavioral sciences, sociology and psychology. Emotions are examined in criminology issues such as anomie theory and studies of 'toughness', 'aggressive behavior' and 'hooliganism'.
- In political science, emotions are examined in a number of sub-fields such as the analysis of voter decision-making.
- In philosophy, emotions are studied in sub-fields such as ethics, the philosophy of art (for example, sensory-emotional values, and matters of taste and sentimentality) and the philosophy of music.
- In history, documents and other sources are examined to interpret and analyze past activities. Speculation on the emotional state of the authors of historical documents is one of the tools of interpretation.
- In literature and film-making, the expression of emotion is the cornerstone of genres such as drama, melodrama and romance.
- In communication studies, scholars study the role that emotion plays in the dissemination of ideas and messages.
- In ethology, emotion in non-human animals is studied. It is a branch of zoology that focuses on the scientific study of animal behavior.

PHYSIOLOGY OF EMOTION

All the internal and many of the external signs of emotion are commanded by the autonomic nervous system and carried out by smooth muscle tissues of the viscera, by the heart muscles, and by the glands. Of course, some of the objective signs of emotions such as smiling, cowering or fleeing are carried out by the somatic nervous and muscular systems. The modern point of view is that the two systems are different peripherally, but similar and intermingled. At any rate, an understanding of one's emotional life is not possible without some rudimentary knowledge of how the nervous system functions in emotion.

Autonomic or Visceral Nervous System

The autonomic or visceral nervous system sends fibers to the visceral organs of the chest, abdomen and pelvis and to other structures containing smooth muscles or glandular tissue (the efferent part of the somatic system sends impulses only to the skeletal muscles). The term autonomic is a misleading one since this part of the nervous system is neither autonomous (self-regulating) nor automatic. It is made up of a set of reflex areas which are subject to the control of certain centers in the brain just as are the reflexes of the somatic nervous system, but with the important difference that in the case of the visceral nervous system, these centers are largely in the hind brain rather than in the cerebral cortex. Thus, very little voluntary control of visceral functions is possible without special training. Control of the skeletal muscles can, of course, be either reflex or voluntary.

The autonomic nervous system also differs from the somatic components of the nervous system in having synapses outside the central nervous system. All the synapses of the somatic components are located in the brain and the spinal cord. Figure 10.9 shows the processes in the autonomic nervous system.

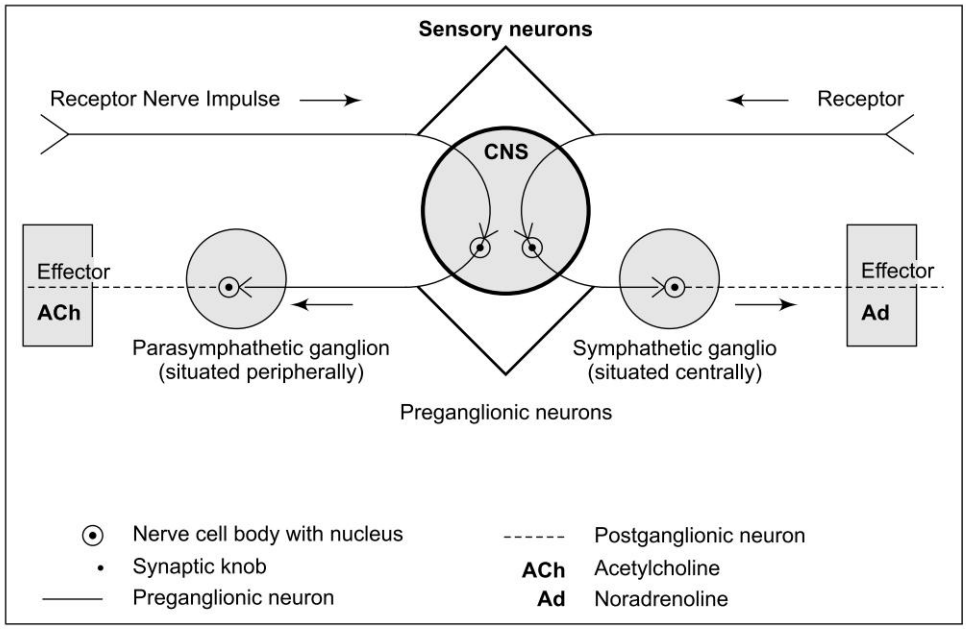


Fig. 10.9 Autonomic Nervous System Process

Sympathetic Division

Branching off from certain of the spinal nerve roots are small bundles of fibers which run to a chain of *ganglia* lying on either side of the spinal cord. The fibers run up or down in this chain and then form a synapse with *effector neurons* that run to smooth muscles and glands of the skin, via nerve branches which rejoin the spinal nerves. At certain points, nerves leave this chain and pass to more distant ganglia where their fibers synapse with others that run to the visceral organs. Since the fibers of this system originate only in the spinal cord segments in the middle of the back, *thoraco-lumbar*, but ultimately reach structures from the head to the toes, it is clear that the sympathetic chain is a disturbing mechanism containing many fibers running up and down, giving off numerous collaterals. This part of the autonomic nervous system is called the sympathetic division because early anatomists believed that its function was to make the visceral organs work 'in sympathy'. Figure 10.10 shows the visceral reflex arc and the sympathetic chain.

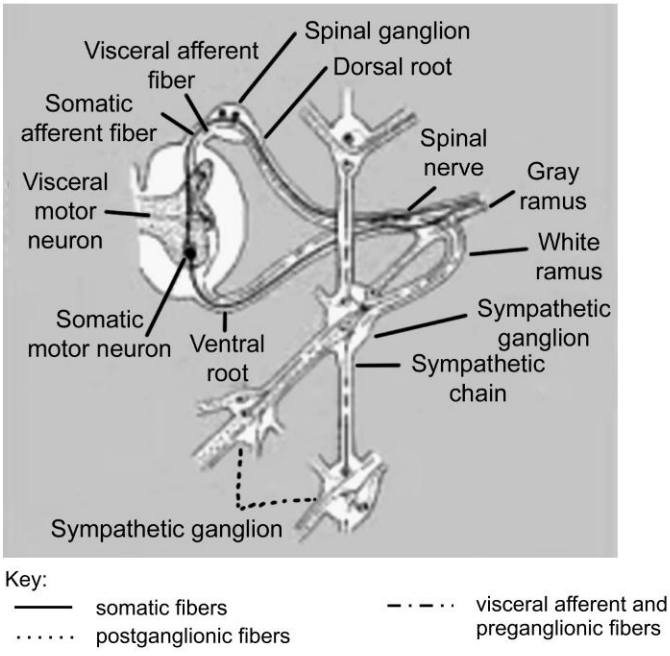


Fig. 10.10 Visceral Reflex Arc and the Sympathetic Chain

Parasympathetic Division

From the lower segment of the spinal cord and from the brain stem originate certain nerves which look like ordinary spinal and cranial nerves but, when traced, are found to pass to visceral structures rather than to skeletal muscles and like the sympathetic nerves, they are interrupted by a synapse outside the central nervous systems, often in the wall of the organs innervated. Since they branch off from the central nervous system above and below the sympathetic nervous fibers, they are known as the parasympathetic or *cranio-sacral* division of the autonomic system.

Most organs of the chest and abdomen receive fibers from both divisions and where this happens, the action of the two divisions is always antagonistic. If one inhibits or decreases its activity, the other excites

the organ to increased activity. Thus, the autonomic nervous system makes for a very effective control of the visceral organs. Which of these systems inhibits or activates a particular organ depends on what that organ does. Figure 10.11 shows the diagrammatic representation of the parasympathetic nervous system.

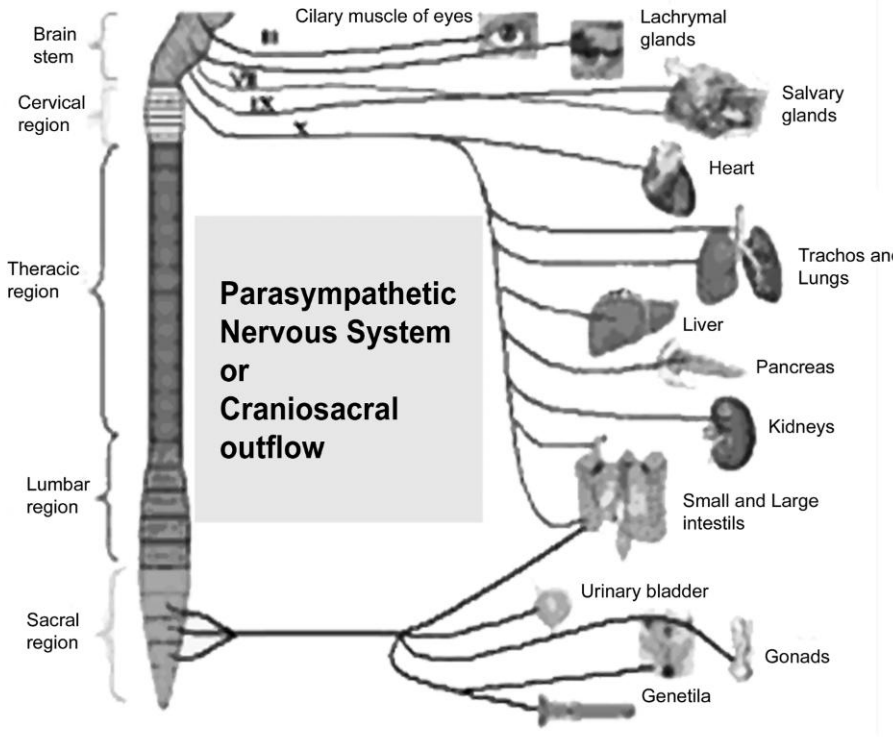


Fig. 10.11 Diagrammatic Representation of the Parasympathetic Nervous System

Division of Labor in the Autonomic Nervous System

Most of the vital functions of life are governed by the parasympathetic division. The sympathetic plays a minor role in such activity; in fact, the whole sympathetic division has been removed from animals without greatly disturbing the ordinary processes of life. The parasympathetic division protects the eye from bright light by constricting the pupil and adjusts the lens of the eye for near vision. It also controls the passage of food along the alimentary canal, its digestion and finally the elimination of wastes. During sexual excitement, the sexual organs become diffused with a richer supply of blood by the action of this division. During orgasm, the sympathetic division is in control proving that the two divisions are not always antagonistic but can work together in sequence.

If the parasympathetic is the drudge that carries on the everyday tasks of life and meets the minor exigencies, the sympathetic division is the trouble shooter which takes charge in the case of a serious emergency. It operates when the life of the organism is threatened and it calls upon all the reserves of energy which parasympathetic activity has build up and held in abeyance for just such emergencies. The sympathetic is known to take over under three conditions:

1. During cold so extreme as to threaten life

2. During any violent effort or exercise
3. During fear and rage

The action of the sympathetic division in anger includes dilating the pupil of the eye, lifting the lid overwide and protruding the eyeball, speeding up the heart beat and raising the blood pressure. In extreme anger, the sympathetic division enables the liver to pour out sugar to be used by the muscles, the spleen to pour out more blood cells to carry oxygen and the bronchioles to dilate so that more air reaches the lungs. There is a cessation of the digestive movements, of peristaltic contraction of the stomach and of secretion of digestive juices. The blood that would normally go to these organs is diverted to the muscles. In hairy animals the hair stands on ends, in humans this is seen as a vestigial response in the form of 'goose flesh'. Finally, the adrenal glands are spurred to great activity and the adrenaline secreted into the blood stream duplicates the actions of the sympathetic division and hence reinforces all the above processes. Figure 10.12 shows the division of labor in the autonomic nervous system.

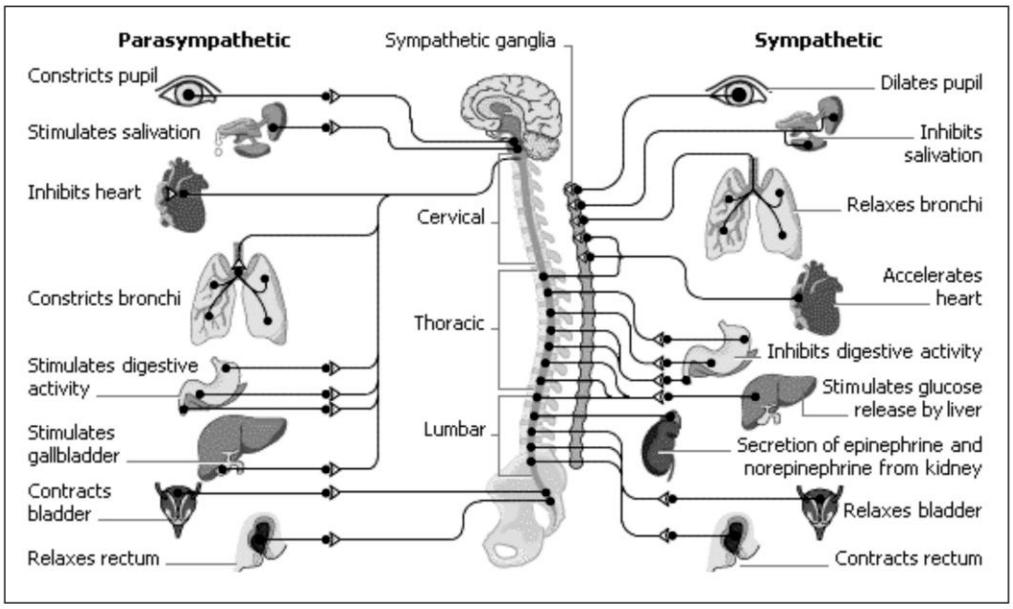


Fig. 10.12 Division of 'Labor' in the Autonomic Nervous System

Visceral Sensation

In the same nerve with the motor fibers going to the visceral organs are numerous sensory axons returning from them. Those found in parasympathetic nerves usually conduct impulses giving rise to organic sensations from the stomach, colon and bladder. The latter are necessary for the reflex control of the viscera in such functions as vomiting and urination. This double pathway of sensation from the viscera makes it possible for surgeons, by seavering appropriate sympathetic nerves, to relieve excrutiating pain from diseased visceral organs without affecting the message that travels over parasympathetic fibers involved in homeostatic adjustment.

Ordinarily, we are quite unaware of any movement going on in our viscera. The pupils of our eyes dilate in pain, but we do not become aware that they have done so. When we believe we are aware of our viscera, as in thinking we feel the heartbeat, we are really receiving the sensation from the chest wall and not over the

sympathetic nerves from the heart. If the abdominal cavity is opened under local anesthesia, the viscera can be cut, pinched or even burned without arousing pain. Yet severe, unbearable pain can arise in the viscera in the form of cramps, stomach aches and so on, and we are all familiar with strong sensations of hunger and nausea. Because of the protected position of the viscera, there has been no occasion of sensitivity to cutting and burning to develop, whereas distentions and contractions have become adequate stimuli.

Visceral sensations differ from those arising from the skin in that they are diffuse and poorly localized despite their intensity. In fact, they are often wrongly localized and seem to come not from the viscera but from the skin. Thus, severe pain originating in a diseased heart may seem to come from the chest wall or sometimes even from the back of the arm.

Centers of Emotions in the Brain

The autonomic nervous system is only the peripheral part of the neural mechanism for emotion. Higher centers in the brain receive messages from it and deliver messages both to it and to the somatic nerves to give the patterns of emotional display. Both cortical and subcortical structures are involved.

Cortical Functioning in Emotion

The cerebral cortex produces measurable electrical activity. Changes in pattern of these brain potentials during emotion indicate that the cortex plays a role in emotional behavior. The apparatus used in obtaining is known as the EEG's recorder.

It is known that cognitive factors play an important role in defining and directing emotional responses. These cognitive factors depend in part on cortical functioning. There seem to be at least three distinct ways in which cortical functioning affects emotional responses:

1. The cerebral cortex is involved in relating current events to past experience - a process which helps to interpret the situation and determines whether or not it arouses emotion.
2. The cerebral cortex has some power to execute visceral activity, which is commonly associated with emotional responses. The acceleration of the heart rate as a result of doing mental arithmetic may be an example of this. Even more direct evidence comes from the stimulation of a strip of cortex running bilaterally from the underside of the *frontal lobes* back to the tip of the *temporal lobes*- a part of the primitive transitional cortex. Such stimulation produces visceral responses and vocalization which some investigators have interpreted as being fragments of emotional responses. In contrast to the subcortical emotional centers, these cerebral areas may be responsible for the integration of some of the more complex forms of emotional behavior.
3. The cerebral cortex also serves as a check on unrestrained responses. Normally, the intensity of emotional responses tends to be proportional to the seriousness of the situation. But when certain parts of the cortex have been destroyed or affected by alcohol, the individual makes wrong or excessive emotional responses. A dog or a cat without its cerebral cortex shows no gradations in intensity of emotion, exhibiting only the most primitive emotional responses of pain, rage and fear, plus certain basic sexual responses (**Bard** 1934).

The forward parts of the frontal lobes, called the *prefrontal* areas, are particularly concerned with the inhibition of certain kinds of emotions and the expression of others. Damage to them changes the emotional life of the patient—the kind and strength of his emotions, their appropriateness to the situation and particularly their intensity. Patients with damage in this area are likely to become lazy, profane and untidy in their personal habits to the extent of urinating in public or upon the floor at home.

The cerebral cortex is certainly involved in both the maturation and the learning that change the infant's 'all or nothing' emotion to adult emotional reactions, with all their graduations, flexibility and subtle nuances. The unrestrained outbursts of the child are not unlike the 'sham rage' of the decorticated animal: in both cases

cortical control is lacking. However, the details of the role of the cerebral cortex in emotional development are still largely unknown.

Subcortical Functioning in Emotion

The exaggeration rather than disappearance of certain emotions after removal of the cerebral cortex proves that subcortical structures can organize some emotional responses. These structures have been identified as lying below the cerebral cortex and above the midbrain. Cutting away from the brain down the midbrain ends all display of emotion.

The important structures between the cortex and the midbrain are the *thalamus*, which receives impulses from the whole body, including the viscera, the *subthalamus*, just beneath it, which exerts control over the voluntary muscles of emotional expression and the *hypothalamus*, an important center controlling both the sympathetic and the parasympathetic system. The *rhiencephalon*, the oldest part of the cerebral hemisphere, contains both primitive cortical and complicated subcortical nuclei. Figure 10.13 shows the view of the brain.

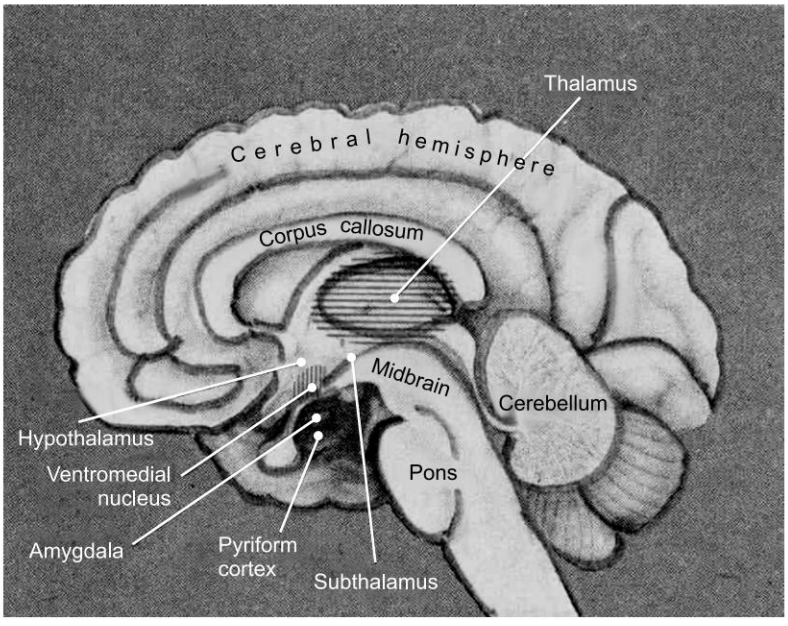


Fig. 10.13 View of the Brain

Disease or tumour of these important regions changes the whole emotional life of the patient. A lesion in one spot may bring about a condition of emotional apathy, somnolence or even narcolepsy. Lesions in others may bring bursts of uncontrollable laughter or tears although the patient feels a contrary emotion or no emotion at all.

It seems safe to conclude that outward and inward behavior and the experience of emotion is not one and the same thing (**Harlow** and **Stagner** 1933). This raises two questions: which part of these subcortical areas carry out expression of emotion (muscular, visceral and glandular responses), and which ones play a part in the experience or inward aspect of emotion?

Subcortical Mechanisms and Expression of Emotion

It is pretty certain from experiments in which the whole cerebral cortex and parts of the older structures have been cut away that the thalamus and the hypothalamus are themselves capable of executing primitive emotions of rage, fear and sex. Corroborating evidence is found when electrical currents are passed through this region. Stimulating certain parts of the hypothalamus has been found to throw the animal into rage behavior or into fear-like behavior. These are patterns of behavior involving somatic and visceral components. Rage may be directed to the experimenter, flight to a weak point in the cage.

Besides this fear-rage executing area, the hypothalamus contains the *ventromedical nucleus*, which restrains emotion. Tame rats that have been deprived of this nucleus become savage and will bite a metal rod repeatedly. It thus appears that nerve cells in or around the ventromedical nucleus normally help inhibit the primitive rage response, which then breaks loose when the area is destroyed.

Further forward, in front of the hypothalamus, is another receptor of the brain which also helps to suppress primitive emotional reactions. This is the *septal region* of the *rhinencephalon* and in lower animals it is located along the dividing line between the two hemispheres, just below the front bend of the *corpus callosum*. The components of the primitive septal region, while still present, are spread more diffusely in this area but presumably still have similar functions.

Destruction of this septal area cause rats to overreact emotionally to handling or to a startling sound, to urinate or defecate, or to attack an object placed near them—mixture of fear and rage responses (**Brady** and **Nauta** 1953, 1955). Septally-damaged animals also learn more quickly than normal ones to avoid anticipated punishment when a warning signal is presented (**King** 1958). More recently, however, experiments have made it clear that the septal area and other parts of the rhinencephalon as well are concerned not solely with the control of emotional behavior but also with response suppression in a number of non-emotional types of behavior. Psychologists have just begun to characterize the septally-damaged animals as generally perseverative or compulsive in their behavior (**McCleary** 1966).

In experiments done in the past, it was discovered that when the temporal lobes of monkeys, including a part of the rhinencephalon within, were removed, the monkeys showed bizarre 'oral tendencies' exploring every object by sniffing it and touching it repeatedly with the lips. The same type of damage resulted in increased sexual activity and had a marked taming effect on the normally wild animals—monkeys (**Kluver** and **Bucy** 1939). It is now known that the exact area involved in the changed sexual behavior is the *pyriform cortex*, a layer on the outside of the temporal lobe. Lesions here cause male monkeys and cats to become so active sexually that another male monkey, cat, a mouse or even a hen becomes a sexual object. It is not yet clear whether these animals are 'hypersexual' in the usual sense of the word or simply are unable to abide by the innate restraints that normally circumscribe the sexual behavior of a particular species.

Removal of the amygdala, lying inside the temporal lobe just above the pyriform cortex, was apparently responsible for the taming effects of Kluver and Bucy's large temporal lobe lesions. It is now known that after its destruction alone, wild animals cease to bite and scratch when handled or even pinched (**Schreiner** and **Kling** 1956).

The behavior that follows removal of these areas is the reverse of the behavior they promote when stimulated in the intact animal. Thus, the amygdala acts as an accelerator of emotional responses, with separate zones for defensive behavior and attack behavior having been identified (**Ursin** and **Kaada** 1960). Parts of the cerebral cortex, the septal region, the ventromedial nucleus and the pyriform cortex, on the other hand, function as brakes. If you remove the acceleration, the animal becomes tame; if you remove the brakes, it runs wild.

Damage to the second member of one of the opposing pairs of structures in the rhinencephalon can offset the effects of damage to the first. A rat made savage by septal damage is promptly tamed by damage of the amygdala **(King** and **Meyer** 1958). Experiments such as this also make it clear that the rhinencephalon

has more than one behavioral function. Even when the septal rage reaction is eliminated by a subsequent amygdalectomy, the experimental animal still shows the compulsive behavior which is also produced by septal damage (**Schwartzbaum** and **Gay** 1966).

The exact interconnections of all these areas are not yet worked out. It may be that they are linked together as a chain, with messages going from the septal region to the ventromedial nucleus and on to the posterior hypothalamus. Or, it may be that messages from these areas act directly on to the nerve fibers that produce the visceral and skeletal muscle signs of emotion. Continuing research will undoubtedly tell us more about them.

Subcortical Mechanisms and The Experience of Emotion

Does the animal that attacks or flees during stimulation of the hypothalamus 'feel angry' or 'feel afraid', as the case may be? To answer this question, the psychologist must again use methods of experimental psychology since, obviously, the animal cannot introspect and report his experience.

Conditioning experiments provide us with important clues. For example, if a cat is trained to turn off a switch whenever it receives a shock to its feet—escape conditioning and the shock is then transferred to the rage-fear center of the hypothalamus, the cat will immediately shut off the current (**Nakao** 1958). A cat can also be trained to avoid a dish of food by stimulation of the fear-rage center (**Delgado**, **Roberts** and **Miller** 1954). If we can assume that the cat finds the shock to the foot unpleasant, we can make the same assumption about the hypothalamic shock, since it also serves to motivate learning.

Further insight into emotion and motivation comes from experiments in which an electric current has been applied to deep brain structures in rats, and the animals have repeatedly sought the stimulus (**Olds** 1962; **Valenstein** 1966). These centers in the brain are called reward centers because the electric current seems to act as a reward or reinforcement like food or water and the animal actively seeks it, even crossing on electric grid to press the bar. The brain areas that yield the highest bar-pressing rates include the septal region, the lateral hypothalamus, and the central part of posterior hypothalamus (**Olds** and **Olds** 1963). (It must be remembered that stimulation should produce the opposite effect from a lesion.) The cerebral cortex and most of the thalamic centers leading to it give consistently low self-stimulation scores, indicating again that many aspects of emotion are carried out subcortically.

Experiments offers particularly strong evidence that some kind of 'feeling' is associated with the activation of these reward centers in the brain. From such experiments, we conclude that the hypothalamus does more than execute emotional behavior by sending impulses to the muscles and glands. Evidently, it also plays a part in the experience of emotion or sends impulses to some other areas which do.

Conclusion

The search for the physiological substrates of emotion has produced much research and theory. Inevitably, some of this has been sophisticated, useful and suggestive and some have been naive, poorly conceived and on occasion, even obstructive. Unfortunately, however, the better work is inconclusive.

The lack of firm, detailed, empirical facts also characterizes the more traditional physiological approach to emotions. We can be certain that the brain stem, the thalamus and the hypothalamus, the limbic system, and to an extent, the neocortex are implicated in emotion. We can also say that endocrine changes are important and that the periphery has a part to play and that there are underlying neurochemical changes. We cannot even assign a relative importance to peripheral and central mechanisms, the ANS or CNS. Nowadays, there are few psychologists who would argue for a mass action concept of brain function. On the other hand, those who work from the localization standpoint use relatively crude techniques; they can rarely be sure of the precise relationship between structure and function.

It is perhaps hardly surprising that the physiologically-oriented theories are of little help. Often, they include far too high a ratio of physiological speculation to empirical fact. Or they are sometimes too narrow, attempting to generalize from a consideration of but one aspect of emotion.

Perhaps the most important final point to bear in mind is that whatever frontiers are passed in research into the physiology of emotion, a complete analysis of the subject cannot be made via physiology alone. That there are important physiological concomitants of emotion is without doubt but to affirm that emotion is in some way caused by physiological change is as arbitrary as saying that the physiological responses are caused by behavioral change. However, to gain a full understanding of emotion, we must analyze the physiological mechanisms involved in it. To do this accurately, there must be more precision on the side of the independent variable (physiological manipulation) and more sophistication and breadth on the side of the dependent variable (behavior).

EMOTIONAL EXPRESSION AND RECOGNITION

Clearly, all recognition of emotion is determined by a very complex process. This process depends on the integration of many cues, from facial expression through body movement to the situation and the more static features of the interactants; while at another level, the process depends on any hypotheses which we may hold about life. **Frijda** (1969) offers the most complete formulation:

1. The understanding of a situation and its implications.
2. A store containing factual and emotional implications; many possible emotions connected with varying probabilities assigned to each situation.
3. We are 'set' for a person in a situation to experience a particular emotion.
4. A store emotional knowledge; emotions and their scale values—from which we also get our own emotional expression.
5. The system must be able to register expressive behavior and code it.
6. A working out of expressive meaning.
7. A comparison of expressive meaning and situational suggestions.
8. A combination of 4 and 6.
9. An emotion is selected from the store in 4.
10. An adjustment is made if the selected emotion does not confirm to expectations.
11. A mechanism to resolve any continuing discordance.
12. The selected mechanism then defines a new emotion.
13. Finally, there is the construction of situational components to fit with the selected emotion.

Frijda (1970) simplifies this formulation to three main points:

1. Categorizing an observed behavior pattern in terms of a set of general dimensions of emotion.
2. Further differentiation.
3. The specification of probable emotion from situational cues or suppositions.

Theoretically, **Frijda** (1970) suggests that his view of emotional expression is also applicable to emotion in general. But the relationship between expressive behavior and emotion is too complicated for this sort of direct inference to be made. It is clear that every emotion can occur in many different expressions, sometimes with very little in common, and often with little hope of its recognition out of context. On the other hand, all the complex combinations of expression make sense in their situational context.

It should be said that in spite of the various attempts to define dimensions of emotional meaning, the process is more complicated than simply inferring the dimensions of emotion directly from the dimensions of

the recognition of emotional expressions. And in real-life situations with all their other cues, our recognition and even the recognition process itself may be quite different from those suggested by lab studies.

In spite of the above conclusions, research (**Izard** 1972; **Ekman *et. al.*** 1972) has demonstrated the importance of the facial expression of emotion. The general implication of Izard's and Ekman's research is that facial expression may fill an information gap which is left in any primarily visceral and cognitive theories of emotion. It allows emotions to be distinguished, allows emotions to change quickly, and also gives more possibility for subjective feedback than is given by the viscera alone. Thus, it is reasonable to argue that any theory of emotion should be like **Izard's** (1972) or **Mandler's** (1975), not only including visceral physiological arousal and cognition but also facial expression.

Following these general considerations, it is important to conclude with some of the more cogent theoretical analyses of the role of facial expression in emotion. These are taken from the ideas of **Tomkins** (1962) and more particularly **Izard** (1972). Tomkins argues that innately determined subcortical programs generate organized patterns of emotional facial expression, such patterning also occurring in the viscera, the endocrine system and in physiological responses generally. He also suggests that when we become aware (via feedback) of facial responses, then we become aware of the emotion. However, emotion can also occur with such awareness, which then becomes a sufficient but not necessary condition for emotion. Izard rests his analysis of facial expression on two assumptions:

1. Emotion is a complex of the physiological, muscular and phenomenological, and has a biological and psychological function for the individual and a social function in interaction. Also, the three levels of emotion are both independent and interdependent. It is feedback which permits an integration of these components into a process and which allows differentiation between the emotions.
2. The relative importance of facial and bodily activity in emotion has changed during the course of evaluation, such developments being paralleled in ontogency. The general point here is that the importance of the face in emotional differentiation and communication increases with *phylogenetic* and *ontogenetic* development, this being in accord with a similar development of the facial muscles.

Izard assumes that feedback from facial expression generates increased hypothalamic activity and a correspondingly more intense emotional experience that would be given from a memory image alone. The experienced emotion would be more precise and complete. Further on, he points out that facial expression is significant in both brain-body communication and interpersonal communication.

COGNITION AND EMOTION: A CRITICAL ANALYSIS

There have been sufficient conceptualizations of emotion which give an important, if not crucial, role to cognition to ensure that these types of analysis are firmly entrenched. Until recently, Schachter's views were probably the most important in this field, namely, that there is scant physiological differentiation between emotional states, rather, distinctions are made on the basis of cognitive labeling. This notion gains support from the work of **Valins** (1970) and others on the perception of bodily change as distinct from the bodily change itself. Breath is also added by **Nowli and Nowli's** (1956) work on mood. In general, these three types of investigation point to an interaction between internal and external cues in emotion.

An important result of Schachter's type of approach to the study of emotion is to have given greater credence to James's ideas. Schachter deals convincingly with a number of Cannon's criticisms of James's, and although his own work is not above criticism it does not point forcefully to the significance of visceral arousal to emotion.

A second major influence on cognitive analysis of emotion has come from the idea of appraisal, although this has less to be said in its favor. As used by **Arnold** (1950) and **Lazarus** (1968), the appraisal tends to be

an elusive concept empirically. At best, appraisals can only be inferred from behavior, although of course it may be that they have a neurophysiological substrate.

There are also large-scale conceptualizations made by **Mandler** (1975) and **Izard** (1972). These are ambitious and far reaching, and sometimes deal very credibly with concepts such as consciousness which psychologists have been too ready to leave out of their consideration. It is likely that these views will become very influential in the next few years and by now it is significant that they give a central role to cognition in emotion. Such potential influence is made more probable since they lay great stress on expressive behavior. This is leading to some important empirical developments in the social psychology of emotion and interesting theoretical developments in the control of emotion.

Finally, the distinction between cognitive activity and emotion experience is probably better conceptualized as more of a gradient rather than two independent systems that can interact with one another. Although scientists are used to thinking about cognitive events (such as thoughts, memories and beliefs) as separate from emotional events, this distinction is probably phenomenological rather than causal and does not seem to be respected by the brain. Brain structures at the heart of the neural circuitry for emotion (e.g. the amygdala) impact cognitive processing from early attention allocation (**Holland** and **Gallagher** 1999) through perceptual processing to memory (**Phelps** 2006). Similarly, brain structures involved in the neural circuitry for cognition, such as DMPFC and VLPFC, have an intrinsic role in the experience of emotion. Decision-making processes that are traditionally thought of in cognitive terms, such as moral reasoning, seem to have core affect as their basis (**Greene et al.** 2004; **Haidt** 2001), and unrelated experiences of emotion can also color diverse outcomes (**Loewenstein** and **Lerner** 2003) and stereotyping (**Bodenhausen** and **Moreno**

PSYCHOLOGY NUGGET

Is Cognition Necessary for Expression of Emotion?

Is cognition and, in particular, cognitive appraisal, necessary for the perception of emotion? Is it possible that if people lack the cognitive capacity to make a particular appraisal of an event, then can they experience the emotion that is normally associated with that event? **Lazarus** (1982, 1984, 1991, 1993) has added greatly to our understanding of emotion and coping processes (*coping processes means ways of dealing with stressors—usually a mixture of being problem-focused and emotion-focused)*. He believes that an event must be understood before emotion can follow. On the other hand, **Zajonc** (1980, 1984) argues that cognition and emotion are independent, with emotion even preceding cognition in some cases. This debate about whether cognition necessarily precedes or follows emotion turns on the definition of cognition. It is clear that conscious thought is not involved in some rapid emotional reactions. A sudden screech of brakes tends to produce an unthinking, uncontrolled emotional reaction. But it can also be argued that some appraisals might also occur unconsciously and immediately. If such appraisals are cognitions, then all emotion is preceded by and involves cognition. The alternative is that some emotions involve cognition and others o not. Perhaps, this is an arid debate. In everyday life, the interplay between emotion and cognition is very intricate. There is a huge difference between the internal lurch you would feel at a sudden loud noise in the middle of the night and the combination of thoughts and feelings you would experience if this turned out to be the precursor to your house going up in flames. In other words, a simple, immediate reflex action that might send a burst of adrenaline through the system is very different from the complexities of emotional reaction when the cortex is involved and specific hopes, fears, memories and expectations are implicated. The reflex system is primitive and very much centered on the 'now', whereas what might be termed 'real' emotion also involves the past and the future (*through appraisals*). It is clear that emotions can—or, as Lazarus would argue, must—result from appraisal. It is also clear that emotional states can affect thoughts and even subsequent emotions. You have judged that your partner as been unfaithful to you (*appraisal*) and this makes you react jealously (*emotion*). But when you are jealous (*emotion*) this may in turn stop you thinking (*cognition*) as clearly as you normally would, and you may become anxious (*emotion*) about that.

2000; **DeSteno et al.** 2004). Consider the distinction between feeling and thinking, compared with other phenomenological boundaries respected by the brain, such as visual and auditory processing. No one would ever mistake seeing for hearing (although one sensory representation might trigger another), but the same cannot be said for feeling and thinking.

Overall, it is a hard matter to determine whether or not the cognitive approach to emotion is worthwhile. It leads to hypotheses which are sometimes difficult to test directly. On the other hand, it has inspired some ingenious and interesting research, which is meaningful and worthwhile in its own right, specifically, Schachter's drugs, Valin's nudes and Lazarus's stressful films.

Assuming that cognitions are important determinants of emotions, then it should be pointed out that even then they may apply to certain types or classes of emotion. The usual emotions discussed by the cognitive theorists are the milder ones. Finally, though, it does seem likely that the next few years will see a proliferation of research into emotion with very much of a cognitive bias. Much is being done in the area of expressive behavior, and information-processing models of emotion such as **Leventhal's** (1974) may well begin to appear.

CONCLUSION OF MULTIPLE PERSPECTIVES ON EMOTION

From an evolutionary perspective, emotions, like many of our physical attributes and psychological processes, represent time-tested solutions to adaptive problems (**Tooby** and **Cosmides** 1990). In particular, emotions are thought to have arisen because they efficiently co-ordinate diverse response systems, thereby help us respond to important challenges or opportunities (**Levenson** 1994). Take fear, for example. When we are afraid, our senses are sharpened, our muscles are primed to move us quickly out of harm's way, and our cardiovascular system is tuned to provide increased oxygen and energy to large muscle groups that will be called upon when we flee. These emotional reactions typically are short-lived and involve changes in subjective experience, expressive behavior, and central, autonomic and endocrine response systems (**Lang** 1995). Different emotions are thought to address different adaptive problems (**Ekman** 1992; **Izard** 1977; **Plutchik** 1980), although there is currently a lively debate about the extent to which each emotion calls forth distinguishable, cross-situationally consistent physiological (**Cacioppo**, **Klein**, **Berntson** and **Hatfield** 1993; **Levenson** 1992; **Zajonc** and **McIntosh** 1992) and behavioral (**Ekman** 1994b; **Frijda** 1986; **Russell** 1994) responses.

For many years, the study of emotion was considered too subjective for mainstream psychology. However, in the last 40 years or so, there has been a renaissance in emotion research. Research on the universality of the facial expression of emotion by **Ekman** 1972; 1999; **Ekman** and **Oster**, 1982 provide a basis for a genetic contribution to the expression of emotion. Research on the neural circuitry of emotion (**LeDoux** 1994, 1996, 2000) has provided strong evidence for the role of several cell groups within the amygdala in emotion. **LeDoux** (2000) provided evidence for circuitry that would allow sensory input to trigger emotion directly (without higher cortical processing). Such research suggests that semi-autonomous emotional circuits may play a crucial role in the motivation of behavior. The ability to act, as a result of emotion, almost automatically and with little or no higher cognitive processing, must have been adaptive earlier in our evolutionary history. It allowed quick behavioral responses in potentially dangerous situations with little or no thought required. It seems likely that such a system would still be useful today.

Cannon (1968) had noted the close relationship between sympathetic nervous system arousal and emotion and proposed an emergency theory of emotion. Basically, he had proposed that sensory information triggered emotion and sympathetic nervous system activity simultaneously. The close relationship between sympathetic nervous arousal (the so called fight or flight system) and emotion suggests a strong role for emotion in survival.

Emotion, however, is not always automatic and non-cognitive. Neural circuits have also been identified that allow cortically processed information to influence emotion (**LeDoux** 2000). Furthermore, it has been argued that emotionally based behavior is often the result of cognitive appraisal **(Lazarus** 1982, 1984). The appraisal of an emotionally charged situation must depend, at least in part, on our expectancies from past experiences and our attributions about the present one. Weiner's research group (**Weiner**, **Amirkhan**, **Folkes** and **Verette** 1987) examined the excuses that people make for failure and found that how controllable an event was determined one's emotion toward the individual making the excuse. If the event for which the excuse was being made was uncontrollable, our attributions produce different emotions than if the event was controllable. Attributions, therefore, appear to influence our emotions and the emotions, in turn, influence our behavior.

When we make attributions and their accompanying emotions are produced, we are also learning (and storing) that information. Those memories (perhaps in the form of expectancies about behavior and the attached emotion) are then available in the future to motivate behavior.

Finally, it seems likely that while emotion can act directly and non-cognitively on behavior in some situations, the cognitive aspects of emotion more often serve to modulate behavior. If someone misses an important meeting and provides an excuse that creates negative emotion in you, your future behavior toward that individual will be tempered by the experience. You probably do not stop interacting with the person, but you do interact differently with them. So, while it is likely that emotion evolved originally as a mechanism for quickly producing behavior in dangerous situations, the cognitive side of emotion is more subtle, allowing one to more finely-tune responses to the environment. Such fine-tuning of emotion was probably necessary for humans in particular, because of our social nature.

PSYCHOLOGY NUGGET

Psychology as a Positive Science

Positive psychology is the scientific study of how humans achieve happiness and mental satisfaction, in order to discover how people can lead the most productive lives possible. The field of positive psychology has been founded upon the belief that people want to lead meaningful and fulfilling lives, to cultivate what is best within themselves, and to enhance their experiences of love, work, and play. It is intended to build strengths in people to make the world a better place.

Dr Martin Seligman centralized the concept of positive psychology around three areas of study: positive emotions, positive character traits and positive institutions. Understanding positive emotions entails the study of contentment with the past, happiness in the present and hope for the future. Understanding positive individual traits consists of the study of the strengths and virtues, such as the capacity for love and work, courage, compassion, resilience, creativity, curiosity, integrity, self-knowledge, moderation, self-control, and wisdom. Understanding positive institutions entails the study of the strengths that foster better communities, such as justice, responsibility, civility, parenting, nurturance, work ethic, leadership, teamwork, purpose, and tolerance.

The goal of positive psychology is to build a science that supports the following:

- Families and schools that allow children to flourish
- Workplaces that foster satisfaction and high productivity
- Communities that encourage civic engagement
- Therapists who identify and nurture their patients' strengths
- The teaching of positive psychology
- Dissemination of positive psychology interventions in organizations and communities

The Positive Psychology Center at the University of Pennsylvania is one of the leading centers that promote research, training, education, and the dissemination of Positive Psychology under the guardianship of Dr Martin E.P. Seligman.

KEY TERMS

Facial expression
Vocal expressions
Postural expressions
Glandular responses
James theory
Lange's theory
Papez's theory
MacLean's theory
Sympathetic division
Parasympathetic division

EVALUATE YOURSELF

Multiple Choice Questions

1. The word 'emotion' is derived from a Latin word
(a) *Emoción* (b) *Emovere*
(c) *Émouvoir* (d) *Gefüh*

2. The facial-feedback hypothesis in part states that
(a) Facial expressions do not reflect emotions
(b) Facial expressions are deceptive
(c) Facial expressions also help determine how people experience and label emotions
(d) The face is the authentic barometer of one's emotions

3. According to the James–Lange theory of emotion, felt emotions depend on the
(a) Perception of bodily changes (b) Activity of lower brain areas
(c) Activity of higher brain areas (d) Interpretation of body arousal

4. The somatic marker hypothesis states that
(a) Somatic feedback associated with emotion precedes awareness and guides emotions
(b) Somatic feedback associated with emotion follows awareness and guides emotions
(c) Somatic feedback is not associated with emotions
(d) Somatic feedback associated with emotions precedes awareness but does not guide emotions

5. The emergency theory of emotion is called such because
(a) It was developed during a period of emergency
(b) It facilitates the body's general capacity to respond vigorously
(c) It renders the organism incapable of any action
(d) Just like that

6. Papez's theory of emotion is
(a) A peripheral theory (b) A hypothalamic theory
(c) A cognitive theory (d) A cortical theory

7. In MacLeans theory, the subjective feeling of emotion is connected with
(a) The hippocampus aided by the amygdaloid complex
(b) The spino-thalamic and trigeminothalamic tracts
(c) The fornix and the mammillary peduncle
(d) None of the above

8. Magda B. Arnold is widely recognized as
(a) The best emotional theorist
(b) The only woman emotional theorist
(c) The pioneer of cognitive emotion theory in modern psychology
(d) The only theorist for relating emotions with memories

9. The Schachter–Singer theory is
(a) Not a theory of emotion (b) Neurobiological theory of emotion
(c) Cognitive theory of emotion (d) Psychoanalytical theory of emotion

10. When both sympathetic and para-sympathetic fibers are connected to the same muscle or gland,
    (a) They usually act in opposite manner.
    (b) They are mutually exclusive.
    (c) They may be active at once, and in some cases they act together in sequence.
    (d) Both (a) and (c) are true.

Descriptive Questions

1. 'Emotion deprives an individual of his equilibrium.' Explain this statement with relevant examples.
2. What are the indicators through which we can gauge the emotions of another person? Discuss them in the light of relevant research studies.
3. What are the physiological changes that take place in an emotionally aroused state?
4. 'The bodily changes directly follow the perception of an exciting fact and our feeling of the same changes as they occur in the emotion.' Critically evaluate this statement on the basis of relevant research studies.
5. What does the thalamic theory of emotion state? Compare it with the peripheral theory proposed by James–Lange.
6. What is Papez's contribution in the area of emotions? Critically evaluate the same.
7. How did MacLean develop Papez's theory of emotion and does it in any manner support the James–Lange theory?
8. Is Arnold's theory of emotion a cognitive theory? Critically evaluate and support your answer with relevant research studies.
9. What does the Jukebox theory of emotion state? Critically evaluate the theory citing relevant research studies.
10. Critically evaluate the opponent-process theory of emotion.

Critical Thinking Questions

1. Critically evaluate the following states of emotion and list the characteristic expressions involving them: Anger, Fear, Happiness, Sadness, Empathy, Disgust, and Sorrow
2. Are we selfish when we show altruism? Or we genuinely seek happiness by helping others?
3. Which theory best sums up the reason for emotion? Give three good reasons.
4. 'Hidden or locked emotions often lead to catharsis (venting).' Explain it using a suitable framework from this chapter.

PRACTICAL EXERCISES

1. Terrorism is a major socio-psychological evil today all over the world. Divide your students into groups and ask them to write a short essay on what they think about the emotional stage of the terrorists who bombed in the Mumbai hotels or caused 9/11.
2. Examine the situation of Robinson Crusoe who was marooned in an island devoid of contact with any other fellow human being. What are the emotional changes he would have undergone? Ask your students to write an essay describing Robinson Crusoe's emotional state.

Answers to Multiple Choice Questions

1. (b) **2.** (c) **3.** (a) **4.** (a) **5.** (b) **6.** (d) **7.** (a) **8.** (c) **9.** (c) **10.** (d)

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Chapter 11

INTELLIGENCE

CHAPTER OBJECTIVES

After reading this chapter, you will learn:

- About what intelligence is, the various ways of defining intelligence and the determinants of intelligence.
- Intelligence quotient (IQ) and its three dimensions.
- Individual and group differences in intelligence.
- About various intelligence tests and their uses.
- About various theories of intelligence.
- Emotional intelligence (EI) and emotional quotient (EQ) and their importance.
- Moral intelligence and social intelligence.

INTRODUCTION

Intelligence, since long, has been regarded as an innate capacity, depending on the genes inherited from the parents. But in the light of such work as **Piaget's** on child development and **D.O. Hebb's** neurological theories, it was realized that inborn power does not develop into effective intelligence without stimulation from the environment; also that an unstimulating or deprived environment can inhibit its growth. Like all other genetic attributes, it is the product of interaction between the organism and its environment.

However clearly we may seem to understand what is meant by intelligence, there is yet no generally recognized definition of the term. Admittedly, intelligence denotes 'ability', i.e. a condition or a complex of conditions for specific performances or achievements. However, the specific types of performance that require intelligence have not yet been unambiguously defined, except to the extent that the term covers cognitive problems. The term intelligence derives initially from the Greek philosopher's distinction between

cognitive or intellectual and affective or emotional faculties of mind. In recent times, intelligence is often regarded as the ability to overcome difficulties in new situations, as proposed almost simultaneously by **E. Claparede** and **W. Stern**, or in other words, as the quality that distinguishes man's adaptability. However, as evident from **W. Kohler's** intelligence tests on anthropoid apes, the ability to adapt to new situations is not only a man's domain. Thus, it is clear that animals too can adapt to new situations for which they have no instinctive solution. Therefore, thought cannot be considered an essential criterion for the exercise of intelligence. To the rescue of the above definition, we can add a few more things and define intelligence as the quality that distinguishes man's adaptability, his capacity to learn and to reason, from the instinctive and reflex processes of animals. Though intelligence is already present in the ability of lower species to sense and react to objects and to learn at a primitive level, it evolved with the enormous growth in size and complexity of the higher brain centers and the cortex. Mammals can generally adapt more readily and cope with more complex tasks than fish and insects, while monkeys and apes are more intelligent than other mammals, apart from man.

To try to define intelligence in terms of mental powers or faculties such as memory, imagination, reasoning, etc. is of little help since these too are vaguely defined and non-observable. Modern psychology is concerned

PSYCHOLOGY IN EVERYDAY LIFE

Street-smart vs Book-smart

Generally, in many parts of the world, intelligence is associated with academic success. Getting good grades in school and college is a sign of intelligence. However, this is only one side of intelligence. There is intelligence that relates with practical functioning and enables one to deal efficiently with daily lifework. The difference between the uses of these two types of intelligence can be seen in our everyday life. There are many instances where people who have been successful in school and college fail in real-life situations and vice versa. We come across even those people who score high on intelligence tests but are clumsy in social interactions and vice versa. This distinction between academic intelligence (book-smarts) and practical intelligence (street-smarts or common sense) has long been recognized by the layman.

If we look for reasons for difference between academic and practical intelligence we come across many. However, one major source of this difference is the situation. Academic problems and problem-solving is based more on theoretical aspects whereas real-life situations need more practical solutions. Real-life problems seldom relate with knowledge acquired through formal classroom education and hence that knowledge gained does not help much.

We all have had the experience of encountering problems to which the solution is neither readily available nor readily derivable from acquired knowledge. This type of frequently experienced problem-solving in daily life is referred to as *practical problem-solving*. We come across such problems at our workplace or in school, household, stores and movie theaters.

There is no consensus on how to define practical problems encountered in life, but building on a distinction made **by U. Neisser** (1976), **R.J. Sternberg** (1985, 1997) and **R.K. Wagner** and **R. J. Sternberg** (1986) have classified problems as academic or practical in nature. Academic problems tend to be formulated by others. These are well defined, are complete in the information they provide, have only one correct answer, have only one method of obtaining the correct answer, are outside of ordinary experience and are of little or no intrinsic interest.

Practical problems, in contrast to academic problems, tend to be unformulated or in need of reformulation. These are of personal interest, lack in information necessary for solution, are related to everyday experience, are poorly defined, have multiple appropriate solutions (each with liabilities and assets) and have multiple methods for picking a solution. Given the differences in the nature of academic and practical problems, it is no surprise that people who are adept at solving one kind of problem may well not be adept at solving problems of the other kind.

We will discuss more on this topic later in this chapter while learning about Sternberg's Triarchic theory.

more with the analysis of behavior and mental processing, than with some hypothetical casual entity in the brain. It is not a 'thing' like red hair but a quality of diverse forms of human activity. By measuring the success or failure of children of different ages, or adults, in a wide range of cognitive tasks, it is found that some persons are consistently more successful than others. The common factor in all such performances was designated by **C. Spearman** as the general or *'G' factor*; and he showed how to determine what mental functions are most characteristic of intelligence, e.g. grasping relationships, abstracting, problem solving; or which are relatively independent, e.g. rote memory and sensory processes. Thus, it is possible to measure intelligence by appropriate tests, although one cannot see it or define it precisely. American psychologists tend to lay stress on this general intelligence, rather than or more specific types or factors of ability, verbal, memorizing, spatial, etc., which may be called group factors or primary factors.

Many writers consider that the term 'intelligence' has outlined its usefulness, since it gives rise to much misunderstanding and controversy (**Resnick** 1976). An alternative approach is the experimental study of mental processes involved in, taking in information, coding and storing it and using this knowledge in coping with problems and thinking. It is also hoped that the construction of computers, which display 'artificial intelligence', will throw further light on human intelligence.

DEFINING INTELLIGENCE

A lot has been said above and a lot more remains to be said regarding how intelligence is to be defined. Here, under this head, our approach will be clear and lucid but philosophical and critical as has been above. Many a great laureates in the field of psychology have tried successfully to define intelligence in various ways and in fact, these definitions can be classified into one of the three groups that we are going to discuss.

The first group consists of those definitions that lay stress on the process by man, of setting right or making suitable the total environment or limited aspects of it for his well-being. In other words, here we are referring to the adjustment or adaptation capabilities and capacity of the individual. By adjustment, we mean a state in which the needs of the individual, on the one hand, and the claims of the environment, on the other hand, are fully satisfied. Thus, adjustment is the biological adaptation of the organism to its environment. Man, not only adapts to its environment but also changes his environment to meet his needs more effectively. However, adjustment depends on various factors. Firstly, it depends on the extent to which the state of harmony prevails among one's manifold drives, motives and ideals. Secondly, it depends on the extent to which one's wishes and aspirations are adequately obtained and thirdly, on the extent to which one's desires and actions are in conformity with the demands and standards of society. Thus, talking of intelligence as adjustment or adaptation involves a lot more than a verbal definition. Adjustment is a process by which a harmonious relationship can be attained, but, alas a state expressible only in theoretical terms, since in practice no more than a relative adjustment is reached in the sense of optimal satisfaction of individual needs and untroubled relations with the environment. However, no doubt adjustment does reflect intelligence, since adjustment takes the form of variation in the environment and variation in the organism through the acquisition of the responses appropriate to the situation, which in turn largely depends on one's general mental ability. Thus, we can say that intelligence, in part, is general mental adaptability to new problems and new situations of life.

The second group of definitions lays stress on an individual's ability to learn. What is of importance here is the explanation of what one means by the ability to learn, or in other words, learning ability. Learning ability is a supposed personality trait, to which individual differences in learning outcome (speed, amount, etc.) in different assignments may be attributed. Another important explanation required here is the meaning of learning. Learning can be defined as a relatively permanent change or modification in behavior that occurs as a result of practice or experience.

Considering the above explanations and then defining intelligence, as an individual's ability to learn requires more than this verbal definition. Since ability and learning are terms that need deep analysis, prior to coming to conclusions on this definition. We will thus examine these terms one by one, and see what role they play in intelligence.

First, we will talk about learning. As defined above, learning involves three important aspects. Firstly, for learning to take place, behavior modification must occur. Secondly, this modification must be permanent in nature, and thirdly, it should occur as a result of practice or experience. Now examining this, we will talk about behavior first.

- Behavior can be defined in many ways:
- It is the observable activity of a specific organism.
- It is the responses of an individual, species or group to stimuli.
- It is a specific response of a specific organism.
- It is a part response of a response pattern.
- It is a movement or movements.
- It is the total activity, subjective and objective, non-observable and observable of an individual or group.

These all definitions represent only a small number of the existing views of the object of psychology. However, in defining behavior, stress is laid on the stimulus-response pattern involving the organism. All responses (behavior) are the outcome of the stimulation received by the organism. A stimulus situation must be perceived and evaluated as significant. This means that the present situation must be related to past experience and seen as having implications for the future. This evaluation and then subsequent response is strongly influenced by one's capabilities.

Now the question of one's ability comes in. Ability means all the psychological conditions needed to perform an activity. Ability is, therefore, operationally defined by the activity with which it is associated. It follows from this definition of the term ability that there are as many different abilities as there are activities, and that the question as to the number and nature of abilities is meaningless. The word 'ability' is, therefore, primarily an abbreviation for 'all the psychological conditions needed to perform an activity'. It should, however, be noted that ability includes only the necessary conditions; some influences that might facilitate the activity, such as interest, degree of activation, practice and certain experiences are therefore excluded. This does not, however, mean that the ability is reduced to innate conditions. Some of the conditions may be well explained by experience and general learning processes.

The decisive change brought about by empirical research into the notion of ability is that abilities are no longer considered as innate, uniform and clearly distinct 'powers' but (in a much less precise manner) as a set of conditions. This attitude has been motivated primarily by research into the relations between abilities, using correlational techniques. Correlation may be determined between performances on a variety of cognitive problems (i.e. highly specialized ability) or between performance in different school subjects or between intelligence in different motor abilities. Studies have shown that many abilities overlap partially; this means that the basic conditions for different abilities are sometimes the same. Further, the conditions on which performance is based are complex, even in the case of specialized activities; in other words there are several conditions for performance, none of which can be attributed to any individual achievement.

Thus, we realize that the conventional classification of ability into intelligence, memory, attention, motor skills and sensorimotor activities is extremely superficial and has little basis in the light of psychological principles. The correlations are sometimes very slight between different feats of intelligence and almost wholly absent between memory and motor skills, etc.

Considering the above discussion, defining intelligence as an individual's ability to learn would rather be incomplete and insufficient since the concept of ability cannot be narrowed down and assigned only to sphere of individual learning in relation with intelligence. Moreover, modern psychologists, particularly in America,

have substituted the term 'human abilities' in place of 'intelligence'. If ability is intelligence, then, it merely incorporates more than learning.

The third group of definitions lays emphasis on the ability to carry on abstract thinking. Here again, the concept of ability comes in, and as explained above, so here also defining intelligence as an ability to carry on abstract thinking would rather be incomplete and insufficient, since the concept of ability cannot be narrowed down and assigned only to the sphere of abstract thinking in relation with intelligence. Again as stated before, if ability is intelligence, then it merely incorporates more than abstract thinking.

Taking into account the three groups of definitions, one thing seems clear that they are not and cannot be mutually exclusive. Each group lays emphasis on the ability to perform or to do a certain activity. In other words, we can say that a more suitable definition based on the explanation given by the three groups would state that *one's intelligence is a synthesis of his abilities* (**Abraham, A**. 2002) since the product of several elements is something new in relation to its parts. Thus, we must view intelligence in totality rather than in fragments of human ability. Considering this, the most suitable definition seems to be that given by **Wechsler**. According to him, '*intelligence is the aggregate capacity of an individual to act purposefully, to think rationally and to deal effectively with his environment'*. Another definition given by **Stoddard** seems to fulfill our criterion. According to him, 'intelligence is the ability to undertake activities that are characterized by: difficulty; complexity; abstractness; economy; adaptiveness to a goal; social values and the emergence of originals and to maintain such activities under conditions that demand concentration of energy and a resistance to emotional forces'.

PSYCHOLOGY NUGGET

Classic Definitions of Intelligence

- 'Intelligence is the ability to carry out abstract thinking.'
  (Terman 1921)
- 'Intelligence is the capacity for knowledge, and knowledge possessed.'
  (Henmon 1921)
- 'Intelligence is the capacity to learn or to profit by experience.'
  (Dearborn 1921)
- 'Intelligence is the capacity to acquire capacity.'
  (Woodrow 1921)
- 'Intelligence is what is measured by intelligence tests.'
  (Boring 1923)
- 'Intelligence is a global concept that involves an individual's ability to act purposefully, think rationally and deal effectively with the environment.'
  (Wechsler 1958)
- 'Intelligence is a general factor that runs through all types of performance.'
  (Jensen)
- 'A person possesses intelligence insofar as he had learned, or can learn, to adjust himself to his environment.'
  (Colvin, cited in Sternberg 1982, p. 30)
- 'Intelligence is that faculty of mind by which order is perceived in a situation previously considered disordered.'
  (R.W. Young, cited in Kurzweil 1999)
- 'Intelligence is the ability to use optimally limited resources—including time—to achieve goals.'
  (Kurzweil 1999)

EXPERIMENTAL PERSPECTIVE

Breastfeeding and Intelligence

Children that are breastfed have a higher IQ than children that are fed formula? Is this some sort of unsupported statement by radical breastfeeding supporters? Has our support of breastfeeding outstripped the facts?

Nothing could be further from the truth. Perhaps one of the most important stories that have been there on the news feeds is that there is a demonstrated direct relation between a child's intelligence and cognitive ability and how long that child was breastfed. Some studies show an increase in intelligence for ***each additional month*** the child was breastfed.

In another article, Dr Michael Kramer reports the results from following the same group of 14,000 children for 6.5 years.

'Our study provides the strongest evidence to date that prolonged and exclusive breastfeeding makes kids smarter,' said Kramer, a Professor of Pediatrics and of Epidemiology & Biostatistics in the McGill University Faculty of Medicine and lead investigator in the study.

Kramer and his colleagues evaluated the children in 31 Belarusian hospitals and clinics. Half the mothers were exposed to an intervention that encouraged prolonged and exclusive breastfeeding. The remaining half continued their usual maternity hospital and outpatient pediatric care and follow-up. This allowed the researchers to measure the effect of breastfeeding on the children's cognitive development without the results being biased by differences in factors such as the mother's intelligence or her way of interacting with her baby.

The children's cognitive ability was assessed by IQ tests administered by the children's pediatricians and by their teachers' ratings of their academic performance in reading, writing, mathematics and other subjects. Both sets of measures were significantly higher in the group randomized to the breastfeeding promotion intervention.

'Although breastfeeding initiation rates have increased substantially during the last 30 years, much less progress has been achieved in increasing the exclusivity and duration of breastfeeding', the authors conclude.

'The effect of breastfeeding on brain development and intelligence has long been a popular and hotly debated topic', says Dr Kramer. 'While most studies have been based on association, however, we can now make a causal inference between breastfeeding and intelligence—because of the randomized design of our study.'

Until now, we have been examining the definitions of intelligence that are only functional in character, i.e., they only tell us how intelligence operates—through learning, adaptation, abstract thinking, etc. We will now proceed with the examination of the structure of intelligence and try to determine its underlying factors. Many theories have been given as regards to the 'structure' of intelligence. Mostly, all the old and modern theories of intelligence will be discussed ahead but before that, we need to know about the determinants of intelligence, intelligence quotient and the classification and types of tests that are there to measure the same.

DETERMINANTS OF INTELLIGENCE

Studies of twins and adopted children and of children raised in enriched or neglectful environments indicate that *genes* and *environment* both interact to produce measured levels of intelligence.

Among the *environmental factors* that tend to influence intelligence are: *nutrition, intellectual stimulation* and the *emotional climate* of the home. It has also found in studies done on the mentally subnormal that some mentally retarded individuals are the product of over-riding biological catastrophes but most cases of *mito mental retardation* result from unfavorable combinations of a number of factors. Thus, *family-cultural retardation*, no physical defect is identifiable but retardation results from inheritance of low intelligence accentuated by impoverished living conditions. On the other hand, a mentally *defective* child, usually has

some brain damage - resulting from material infections during pregnancy, birth trauma, genetic defects such as *Down's syndrome* or other disorders.

Our psychological development is constantly being shaped by forces in our environment. Different physical environments foster somewhat different characteristics, even among people with similar inheritance. Our *sociocultural* environment influences our intellectual development a lot more dramatically. Through our contact with it, we learn the competencies necessary for dealing with life problems.

Reliable intelligence differences can be identified among groups differing in sex, home environment and race but within-group differences tend to be far larger than between group differences.

CONCEPT OF INTELLIGENCE QUOTIENT (IQ)

The German psychologist William Stern devised the term 'IQ' from the German Intelligenz-Quotient in 1912 as a proposed method of scoring children's intelligence tests such as those developed by Alfred Binet and Théodore Simon in the early 20th Century. Lewis Terman accepted that form of scoring, expressing a score as a quotient of 'mental age' and 'chronological age' for his revision of the Binet-Simon test the first version of the Stanford-Binet Intelligence Scales.

The IQ, as proposed by Stern, represented the *ratio* of a child's mental age to his or her chronological age. To be rid of fractions, the ratio was multiplied by 100. This meant that for any chronological age, the average IQ was 100. Obviously, if a child's mental age was greater than the chronological age, the IQ would be above hundred. If the mental age were lower than the chronological age, the IQ would be below 100. For a 10-year old child with a mental age of 12, the formula for calculating IQ gives the following result:

$$\text{IQ} = \frac{\textbf{Mental Age}}{\textbf{Chronological Age}} \times 100 = \frac{12}{10} \times 100 = 120$$

If the same 10-year-old has a mental age of 8, the IQ would be calculated as 80 and so on. Figure 11.1 shows the distribution of IQ in the normal population.

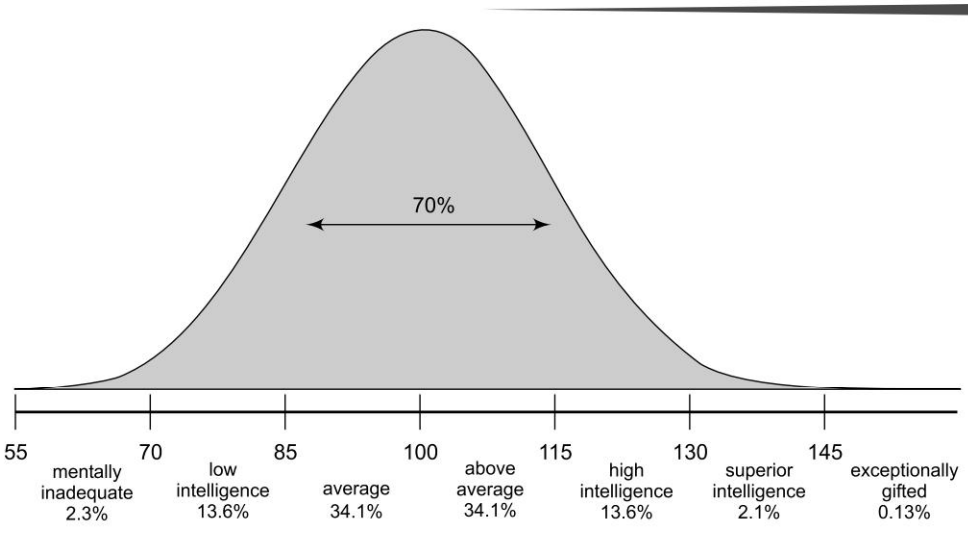

Fig. 11.1 Distribution of IQ in the Normal Population

Although the term 'IQ' is still in common use, the scoring of modern IQ tests such as the Wechsler Adult Intelligence Scale is now based on standard scoring of the subject's rank order on the test item content with the median score set to 100, and a standard deviation of 15, although not all tests adhere to that assignment of 15 IQ points to each standard deviation.

Table 11.1 shows interpretations of IQ scores.

TABLE 11.1 Interpretations of IQ Scores

IQ Score	Interpretation
Over 140	Genius or almost genius
120–140	Very superior intelligence (Gifted)
110–119	Superior intelligence
90–109	Average or normal intelligence
80–89	Dullness
70–79	Borderline deficiency in intelligence
Under 70	Feeble-mindedness

Three Dimensions of Intelligent Quotient

David Perkins (1992) has analyzed a number of different educational theories and approaches to education in his book '*Smart Schools'*. The analysis strongly supports Gardner's theory of multiple intelligences and contains elaborative research-based evidence indicating that education can be considerably improved by more explicit and appropriate teaching for transfer, focusing on higher-order cognitive skills and the use of project-based learning. He has also examined many researches on measurement if intelligence quotient and programs designed to increase the same. Based on this, he has presented detailed arguments supporting the fact that intelligence quotient has three major components or dimensions (**Perkins** 1995). These dimensions are as follows:

1. **Neural intelligence**: This refers to the efficiency and precision of one's neurological system.
2. **Experiential intelligence**: This refers to one's accumulated knowledge and experience in different areas. It can be thought of as the accumulation of all of one's expertise.
3. **Reflective intelligence**: This refers to one's broad-based strategies for attacking problems, for learning and for approaching intellectually challenging tasks. It includes attitudes that support persistence, systemization and imagination. It includes self-monitoring and self-management.

Experimental evidences favor the belief that if a mother, who is pregnant and consumes drugs such as alcohol and cocaine, then it can adversely affect the neural intelligence of the child in her womb. Further, there is also evidence that lead (such as from lead-based paint) can do severe neural damage to a person. Vitamins or the lack thereof can affect neural intelligence. There is also evidence that neural intelligence has a 'use it or lose it' characteristic. It is now clear that one can maintain as well as increase ones neural intelligence by use.

Years and years of accumulating knowledge and experience in both informal and formal learning environments is the very base of experimental intelligence. This type of knowledge leads to a high level of expertise in one or more fields. Those people who live in 'rich' learning environments have a significant intelligence advantage over people who grow up in less stimulating environments. There is strong evidence that such conducive environments help in the increase of experimental intelligence.

Reflexive intelligence, on the other hand, is some sort of a control system that helps to make effective use of neural intelligence and experiential intelligence. Strategies can be learned by people to make effective use of neural and experiential intelligence. Furthermore, the habits of mind included under reflexive intelligence can be learned and improved. Metacognition and other approaches to reflecting about one's cognitive processes can also be of help.

PSYCHOLOGY IN EVERYDAY LIFE

Is IQ Test Important?

IQ and personality testing has become an essential part in many schools and colleges. It is an important part of the selection process for entrance exams and jobs. In India, today IQ and personality tests have become important tools for selection in central, state and banking service examinations and for entry to engineering, medical and other professional (management, administrative, etc.) courses. Legislatures, schools and universities, employers, industries, companies, service and other organizations are all using these tests in a multitude of ways to sieve the best from the rest and thereby make selections based upon it and other requirements.

IQ scores are used in many other contexts as well. Some of these are listed below:

- These can act as predictors of educational achievement for a group or controlled batch of students or trainees.
- These can help in identifying people with special needs (gifted, disabled, etc.) and then accordingly education imparted.
- IQ scores are examined by social scientists who study their distribution in populations and the relationships between them and other variables and as predictors of job performance and income.

However, like many other measures the accuracy of IQ scores as an indicator of intelligence has been put to question. On a positive side, there is still a general agreement that IQ scores serve as good predictors of success in the academic areas. They also serve as boosters of confidence for those who score high on intelligence tests.

INDIVIDUAL AND GROUP DIFFERENCES IN INTELLIGENCE

Intelligence, like most other traits, seems to be distributed in the population in such a way that most people make scores in the middle range, while only a few on the high and low range. This produces a bell-shaped distribution and is known as the *normal curve* (Fig. 11.1). The difference in intelligence affects the coping ability required for social demands.

Mental Retardation: Mental retardation is defined by significantly sub-average levels of intellectual functioning along with deficits in adaptive behavior. The levels of retardation include mildly retarded (IQ of 55 to 69), moderately retarded (IQ of 40 to 54), severely retarded (IQ of 25 to 39) and profoundly retarded (IQ below 25). The most frequent causes of mental retardation are *Down syndrome* (a disorder caused by an extra chromosome that is responsible for some cases of mental retardation) and *familial* influences (some forms of retardation have a genetic basis and can be passed through families). Some become retarded because of either of the two factors but most retardation is the result of an unfavorable combination of environmental and genetic factors. The intellectual development of mentally retarded people proceeds more slowly and ceases at a less—advanced level, than that of non-retarded people. The intellectually gifted have IQs above 130 and comprise 2 to 4 percent of the population. People with high intelligence are known as *intellectually gifted*. They are generally more socially adept than those with a lower IQ.

Reliable IQ differences can be identified among groups differing in *home environment* and *race*, but differences within the groups tend to be far larger than these between - group differences. The *home environment* plays a very crucial role in the development of intelligence. The more conducive the environment, the better the mental development (other factors being constant).

The overall IQs of males and females at any age are virtually the same. During childhood, there are few impressive *sex differences* on intellectual tasks, although girls do show an early and increasing superiority in verbal behavior. *At the time of adolescence, differences become more noticeable*. The tasks that call for *verbal expression* and *fluency, the perception of details quickly* and *accurately* and *rapid, accurate manual movements* are performed better by girls and women generally. Tasks related with *spatial, numerical* and many more mechanical tasks are done better by boys and men.

Finally, it must be pointed that *intelligence test scores reflect only one aspect of personal competence*. Other attributes such as motivation, character, social skills, artistic talent, athletic ability, sensitivity and emotional maturity matter. Differences are not deficits. Because there are many ways of being successful, our personal and cultural differences—regardless of their origins—are valuable variations on the human theme of adaptability. Like essence, human traits and gifts come in many flavors.

CLASSIFICATION OF INTELLIGENCE TESTS

The term 'intelligence tests' covers psychological test methods designed to determine inter-individual differences in the sphere of human intelligence. Intelligence tests are classified as follows according to the activities prescribed in them:

1. **Verbal Intelligence Tests**
2. **Non-verbal Intelligence Tests**

Verbal tests make use of language while non-verbal tests include such activities that do not necessitate the use of language. Both these types are suitable for individuals as well as group tests. Consequently, both of these are further sub-divided into two classes – individual and group. Thus, finally there are four types of intelligence tests:

1. Verbal individual intelligence tests
2. Non-verbal individual intelligence tests
3. Verbal group intelligence tests
4. Non-verbal group intelligence tests

We will now discuss each of these briefly.

Verbal Individual Intelligence Tests

The very name of these tests suggests that these are intelligence tests given to individuals or in other words, they are meant to test the intelligence of individuals. Language finds adequate use in them. Binet-Simon tests and the various revisions are all included in this classification.

Non-verbal Individual Intelligence Tests

In a verbal test, the knowledge of language is more in demand and therefore the use of these tests is limited to students and literate persons. However, since the verbal tests involve an extensive use of language, they cannot be used in the case of illiterate individuals. Consequently, illiterate individuals are tested with the

help of non-verbal individual intelligence tests. The name itself indicates the nature of these tests. These tests involve the least possible use of linguistic ability and are similarly, almost unaffected by knowledge derived from books. Example of these tests include—The Merril-Palmer block building test; Pinter-Paterson performance test; Porteus Maze test; Form Board test; Wechsler Bellevue test and the Bhatia's battery of performance tests.

Verbal Group Intelligence Tests

The group intelligence tests owe their origin and development to the difficulties from which the individual tests suffer (difficulty of time, need for experienced examiners, etc.). As the name suggests, these tests are designed to test the intelligence of a group and not of an individual. All the people in the group are given the same directions and have to perform the same activities. Even the score of the results, in most of the cases, are calculated by machines, thus dispensing with the necessity of skilled examiners, resulting in an economy of time. Some examples of these tests are – Army Alpha test, Naval and Army general classification tests, etc.

Non-verbal Group Intelligence Tests

Since the verbal intelligence, tests are meant only for the literates because of the requirements of linguistic ability hence it is for this reason that the non-verbal group intelligence tests have been developed, in which the examinee makes a minimum use of language and performs many activities instead. In these non-verbal group intelligence tests, the examiners have to explain to the examinee even the simplest directions that are also demonstrated as far as possible. All this is done to make the least possible use of language. There are some performance tests in these group intelligence tests, in which the examinee draws some lines according to his ability, fills in some empty spaces, draws some simple figures or performs some simple activities. Some psychologists do not give credence to the non-verbal tests in their role of measuring intelligence of the subjects. While, on the other hand, some psychologists consider them to be better than verbal tests. As Alexander comments, 'a complete performance battery will be a better measure than a complete verbal battery'.

SOME WELL-KNOWN INTELLIGENCE TESTS

Intelligence tests help measure the intelligence of an individual. They can be either verbal or non-verbal in nature, and as well be administered both to the individual and to a large group.

Intelligence is generally measured by the *intelligence quotient* (IQ), which indicates, in its commonest form, the position of S in relation to the population as a whole on a normally divided scale (mean value 1001; dispersion 15). Normally, the designation 'intelligence test' implies that the method concerned is assumed to measure '*general intelligence'* and not partial aspects of the latter. Psychologists are not, however, of one mind as to the performance areas covered by '*g*' or its structure; accordingly, the different intelligence tests are sometimes based on highly divergent models of intelligence.

The earliest attempts at a psychological diagnosis of intelligence were made in the nineteenth century. Galton was the first to organize relatively large-scale systematic experiments to detect inter-individual differences in the sphere of intelligence. *He postulated the standard distribution of intelligence* generally accepted today.

Pioneering work was done by Binet, who along with Simon in 1905, published the first procedures to justify the use of the term 'intelligence test' in its present sense. Binet provided the original major impetus to the study of individual differences by means of standardized tests.

While Binet's method was designed for educational purposes as an intelligence test for children, the first intelligence test for adults were developed by military psychologists in America during the World War I. They were the *Army Alpha* (verbal tests) and *Army Beta* (non-verbal) tests. These methods were suitable for use as group tests and were designed as test batteries (*test batteries are a group of tests combined to make a single test*) they therefore already possessed two major characteristics typical to most modern intelligence tests.

The diagnostic possibilities of test batteries were subsequently extended by adding the psychological profile (test profile) formulated by the Russian psychiatrist G.J. Rossolimo. The psychological profile evaluated the interrelationship between the individual subtests on a differential diagnostic basis.

The intelligence diagnosis method owes most of the qualitative improvements it has undergone to the use of statistical methods. These methods enabled the tests to be designed scientifically and standardized as measuring instruments. With the help of statistical methods, i.e. factor analysis, it proved possible to obtain direct empirical access to the problem of intelligence, and to base intelligence tests on experimental findings. We will discuss some of the famous tests of intelligence.

Stanford–Binet Tests (1937)

The procedure applies the well-known Binet model of arrangement of tests according to age order. The calculation of intelligence age and intelligence quotients likewise takes place in the traditional form. The tests are used for children from 3–14, without differentiation for adolescents and adults. The revisions of Binet scale are: *Goddard* (1911); *Goddard* and *Kuhlmann* (1911); *Lewis M. Terman* (1912, 1915); *Maude E Merrill* (1937) and finally *Terman* and *Maude* (1960).

Wechsler-Bellevue Intelligence Test (1939)

This is a test battery of ten subtests for general intelligence. The selection of subtests and their grouping in a verbal scale and a performance scale extended, according to *D. Wechsler*, the diagonistic, possibilities of the battery is comparison with earlier intelligence, especially in the clinical sense. The test is of use between ages 10 to 59. The author suggests that the retest reliability of the whole test is 0.94.

Wechsler Adult Intelligence Scale (1955)

This is the 1955 revision of the Wechsler–Bellevue scale and is commonly known as WAIS. It is for ages 16 and above. The instrument has six subtests that constitute the verbal scale and five in the performance scale. These are as follows:

Information test: The range of an individual's information is an indication of his intellectual capacity.

General comprehension test: Success on this subtest depends upon possession of practical information, plus ability to evaluate and utilize past experience.

Arithmetical reasoning: This is designed to test 'mental alertness'.

Similarities test: It samples the 'general factor' (Spearman's *g*), or what is commonly called *general intelligence*. *Memory span for digits, forward and backward* - this is a test of immediate memory span and is helpful in detecting the mentally defective.

Vocabulary test: It is helpful in deriving an index of a person's general mental ability.

Digit-symbol test: Also known as the *substitution test*, it requires the association of symbols and involved speed and accuracy of performance. It also involves visual memory.

Picture completion tests: It is valuable in testing lower-level intelligence. It measures the individual's basic perceptual and conceptual abilities. In a broad sense, it measures the ability of the individual to differentiate essential from nonessential details.

Block design tests: Performance on this test involves visual analysis and synthesis. It measures a person's ability to comprehend and evaluate a total situation without the use of language.

Object assembly test: It requires perception of parts and their reconstruction into a meaningful whole. It has clinical value of a qualitative kind; for it contributes to the examiner's understanding of the subjects modes of perception, the degree to which he relies upon trial-and-success methods and the manner in which he responds to his errors.

Wechsler Intelligence Scale for Children (WISC)

This test is for the children from 5 through 15 years of age. It was developed in 1949 on the same principles and in the same form as the WAIS: verbal subtests, performance subtests, a verbal IQ, a performance IQ and a full-scale IQ. The subtest types are identical with those of the older scale, with the exceptions that follow: Digit span is made optional; an optional maze test has been added; and in place of the digit symbol test, a coding test has been substituted, in which various lines in varied positions (single, double, circle) are associated with geometric figures (star, circle, triangle, cross, rectangle).

THEORIES OF INTELLIGENCE

Some well-known theories of intelligence are discussed here.

Faculty Theory

The faculty theory of intelligence is the oldest theory that flourished during 18th and 19th century and explained the nature of intelligence. According to this theory, mind is made up of different faculties like reasoning, memory, discrimination, imagination, etc. These faculties are independent of each other and can be developed by vigorous training. However, this theory had undergone extreme criticism by experimental psychologists who disproved the existence of independent faculties in the brain.

One factor/UNI factor Theory

This theory reduces all abilities to a single capacity of general intelligence or 'common sense'. This would imply that they are all perfectly correlated, and would make no allowance for the unevenness of people i.e. abilities along different lines. Since it goes against the common observation that 'an individual does possess different levels of different abilities and does not shine equally in all directions'—it has no ground to stand.

Two-Factor Theory

C. Spearman (1904, 1923 and 1927) took the crucial step towards quantitative testing of theories, as opposed to simple quantification or measurement. He developed the two-factor theory that is at extreme contrast with Thorndike's theory and stands at the other extreme of interpretations.

According to Spearman, all intellectual (in a broad sense) operations involve a single, common factor (*general factor* or *g*) and a *specific factor* for each performance. This general factor can therefore be defined as 'general intelligence'. Stated in other words – all intellectual activity is dependent primarily upon and is

EXPERIMENTAL PERSPECTIVE

Spearman's Contribution to Psychological Testing

Many theories and discoveries to the world of psychological testing have been contributed by Charles Spearman. In an article 'General Intelligence Objectivity Determined and Measured', authored by him he put forth these four discoveries:

1. Two measures which begin to have more variation cause the correlation to move towards zero (i.e. the value would have little meaning).
2. One was able to use raw scores to compute true values, provided that the two measures are available.
3. The equations used in the second law could be used to determine if the causes between two sets of measures have something in common with two other sets of measure.
4. The common and essential element in the intelligences wholly coincides with the common and essential element in the Sensory Functions.

The fourth issue put forth by Spearman became a topic of controversy, one which he would then learn to accept.
Six events were chosen by Spearman that he considered to be significant. These events are as follows:

1. Through the use of 'g', there was now theoretical basis for Binet's way of designing tests. Spearman felt that there needed to be a clear relationship between theory and practice in order to get into the heart of 'mental test'.
2. Spearman brought the two ideas of general psychology and the psychology of individual differences together as one discipline.
3. His development of the 'two-factor' theory of intelligence. This consisted of 'g' being general intelligence and 's' being task specific intelligence. This theory was further studied as Spearman came to realize the importance of 'broad factors'.
4. Spearman's idea of 'g' was further supported by Karl Lashley's experiments with rats. The loss of cerebral tissue would cause rats to hinder specific functions, this supported Spearman's theory.
5. The idea that 'g' and 's' complement each other was an important discovery as was the results of experiments in formal training. Research shows that 'g' could not be improved through extensive use and that the outcome of training became habit. Furthermore, it was reported that these habits coincided with the idea of 's'.
6. Spearman found that considered qualitatively, 'g' manifested itself only in the noegenetic processes (but at the same time equally in all of them, in so far at least as they fell into the categories of relation and correlate education) and that therefore the 'g' saturation of any test or task was directly proportional to the extent that it demanded no egeneses (as distinct for instance from retentivity or from sensory or motor capacity).

Though Spearman was the founder of many theories but he was proud of these six that he found.

an expression of a general factor, common to all mental activity. This factor, designated by the symbol *g*, is possessed by all the individuals but in varying degrees, of course, since people differ in mental ability as it (*g*) operates in all mental activity, though in varying amounts. Spearman interpreted this general factor as general mental energy, since it has a role similar to physical energy.

The *g factor* was postulated by Spearman to explain correlations that he found that exist among diverse sorts of perceiving, knowing, reasoning and thinking. However, these correlations obtained were by no means perfect. Thus, Spearman postulated the existence of *specific factors* called *s factors*, each of which is specific to a particular type of activity and so along with this emerged his two-factor theory.

The basic assumption of the two-factor theory is that every cognitive performance represents a function of two factors: (a) a general intelligence factor '*g*', which underlies every performance of the individual and (b) specific ability factors that only come into play at any time in particular kinds of tasks. Thus, the two-factor

theory states that, '*all mental activities have in common some of the general factor; each mental activity might also be a member of a 'group', and each has also its own specific factors*'. Figure 11.2 depicts the two-factor theory pictorially.

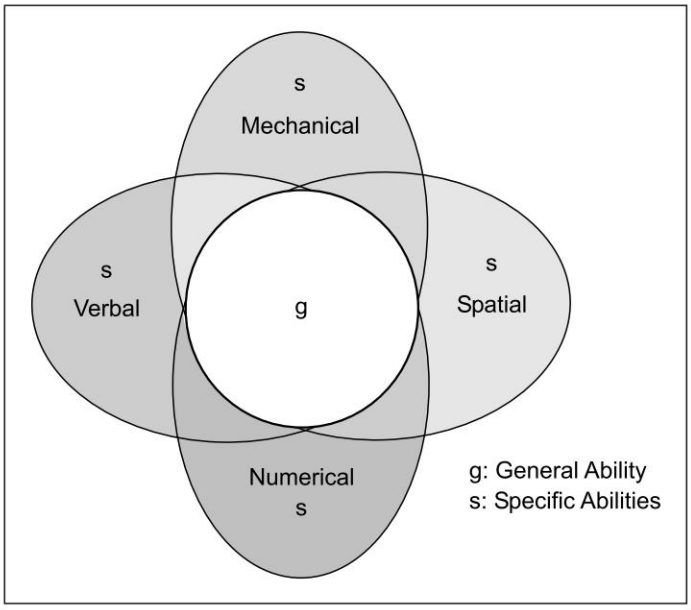

Fig. 11.2 Two-Factor Theory

Research eventually showed, however, that there are certain common features between certain types of performance, which are not dependent on '*g*'. Spearman in subsequent revisions of his theory recognized in addition, the existence of individual group factors without however abandoning his basic concept of *g* and *s* factors.

Multifactor Theory

Edward Lee Thorndike (1911) proposed the multifactor theory of intelligence. This theory stands at one extreme of the interpretations regarding the nature of mental organization. As the name suggests, intelligence is said to be constituted of a multitude of separate factors or elements, each one being a minute element of ability. Thus, any mental act, according to this theory, involves a number of these minute elements operating together. Further, any other mental act also involves a number of elements in combination. Hence, if performances on these two mental tasks are positively correlated, the degree of correlation is due to the number of common elements involved in the two acts. Figure 11.3 represents this theory diagrammatically.

Critical Review

According to this theory, if two types of mental activities, say A and B, are more highly correlated than A and C, the reason for this is that the first pair (A and B) has more common elements than the second pair (A

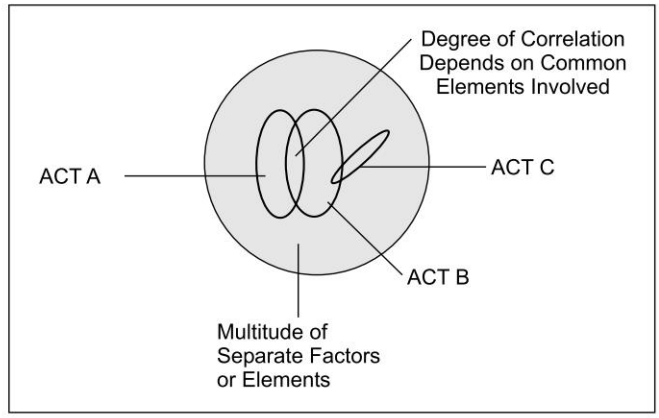

Fig. 11.3 Multifactor Theory

and C). If this reason is believed, then there is really no such factor as 'general intelligence'; there are many highly specific acts. Thus, Thorndike's theory is really an 'atomistic' theory of mental ability. In due course, Thorndike also realized that his 'atomistic' theory is of less practical significance.

Group Factor Theory

The most prominent group factor theory intermediate between the theories of Thorndike and Spearman is that of **Thurstone's**. Thurstone offered a new factor model in 1938. This provides, in addition to the specific factors, for group factors (but not general factors), each of which is responsible for one class of performance.

Thurstone generalized Spearman's method and formulas, translated them into matrix algebra and carried out large-scale studies. He concluded that Spearman was wrong in postulating a single '*g*' factor, and that an alternative description in terms of several 'primary abilities' fitted the data much better. The main factors he discovered were *S* (spatial ability), *P* (perceptual speed), *N* (numerical ability), *V* (verbal meaning), *M* (memory), *W* (verbal fluency) and *R* (inductive reasoning). These all factors are listed in Table 11.2. Based on these factors, Thurstone constructed a new test of intelligence known as 'Test of Primary Mental Abilities (PMA)'.

There are several reasons why this apparent conflict between the two systems is less real than it appears at first. Spearman had laid down two main conditions under which he said his '*g*' would be found. The first was related to populations sampled and the second related to choice of tests. These two conditions differ in case of comparative analysis of Spearman and Thurstone's work and thus the findings differ.

Thurstone later recognized the force of these objectives and on further research found that his factors correlated quite well and corresponded quite well to the types of tests Spearman had called for and Thurstone found that when the matrix of intercorrelations between his factors was analyzed, a single '*g*' factor was found. This suggests a hierarchical structure of intellect with a '*g*' at the top and the 'primary abilities' (whose intercorrelations necessitated the postulation of '*g*') at a lower level.

TABLE 11.2 Group Factors

Factor	Meaning
Number Factor (N)	Ability to do numerical calculations rapidly and accurately
Verbal Factor (V)	Found in tests involving verbal comprehension.
Space Factor (S)	Involved in any task in which the subject manipulates the imaginary object in space
Memory (M)	Involving ability to memorize quickly
Word Fluency Factor (W)	Involved whenever the subject is asked to think of isolated words at a rapid rate
Reasoning Factor (R)	Found in tasks that require a subject to discover a rule or principle involved in a series or groups of letters

The agreement between Spearman and Thurstone is almost perfect, and it should be noted that, in his work, Spearman had also found evidence of group or 'primary' factors, such as verbal ability and fluency that could not be explained entirely in terms of similar '*s'* factors.

Vernon's Hierarchical Theory

Vernon became increasingly involved in studying the contributions of environmental and genetic factors to intellectual development. He continued to analyze the effects of genes and the environment on both individual and group difference in intelligence. He concludes that individual difference in intelligence are approximately 60 percent attributable to genetic factors and that there is some evidence implicating genes in racial group differences in average levels of mental ability. Based on his long research findings, he formulated his hierarchical theory of intelligence.

Vernon (1960, 1965, 1971), in his theory, has described different levels of intelligence that may fill in the gaps between two extreme theories, Spearman's the two-factor theory that did not allow for the existence of group factors and Thurstone's multiple-factor theory, which did not allow a '*g*' factor. According to his theory, intelligence can be described as comprising abilities at varying levels of generality:

1. **Highest level** The highest level is the '*g*' (general intelligence) factor with the largest source of variance between individuals (Spearman).
2. **Next level** Major group factors such as verbal-numerical-educational (v.ed.) and practical-mechanical-spatial-physical (k.m.) ability.
3. **Next level** Minor group factors are divided from major group factors.
4. **Bottom level** The bottom level is the '*s*' (specific) factor (Spearmen).

In this manner, Vernon inserted two further levels between Spearman's *g* and specific factors relevant to only one test.

Guilford's Model of Human Intellect

The structure of intelligence can be determined from a number of different standpoints. In the factor-analytical sphere, the concept of the structure of intelligence has acquired a special meaning as a system of factors that determine intellectual performance. A particularly well-known model for the structure of intellect (intelligence) has been suggested by **Guilford** (1959, 1967). In his model of human intellect, Guilford has taken Thurstone's set of factors even further and has admitted no '*g*' at all. Guilford postulates four types of mental contents (figural, symbolic, semantic and behavioral), upon which five types of operations can be performed: cognition, memory, evaluation, divergent production and convergent production. This leads to one or more of six products: units, classes, relations, systems, transformation or implications. Thus, we have

120 possible combinations of these three classes of variables, and Guilford points out that example of most of these are already in existence in the mental testing literature; he himself and his students have added many of the missing ones. In 1984, Guilford increased the number of abilities proposed by his theory, raising the total to 150.

Content	*	Operation	*	Product	=	Intelligence
4	*	5	*	6	=	120
5	*	5	*	6	=	120

Guilford distinguishes between three aspects of every act of intelligence*: content*, *operation* and *product*, and describes various modes of variation or categories, of each dimension. Contents are symbols and terms—tools in which we think (words, images), operations refer to acts of thinking, and product are the ideas we come up with. In addition to the categories, 'figural', 'symbolic', 'semantic', he posits a fourth category that is purely theoretical, along the dimension of content designated as 'behavioral' and representing the general area of 'social intelligence'. Guilford's theoretical model represents (i.e. predicts) 120 distinct abilities in a cube, each cell containing a kind of problem and the corresponding factor. Figure 11.4 shows Guilford's three-dimensional model.

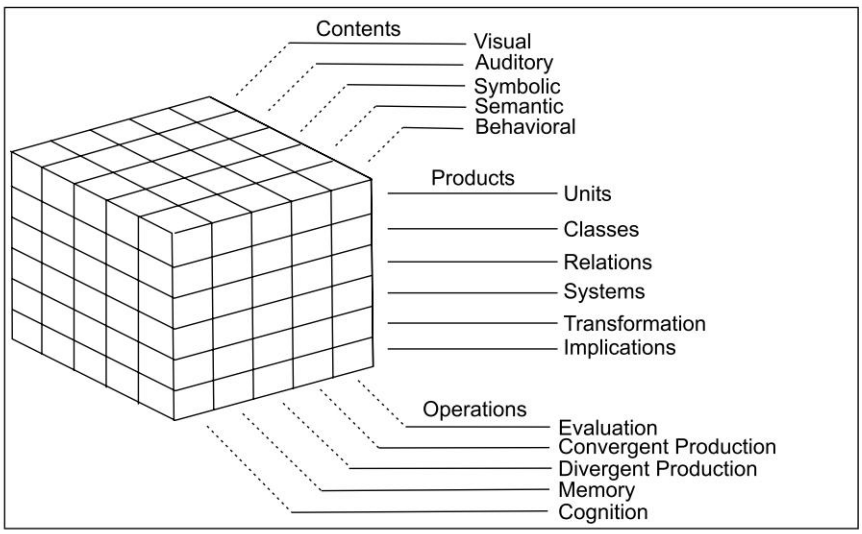

Fig. 11.4 Guilford's Three-Dimensional Model

Guilford's work is subject to several criticisms but in spite of these, it has certainly been useful in producing a whole range of novel tests and in linking mental testing much more firmly than was previously the case with experimental and theoretical psychology.

However, Guilford's factors are so narrow and specialized that they have little value in prediction as in educational and vocational guidance.

PSYCHOLOGY NUGGET

Guilford's Three Dimensions

Contents (Kinds of Information Substance)

1. **Visual**: Information arising from the direct stimulation of the retina
2. **Auditory**: Information arising from the direct stimulation of the cochlea
3. **Symbolic**: Digit, letters and their combination for math's and language
4. **Semantic**: Meaning of words and symbols

Operation (Mental Processes)

1. **Cognitive**: Discovering, knowing or comprehending items of information, process of structuring items of information by the brain
2. **Memory**: From STM to LTM
3. **Divergent Production**: Producing number of alternative items from the memory
4. **Convergent Production**: Drawing the correct conclusion from given facts
5. **Evaluation**: To judge the actuality of behavior, events and to legalize decision

Product (Information Forms)

1. **Unit**: Object combination of properties and attributes, e.g. word, object, a sound and a picture
2. **Class**: A concept behind a set of similar units, e.g. set of rectangles and set of occupation
3. **Relation**: An observed connection between two items, e.g. Amita is Amit's sister
4. **System**: Three or more items correlated in a recognizable whole, e.g. a plan of sequence of action
5. **Transformation**: Any change in an item of information, including substitution, e.g. correction in misspelling
6. **Implication**: An item of information suggested by a given item of information, e.g. seeing 5*4 and thinking 20

Critical Review

It had become apparent that there were serious problems with psychometric theories, not just individually but as a basic approach to the question. For one thing, the number of abilities seemed to be getting out of hand. A movement that had started by postulating one important ability had come, in one of its major manifestations, to postulating 150. Because parsimony is usually regarded as one of several desirable features of a scientific theory, this number caused some disturbance. For another thing, the psychometricians, as practitioners of factor analysis were called, did not seem to have any strong scientific means of resolving their differences. Any method that could support so many theories seemed somewhat suspect, at least in the use to which it was being put. Most significant, however, was the seeming inability of psychometric theories to say anything substantial about the processes underlying intelligence. It is one thing to discuss 'general ability' or 'fluid ability', but quite another to describe just what is happening in people's minds when they are exercising the ability in question. The cognitive psychologists proposed a solution to these problems, which was to study directly the mental processes underlying intelligence and perhaps relate them to the factors of intelligence proposed by the psychometricians.

While there are still many more points of detail on which experts disagree, overall, most would probably now agree on some form of hierarchical model, although they might not be at assessing the practical importance of '*g*' as opposed to 'primary abilities'. In addition, the division of 'intellect' into these various factors is not the only kind that is possible; **Cattell**, for instance has suggested that we should distinguish 'fluid' from 'crystallized' ability, i.e. potentiality for intellectual achievement from acquired knowledge. **Jensen** has suggested a division between level 1 (associative ability) and Level 2 (reasoning ability). A thorough discussion of these and other schemes is given by **Butcher**; like all descriptive systems there is no one 'true' scheme that must prevail, but different schemes may serve different purposes.

Jensen's Theory of Intelligence

Psychologist Arthur Jensen believes that the '*g* factor reflects individual differences in information processing'. He makes the following statement, 'The positive correlation between all cognitive test items is a given, an inexorable fact of nature. The all-positive inter-item correlation matrix is not an artifact of test construction or item selection, as some test critics mistakenly believe' (**Jenson** 1997). This *g* factor is highly positively correlated with reaction time in completing simple cognitive tasks that take most adults less than one second each (**Jensen** 1993). According to Jensen, tests that yield an IQ score correlate to some extent. Because these cognitive tests differ in their content and requisite skills, Jensen reasons that the correlation among them is not contaminated by the tests or the statistical tool of factor analysis instead, loadings on *g* reflect an attribute of the brain. It seems reasonable for Jensen to view *g* as closely related to information processing capacity. At the level of the organism, information processing encompasses a wide range of cognitive functions such as attention, memory and problem solving. At the cellular level, a neuron both receives and transmits signals. If *g* is related to the information processing and given that information processing is a fundamental aspect of our nervous system, it is possible that *g* has a biological basis.

In years since the publication of the 1969 *Harvard Educational Review* article, Jensen has published a large body of empirical research demonstrating that genetic factors are a substantial source of the variance in individual differences in IQ (**Fancher** 1985). Despite the controversial nature of his claims, in 2003 Jensen won the prestigious Kistler Prize for original contributions to the understanding of the connection between the human genome and human society.

Critical Review

Stephen Jay Gould (1981) in his book *The Mismeasure of Man* has bitterly criticized Jensen's work on three counts. The first is that Jensen misunderstands the concept of 'heritability'. Heritability measures the percentage of variation of a trait due to inheritance, *within* a population. Jensen, however, has used the concept of heritability to measure differences in inheritance *between* populations (**Gould** 1981). The second criticism is relatively minor: Gould disagrees with Jensen's support of the attempts of others to calculate the IQ of dead people (1981: 153–154). The third criticism is significant: Gould disagrees with Jensen's belief that IQ tests measure a real variable, *g*, or 'the general factor common to a large number of cognitive abilities', which can be measured along a unilinear scale. This is a claim most closely identified with Cyril Burt and Charles Spearman. According to Gould, Jensen misunderstood the research of L.L. Thurstone to ultimately support this claim; **Gould** (1981) however argues that Thurstone's factorial analysis of intelligence revealed *g* to be an illusion.

Jensen's Reply to the Criticism

In a review of Gould's *Mismeasure of Man*, Dr Arthur Jensen has replied to Gould's severe criticism of him in the book. (The Debunking of Scientific Fossils and Straw Persons, Contemporary Education Review,

Summer 1982, Volume 1, Number 2, pp. 121–135). While Jensen recognizes the validity of some of Gould's claims, in many places, he criticizes Gould's general approach, 'This charge of a social, value-laden science undoubtedly contains an element of truth. In recent years, however, we recognize this charge as the keystone of the Marxist interpretation of the history of science'. Jensen adds that Gould made a number of misrepresentations, whether intentional or unintentional, while purporting to present Jensen's own positions, 'In his references to my own work, Gould includes at least nine citations that involve more than just an expression of Gould's opinion; in these citations, Gould purportedly paraphrases my views. Yet, in eight of the nine cases, Gould's representation of these views is false, misleading or grossly caricatured. Nonspecialists could have no way of knowing any of this without reading the cited sources. While an author can occasionally make an inadvertent mistake in paraphrasing another, it appears Gould's paraphrases are consistently slanted to serve his own message.'

Cattell's and Horn's Theory of Fluid and Crystallized Intelligence

Many people complain that with age, their intelligence has also declined and researches on intelligence tell this decrease begins after adolescence (**Horn, J.L**. and **Cattell, R.B**. 1967) and is only that of *fluid intelligence*, which is 'the ability to perceive relationships independent of previous specific practice or instruction concerning those relationships' (**Horn** 1967). On the other hand, *crystallized intelligence*, learning from past experiences and learning, continues to increase throughout adulthood (**Horn** and **Cattell** 1967).

To understand the simple statements better, we need to examine in detail the Cattell's and Horn's theory of fluid and crystallized intelligence. Raymond Cattell first proposed the concepts of fluid and crystallized intelligence and further developed the theory with John Horn. This theory came to be known as the Cattell-Horn theory of fluid and crystallized intelligence—*Gf-Gc* theory (**R.B. Cattell** 1941, 1950; 1971; **Horn** 1965; **Horn** and **Cattell** 1966a, 1966b). This theory proposes that general intelligence is actually an accumulation of perhaps 100 abilities working together in various ways in different people to bring out different intelligences. The *Gf-Gc* theory separates these abilities broadly into, first, two different sets of abilities that have quite different trajectories over the course of development from childhood through adulthood.

PSYCHOLOGY NUGGET

Fluid vs Crystallized Intelligence

According to **Knox** (1977), '. . . they constitute the global capacity to learn reason and solve problems that most people refer to as intelligence. Fluid and crystallized intelligence are complementary in that some learning tasks can be mastered mainly by exercising either fluid or crystallized intelligence.'

- Fluid and Crystallized Intelligence remain throughout life.
- Both types of intelligence increase throughout childhood and adolescence.
- Fluid intelligence peaks in adolescence and begins to decline progressively beginning around age 30 or 40.
- Crystallized intelligence continues to grow throughout adulthood.

The *fluid abilities* (*Gf*) drive the individual's ability to think and act quickly, solve novel problems and encode short-term memories. They have been described as the source of intelligence that an individual

uses when he or she does not already know what to do. Fluid intelligence is grounded in physiological efficiency, and is thus relatively independent of education and acculturation (**Horn** 1967). The other factor, encompassing *crystallized abilities* (*Gc*), stems from learning and acculturation and is reflected in tests of knowledge, general information, use of language (vocabulary) and a wide variety of acquired skills (**Horn** and **Cattell** 1967). Personality factors, motivation and educational and cultural opportunity are central to its development and it is only indirectly dependent on the physiological influences that mainly affect fluid abilities.

In simple words, intelligence is composed of a number of different abilities that interact and work together to produce overall individual intelligence. The fluid aspect of this theory says that intelligence is a basic capacity due to genetic potentiality and is affected by the past and new experiences, Fluid intelligence is the ability to think and reason abstractly and solve problems. This ability is considered independent of learning, experience and education. Examples of the use of fluid intelligence include solving puzzles and coming up with problem-solving strategies. On the other hand, the crystallized theory is a capacity resultant of experiences, learning and environment. This type of intelligence is based upon facts and is rooted in experiences.

PSYCHOLOGY NUGGET

Controversies In Intelligence Theories

Cattell's View

Raymond Cattell held a hereditarian view of intelligence, arguing that the weight of the statistical evidence supports the idea that intelligence is largely determined by genetics. He also noted that individuals with higher IQs tend to have fewer children than individuals with lower IQs. Therefore, he suggested that it would be prudent for more intelligent people to be encouraged to have more children, and that less intelligent individuals should have fewer. Although hardly a new idea, these views excited a great deal of controversy (**Horn** 2000).

Flynn Effect

The APA Dictionary of Psychology defines the Flynn effect as 'a gradual rise of IQ level that has been observed since the time when records of IQ first were kept'. Although the average IQ remains 100 due to periodic renorming of IQ tests, raw scores have been rising. These increases have been roughly 9 points per generation (i.e. 30 years). The gains have been unequally distributed across the different abilities, with fluid abilities showing substantially greater gains than crystallized abilities.

In simple terms, psychologists and psychological measurement experts typically describe the Flynn effect as resulting from a 'softening' of IQ tests norms with the passage of time. That is, individuals tested today on an IQ test normed many years earlier, will obtain inflated IQ scores, as the older test norms are too easy (are obsolete) for individuals in contemporary society. This is one of the primary reasons why authors and publishers of IQ tests must provide 'freshened' norms via the collection of new nationally representative sample data for intelligence test batteries at least every 10 years (the generally accepted rule of thumb in the IQ testing industry). If the new norms are not provided, individuals tested on IQ tests with outdated norms will typically obtain inflated IQ scores.

Flynn effect has been observed in most parts of the world at different rates. If the Flynn effect has ended in developed nations, then this may possibly allow national differences in IQ scores to diminish if the Flynn effect continues in nations with lower average national IQs. Also, if the Flynn effect has ended for the majority in developed nations, it may still continue for minorities, especially for groups like immigrants where many may have received poor nutrition during early childhood or have had other disadvantages.

This type of intelligence becomes stronger as we age and accumulate new knowledge and understanding. Situations that require crystallized intelligence include reading comprehension and vocabulary exams.

Gardner's Theory of Multiple Intelligence

A few researches in the field of intelligence have argued that people have a variety of different intelligences. It is common observance that some people are good at learning one skill (learning languages for example) while terrible at another (learning music for example). Thus, keeping this fact in mind it becomes very unreasonable to suggest that any single number that indicates an IQ score cannot adequately represent the complex and diverse capabilities of a human being. Because of these research findings and Gardner's (1983) own observations regarding the current psychometric tests that only examined the linguistic, logical and some aspects of spatial intelligence and excluded the other facets of intelligent behavior such as athleticism, musical talent and social awareness (**Neisser et al**. 1996). Apart from this, Gardner also felt that the classical view of intelligence reflects a Western bias towards logical reasoning that in turn is reflected in the educational system. According to him, when we talk about intelligence in terms of processing capacity or considering Thrustone's primary mental abilities (spatial ability, perceptual speed, numerical ability, verbal meaning, memory, verbal fluency and inductive reasoning) or reviewing the tasks that are routinely included in intelligence tests, we typically are focusing on a very narrow range of logico-mathematical abilities. Keeping this fact in mind, he has developed his own theory of multiple intelligence that accounts for the diverse range of important adult capacities by considering a diverse range of abilities, each of which he values as highly as traditional conceptions of 'intelligence'.

According to Gardner's theory of multiple intelligence, there are eight different forms of intelligence. Figure 11.5 shows these pictorially. These multiple intelligences are bodily-kinaesthetic, interpersonal,

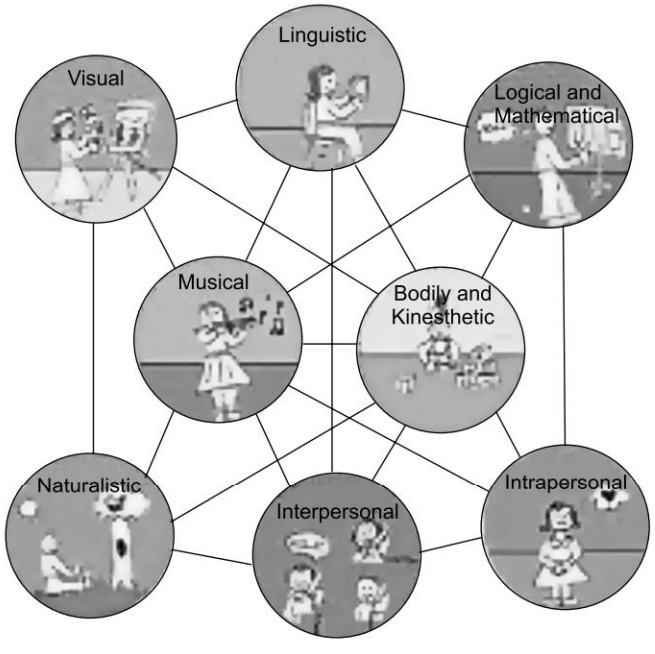

Fig. 11.5 Gardner's Theory of Multiple Intelligence

EXPERIMENTAL PERSPECTIVE

Gardner's Five Signs of Intelligence

Gardner has examined a variety of sources in order to formulate his theory of intelligence: intelligence tests, cognition experiments, neuropsychological research, child prodigies and idiot savants.

As a result, Gardner has proposed five 'signs' or criteria that he uses to identify whether an intelligence qualifies as being distinct and autonomous from other intelligences:

1. Neuropsychological evidence: isolation by brain damage

One criterion was whether an intelligence could be isolated neuropsychologically. Gardner argues that people have multiple intelligences because they have multiple neural modules. Each module, he believes, has its own way of operating and its own memory systems. Brain damage may sometimes impair one intellectual skill whilst other skills remain at least partially intact after brain damage. For example, brain-injured musicians may have impaired speech, yet retain the ability to play music (aphasia without amusia (Hodges 1996; Sergent 1993).

2. The existence of individuals with exceptional talent:

Selective competence (such as idiot savants, prodigies), such as selective deficits, suggests autonomy of that particular competence. In other words, the presence of extraordinary intelligence in one area suggests a distinct form of intelligence. If Mozart could write music before he could even read, then the neural systems involved in musical intelligence must be separate from those involved in language processing.

3. A distinct developmental history

Another source of evidence for an intelligence is a characteristic developmental trajectory leading from basic and universal manifestations to one or more expert end-states. For example, spoken language develops quickly and to great competence in normal people. In contrast, while all normal individuals can count small quantities, few progress to an understanding of higher mathematics even with formal schooling. (**Torff & Gardner** 1999).

4. Experimental evidence

For instance, individuals performing two different tasks at once indicate that some intelligences (or is it just abilities) operate autonomously.

5. Psychometric support:

For example, factor analysis shows different factors in intelligence. FA generally supports the existence of two big group factors: verbal and spatial (**Torff & Gardner,** 1999).

intrapersonal, linguistic, logical-mathematical, musical, naturalistic and spatial (**Gardner, Kornhaber** and **Wake** 1996). He believes that these multiple intelligences are relatively distinct from each other and that each person has some level of each of these eight intelligences.

Table 11.3 lists these eight intelligences identified by Gardner and provides some information about them.

TABLE 11.3 Examples of Each of the Eight Intelligences

Intelligence	Examples	Discussion
Bodily-kinesthetic	Dancers, athletes, surgeons, crafts people	The ability to use one's physical body well
Interpersonal	Sales people, teachers, clinicians, politicians, religious leaders	The ability to sense other's feelings and be in tune with others
Intrapersonal	People who have good insight into themselves and make effective use of their other intelligences	Self-awareness; the ability to know your own body and mind
Linguistic	Poets, writers, orators, communicators	The ability to communicate well, perhaps both orally and in writing, perhaps in several languages
Logical-mathematical	Mathematicians, logicians	The ability to learn higher mathematics; the ability to handle complex logical arguments
Musical	Musicians, composers	The ability to learn, perform and compose music
Naturalistic	Biologists, naturalists	The ability to understand different species, recognize patterns in nature, classify natural objects
Spatial	Sailors navigating without modern navigational aids, surgeons, sculptors, painters	The ability to know where you are relative to fixed locations; the ability to accomplish tasks requiring three-dimensional visualization and placement of your hands or other parts of your body

In developing his theory, **Gardner** (1983) attempted to rectify some of the errors of earlier psychologists who 'all ignored biology or had all failed to come to grips with the higher levels of creativity and all were insensitive to the range of roles highlighted in human society'. Therefore, Gardner based his own theory of intelligence on biological facts. **Li** (1996) summarizes Gardner's theory as follows:

Premise 1: If it can be found that certain brain parts can distinctively map with certain cognitive functioning (A), then that cognitive functioning can be isolated as one candidate of multiple intelligences (B). (If A, then B)

Premise 2: Now it has been found that certain brain parts do distinctively map with certain cognitive functioning, as evidenced by certain brain damage leading to loss of certain cognitive function. (Evidence of A)

Conclusion: Therefore, multiple intelligences. (Therefore B)

Gardner's theory has a very solid biological basis. Premise 2 takes into account the brain as a major physical determinant of intelligence. By studying individuals who had speech impairment, paralysis or other disabilities, Gardner could localize the parts of the brain that were needed to perform the physical function. He studied the brains of people with disabilities postmortem and found that there was damage in specific areas, in comparison to those who did not have a disability. Gardner found eight different areas of the brain, and so his theory consists of eight different intelligences, each related to a specific portion of the human brain (**Li** 1996).

Critical Review

Gardner's (1983) theory has not gone without being criticized in its early years of it being put forth. Though like others, he also has claimed that there is no general factor of intelligence but has not provided any theoretical support for what constitutes or how the multiple intelligences work at the social, cognitive or biological levels (**Anderson** 1992). However, **Li** (1996) later provided a solid biological basis and explanation to Gardner's

theory. Because of this reason, it becomes difficult to gather evidence for the theory of multiple intelligence. Although it is a challenging and somewhat appealing idea, there is no evidence for true autonomy of intelligences either—rather the reverse. Indeed, as per the earlier theorizing of Charles Spearman, diverse abilities are generally correlated.

Conclusion

Gardner's multiple intelligence model made a significant impact in the field of education, with schools developing broader and more responsive approaches to assessment, and a more diverse curriculum to help develop individual intelligences in each student. In addition, the idea that there is more to intelligence than *g* alone is now generally accepted. The challenge for the future is to develop a theory that makes *g* compatible with the observed degree of specificity in intellectual functioning that has been outlined as evidence by Gardner. Gardner's desire to emphasize on the value of a diverse range of human talents is laudable, but attempting to achieve this by re-naming them 'intelligences' can lead to confusion and errors in application. While it is a truism to say that we all have our strengths and weaknesses, few of us will truly excel even with concentrated application in one domain.

Sternberg's Triarchic Theory of Intelligence

An alternative theory also taking into accounts both cognition and context is Sternberg's 'triarchic' theory of human intelligence. According to Sternberg, intelligence has three aspects. These are not multiple intelligences as in Gardner's scheme. Where Gardner viewed the various intelligences as separate and independent, Sternberg posited three integrated and interdependent aspects of intelligence. These aspects relate intelligence to what goes on internally within a person to what goes on in the external world and to experience that mediates between the internal and external worlds. However, Sternberg agreed with Gardner that conventional notions of intelligence were too narrow but he disagreed as to how psychologists should go beyond traditional conceptions, suggesting that abilities such as musical and bodily-kinesthetic ones are talents, rather than intelligences in that they are fairly specific and are not prerequisites for adaptation in most cultures.

Information-Processing Components Underlying Intelligence

According to Robert Sternberg's proposed theory of human intelligence, a common set of universal mental processes underlies all aspects of intelligence. Although the particular solutions to problems that are considered 'intelligent' in one culture may be different from those considered intelligent in another, the mental processes needed to reach these solutions are the same. *Metacomponents* or executive processes enable a person to plan what to do, monitor things as they are being done and evaluate things after they are done. *Performance components* execute the instructions of the metacomponents. *Knowledge-acquisition components* are used to learn how to solve problems or simply to acquire knowledge in the first place. For example, a student may plan to write a paper (metacomponents), write the paper (performance components) and learn new things while writing (knowledge-acquisition components).

Three Aspects of Intelligence

Starting with his Triarchic Theory of Human Intelligence (**Sternberg** 1985), he has expanded on his view of human ability and success. Successful intelligence is defined as that set of mental abilities used to achieve one's goals in life, given a socio-cultural context, through adaptation to, selection of and shaping of environments. Successful intelligence involves three aspects that are interrelated but largely distinct: *analytical*, *creative* and *practical thinking* (**Sternberg** 1998). Practical Intelligence is the ability to size up a situation

well, to be able to determine how to achieve goals, to display awareness to the world around you and to display interest in the world at large (**Sternberg** 1990; **Sternberg et al**. 2000; **Wagner** 2000). The main difference of the Triarchic Theory of Intelligence from the previous theory of multiple intelligences is that in Sternberg's theory, the three parts are related with each other and are divisions of a bigger entity.

In his theory, the *analytic skill* (componential intelligence) draws on the basic cognitive processes. It is the ability to reason, to process information and to solve problems. In addition, the skill resembles more with the general concept of intelligence. The *creative skill* (experiential component) is the ability to use past experiences and learn from them in order to deal with new situations in the future. Figure 11.6 shows the three main components to the triarchic model of intelligence pictorially.

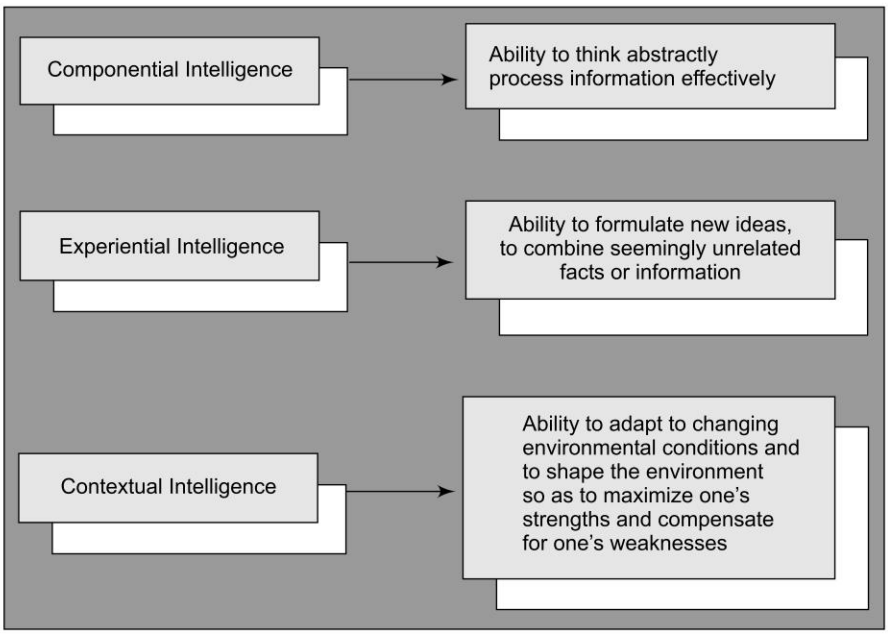

Fig. 11.6 Three Main Components to the Triarchic Model of Intelligence

Sternberg noticed that the psychometric tests were unable to measure the creative intelligence because people who had scored high in such tests had problems in dealing with real-life situations. The *practical skill* (contextual intelligence) is the people's adaptation ability to environment. This is like the recent definition of intelligence. Thus, accordingly people, who are able to adapt to and manipulate their environment in order to bring it on their needs have a tendency to be successful in real-world situations. Sternberg also noted that high practical intelligence does not mean high scores on IQ tests.

Sternberg strongly believes that intelligence can be increased by study and practice. Quite a bit of his research focuses on such endeavors. Some of Sternberg's work focuses specifically on 'street-smarts' versus 'school-smarts'. He notes that some people are particularly talented in one of these two areas and not in the other. This observation is consistent with the work of Lev Vygotsky (**Fosnot** 1996) who argues that the

type of learning that goes on outside of school is distinctly different from the type of learning that goes on in school. While some students are talented in both informal and formal education, others are much more successful in one, rather than the other.

Conclusion

The triarchic theory of intelligence provides a useful way of understanding human intelligence. It seems to capture important aspects of intelligence not captured by more conventional theories. It also differs from the theories of Howard Gardner that emphasize on eight independent multiple intelligences (such as linguistic and musical intelligence) and from the theory of emotional intelligence. The triarchic theory emphasizes on processes of intelligence, rather than domains of intelligence, as in Gardner's theory. It also views emotions as distinct from intelligence. Eventually, a theory may be proposed that integrates the best elements of all the existing theories.

Anderson's Intelligence and Development: A Cognitive Theory

Mike Anderson (1992, 1999) argues for a theory of intelligence and development that allows a synthesis of two positions: those who believe that intelligence is a biological property of our brains genetically determined and those who believe that it is a property of knowledge systems and is culturally determined.

He posited a theory of *Minimal Cognitive Architecture* (1992, 1999) in which he suggests that one route to knowledge is through thinking, and thought is constrained by the speed of some basic processing mechanism and it is this speed that is the fount of one's general intelligence or IQ. According to Anderson, this speed of processing is an innate component of individual differences. **Anderson** (1992), however, also argues that there is more to intelligence than speed of processing. It is also to do with higher levels of knowledge that are acquired through the low-level components (such as processing speed). In other words, this low-level functioning limits the higher-level capacities. Further to this, Anderson proposes that it is specificity and individual differences in types of knowledge that subsequently leads to the specific abilities such as those identified by Gardner.

Anderson proposes that human cognitive architectures will have adapted optimally to the problems posed in their environment. Therefore, discovering the optimal solution to the problem posed by the environment, independent of the architecture, is equivalent to discovering the mechanism used by the architecture. A 'Rational Analysis', as it is called, takes into account the available information in the environment, the goals of the agent, some basic assumptions about computational cost (in terms of a 'general' architecture mechanism) and produces the optimal behavioral function. This function then of course can be tested empirically and assumptions modified if it proves inaccurate. A contrasting point of view to this is espoused by Simon and is centered around the claim that in a rational analysis, the assumptions about the architecture actually do most of the work.

Eysenck's Structural Theory

In his book, *The structure and measurement of intelligence*, **Eysenck** (1979) comments that 'If we can derive a model of the intellect, therefore, from the existing literature, it may be suggested that a combination of Spearman's *g*, Thurstone's primary abilities (grouped under mental processes and test material), and the break-down of the IQ into speed, persistence and error-checking, may be the best available at the moment.' Carrying on from this point, Eysenck discovered the neurological correlates of intelligence. He identified three correlates of intelligence, i.e., reaction time, inspection time and average evoked potential. First two are observed behavior. Third behavior is description of mental waves. Brighter individual progressively takes less

time in responding. They show less variability in reaction time. Their inspection time is also less as compared to less intelligent. Average evoked potential is often measured by the wavelength in electroencephalogram and complexities of waveform. He found that the waves of intelligent individuals are complex.

Technically speaking, Eysenck has advocated Donald Hebb's theory of intelligence, which Vernon has elaborated. Hebb had labeled the biological substrate of human cognitive ability as *intelligence A*. According to him, when intelligence A interacts with environmental influences, it generated *intelligence B*. This view has been elaborated by Vernon to include *intelligence C*, which is what manifests on tests of cognitive ability. This distinction is important for the scientific study of intelligence; Intelligence B is essentially immeasurable due to the large number of confounding variables. Intelligence A is not a concrete 'thing' that can be measured, and can only be approached through measures that yield an index of Intelligence C. Intelligence tests, however, are imperfect and vary to the degree that they reflect Intelligence A or B. Eysenck believed that culturally-bounded tests and tests of educational attainment are likely to capture Intelligence B, whereas physiological measures such as positron emission tomography (PET) and electroencephalography (EEG) held more potential as possible tools for capturing intelligence A (**Jensen** 1994).

According to this theory, *intelligence A* includes all genetically determined, physiologically mediated forms of intelligence. Intelligence A can be measured by such means as electroencephalograms (EEGs) and reaction times on simple cognitive tasks (RTs). *Intelligence B* includes environmentally determined forms of intelligence, such as social or practical intelligence and *intelligence C* is that form of intelligence measured by psychometric tests.

EXPERIMENTAL PERSPECTIVE

Strategy Use and Feedback in Inspection Time

Though there is a consensus that psychometric intelligence correlates significantly with inspection time (IT), a putative measure of the efficiency of the early stages of visual information processing a controversy exists as to whether IT is a cause or a consequence of IQ differences. It has been suggested that individuals with a high IQ form macro level strategies that undermine the micro level processing assumptions of IT testing and that feedback given in the early stages of IT testing facilitates strategy formation. One such strategy involves detecting apparent movement in IT stimulus-mask displays. **Craig R. Simpson** and **Ian J. Deary** (1997) manipulated feedback during IT testing and found that:

1. There is no evidence that feedback encouraged the formation of strategies
2. Feedback did not aid performance on IT

Strategy users did not have superior IT performance. The overall level of strategy reporting was low, presumably because an effective backward mask was employed. These results do not support a causal role for strategies in the correlation between IT and psychometric intelligence; however, they are congruent with the notion that strategy reporting in the IT task is a verbal epiphenomenon. With appropriate stimulus presentation devices and an effective backward mask, many of the stimulus-mask artefact problems that lead to strategies in the IT task may be avoided.

Ceci's Bio-ecological Theory of Intelligence

Interestingly, Stephen J. Ceci's approach to intelligence theory is often cited in the psychological literature but is less popular and rarely discussed by educators of the gifted. **Ceci's** (1990) extension of Sternberg's theory to incorporate bio-ecological elements receives very little attention among educators. Ceci's biological

theory proposes that there are '*multiple cognitive potentials*' rather than a single underlying general intelligence or (g). Their emergence, however, is shaped by the challenges and opportunities in the individual's environment or context. These multiple abilities or intelligences are biologically based and place limits on mental processes. These are closely linked to the challenges and opportunities in the individual's environment. In his view, context is essential to the demonstration of cognitive abilities. By context, he means domain of knowledge and other factors such as personalities, motivation and education. Context can be mental, social or physical.

Carroll's Three-Stratum Theory of Cognitive Abilities

Another theory that is often cited in the psychological literature but is less popular and rarely discussed by educators of the gifted is **John Carroll's** (1993) Three-Stratum Theory of Cognitive Abilities. These conceptualizations of intelligence are surely worthy of further investigation.

PSYCHOLOGY NUGGET

Three-Stratum Theory of Cognitive Abilities: Test of The Structure of Intelligence Across The Lifespan

Patricia G. Bickley, **Timothy Z. Keith** and **Lee M. Wolfle** (2002) tested Carroll's three-stratum theory of intelligence using hierarchical confirmatory factor analysis with the LISREL computer program. Developmental changes in the structure of intelligence were also investigated. Results provided support for the three-stratum theory and suggested the possibility of intermediate factors between the second and third strata but did not support developmental changes in the organization of cognitive abilities over the lifespan.

Carroll in his book, 'Human cognitive abilities: A Survey of factor-analytic studies', has outlined his hierarchical theory. His theory combines the major aspects of **Spearman's** (1927) theory of general intelligence (*g*) and **Horn** and **Cattell's** (1966) theory of crystallized and fluid intelligence (G_f-G_c). He also distinguishes his hierarchical approach from taxonomic approaches such as Guilford's Structure of Intellect model (three-dimensional model with contents, operations and products). His theory is based on a factor analytic study of correlation of individual differences variables from measures including psychological tests, school marks and competence ratings. The factor analysis suggests three layers or strata, with each layer attempting to account for the variation in factor loadings at the next lower level. Thus, the three strata are defined as representing narrow, broad and general cognitive ability.

- **Stratum III** *The general level*: General intellectual ability, similar to *g*
- **Stratum II** *The broad level*: Eight factors including fluid intelligence, crystallized intelligence, general memory and learning, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speediness and processing speed.
- **Stratum I** *The specific level*: 69 narrow abilities; more specific factors grouped under the Stratum II factors and each related to a specific Stratum II domain.

According to Carroll, the factors are not simply artifacts of a mathematical process but describe stable and observable differences among individuals in the performance of tasks. The effectiveness of factors is not the least limited in accounting for behavioral differences by the existence of physiological explanations for the difference in abilities such as muscle firing rates.

Carroll has distinguished between level factors and speed factors by proposing a taxonomic dimension. The tasks that contribute to the identification or level factors can be sorted by difficulty and individuals differentiated by whether they have acquired the skill to perform the tasks. Tasks that contribute to speed factors are distinguished by the relative speed with which individuals can complete them. Carroll suggests that the distinction between level and speed factors may be the broadest taxonomy of cognitive tasks that can be offered.

Theory of Emotional Intelligence

According to **Goleman** (1995), Emotional Intelligence consists of 'abilities such as being able to motivate oneself and persist in the face of frustrations; to control impulse and delay gratification; to regulate one's moods and keep distress from swamping the ability to think : to empathize, and to hope'. The main areas are - knowing one's emotions, managing emotions, motivating oneself, recognizing emotions in others and handling relationships.

PASS Theory of Intelligence

As a by-product of the cognitive revolution, a coherent theory of cognitive processing has challenged traditional methods of studying and measuring intelligence. The PASS (Planning, Attention, Simultaneous and Successive cognitive processing) theory of intelligence identifies three operational units that are important to understand mental functioning: attention, simultaneous and successive processing and planning. The PASS theory of intelligence is based on the neuropsychological work of **A.R. Luria** (1966). The PASS model is an alternative approach to measuring and studying intelligence.

The Planning, Attention-Arousal, Simultaneous and Successive (PASS) model of processing was first proposed in 1975 by **Das**, **Kirby** and **Jarman,** and later elaborated by **Das**, **Naglieri**, **Kirby** 1994, **Das**, **Kar** and **Parrila** 1996. This model challenges the *g*-theory stating that according to neuropsychological research the brain is made up of interdependent but separate functional systems. Further, the neuroimaging and clinical studies of individuals with brain lesions make it clear that the brain is modularized. This is demonstrated by the fact that damage to a very specific area of the left temporal lobe impairs the production, but not the comprehension, of spoken and written language. On the other hand, damage to an adjacent area will have the opposite impact—preserving the individual's ability to produce, but not understand, speech and text.

The PASS theory states that when any information arrives from either external or internal sources, the four cognitive processes (see the PASS model box for the four cognitive processes) are activated, trying to decode the same within the context of the individual's knowledge base. This knowledge base can either be semantic and episodic knowledge, implicit and procedural memories and so on. In this manner, the same information can be processed in multiple ways (**Das** 2002).

The PASS theory has provided a theoretical framework for a measurement instrument called the Naglieri-Das Cognitive Assessment System (CAS), published in 1997. It has also proven useful for both intellectual assessment (e.g. the CAS) and educational intervention (**Das** 1999). However, in a study done by **Erich Christian Fein and Eric Anthony Day, (**2003**)** they extended the empirical research on the planning, attention, simultaneous and successive (PASS) theory of intelligence and its assessment via the Cognitive Assessment System (CAS) by examining the criterion-related validity of CAS scores with respect to the acquisition of a complex skill. Accordingly, 92 young adult males completed 7 hours of training

EXPERIMENTAL PERSPECTIVE

PASS Model

Based on extensive past researches (**A.R. Luria** 1966) on the modularization of brain function and supported by decades of neuroimaging research, the PASS theory divides intelligence into four interrelated cognitive processes:

1. **Planning** The planning processes involve decision-making, problem solving and performing activities and requires goal setting, self-monitoring, anticipating consequences and using feedback. It also involves the attention-arousal, simultaneous and successive processing functions described below and is associated with the frontal lobes of the brain.
2. **Attention-Arousal** The attention-arousal component involves selectively attending to a particular stimulus, ignoring distractions and maintaining vigilance. Individuals with Attention Deficit Disorder (ADD) have impairments in this area. The arousal functions are generally associated with the brain stem and thalamus, whereas the higher attentional processes are thought to be related to the planning functions of the frontal lobe.
3. **Simultaneous Processing** Simultaneous processing involves the integration of stimuli into a group and requires the observation of relationships. Simultaneous processing is necessary for language comprehension, as in: 'Who is the person in the following statement: My mother's father was his only son?' (**Naglieri** and **Das** 1997) The occipital and parietal lobes are thought to be important for these functions.
4. **Successive Processing** Successive processing involves the integration of stimuli into serial order. An example of this process is the sequencing of letters and words in reading and writing. This type of processing is believed to be related to frontal-temporal lobe functioning (**Das** 2002).

on a computer-based task that simulated the demands of a dynamic aviation environment. Cognitive and skill-based learning were assessed. Although the CAS Full score was correlated with learning, there were differences in the predictive value of the CAS scales. Successive processing was the only CAS scale to explain a unique proportion of variance in all the learning measures. Scores on simultaneous processing made important contributions to cognitive learning, and attention scores were an important contributor to skill-based learning. Planning scores were not significantly related to any of the learning criteria.

Table 11.4 summarizes intelligence theorists.

EMOTIONAL INTELLIGENCE

When we talk about emotional intelligence, we are referring to an individual's personal skills that characterize a rich and balanced personality. The label emotional intelligence may be new but the concept, as it appears too many, is not new. Many centuries back, Aristotle has talked about this. According to him, emotional intelligence is a rare ability 'to be angry with the right person, to the right degree, at the right time, for the right purpose and in the right way'. One should also not confuse between emotional intelligence and intelligent quotient. Both are distinct from the other. Intelligence quotient is an individual's ability to perform cognitive tasks adeptly. Both these kinds of intelligence are based in differing but interlinked neural circuitry, with emotional intelligence largely mediated by limbic and prefrontal areas and intelligence quotient by neocortical zones alone. However, both are not opposing competencies but discrete and synergistic ones.

The knowledge about emotional intelligence is of great assistance in psychiatry and clinical psychology. This is so because the competencies of emotional intelligence are crucial for the self-management of emotion and for the skillful handling of relationships. One learns these abilities throughout life beginning with the

TABLE 11.4 Summary of Intelligence Theorists

	Intelligence A Elementary Information Processing	Intelligence B Acquired Problem-Solving Skills	Intelligence C Artifact of Averaging Unlike Abilities
Binet			Binet concern with intelligence testing was highly practical, and relatively a theoretical. He did not regard intelligence as an entity, or even a concept, to be studied in its own right, but rather as merely the average of many unlike abilities. The composite score of an individual on a Binet-style intelligence test is call an intelligence quotient, or IQ. A psychologist at Stanford University named Terman revised Binet's original tests, and this revision became the now classic Stanford-Binet, the model for nearly all intelligence testing (including, for example, college and graduate school admissions tests like the SAT, GRE, MCAT, GMAT and LSAT).
Cattell	The fluid aspect of this theory says that intelligence is a basic capacity due to genetic potentiality that is affected by the past and new experiences.	The crystallized theory is a capacity resultant of experiences, learning and environment.	
Eysenck	Intelligence A includes all genetically determined, physiologically mediated forms of intelligence. Intelligence A can be measured by such means as electroencephalograms (EEGs) and reaction times on simple cognitive tasks (RTs).	Intelligence B includes environmentally determined forms of intelligence, such as social or practical intelligence.	Intelligence C is that form of intelligence measured by psychometric tests.
Galton	Galton founded the English school of intelligence, in which it was believed that intelligence is a real faculty with a biological basis and could be studied using reaction times on simple cognitive tasks.		

(Contd.)

TABLE 11.4 *(Contd.)*

	Intelligence A Elementary Information Processing	Intelligence B Acquired Problem-Solving Skills	Intelligence C Artifact of Averaging Unlike Abilities
Gould			He claims that general intelligence, defined as the factor common to different cognitive abilities, is merely a mathematical abstraction; hence if we consider it a measurable attribute we are reifying it, falsely converting an abstraction into an 'entity' or a 'thing'—variously referred to as 'a hard, quantifiable thing', 'a fundamental particle', 'a thing in the most direct, material sense'.
Jensen	Jensen (1997), a leading proponent of Spearman's idea of general intelligence, or *g*, makes the following statements. 'The positive correlation between all cognitive test items is a given, an inexorable fact of nature. The all-positive interitem correlation matrix is not an artifact of test construction or item selection, as some test critics mistakenly believe.' This *g* factor is highly positively correlated with reaction time in completing simple cognitive tasks that take most adults less than one second each (**Jensen** 1993).		
Spearman	Spearman (1904) gave persons tests of many different kinds of cognitive ability. When he examined the correlations of these tests with each other, he found that all the correlations were positive and called this the '**positive manifold'**. The positive manifold leads to a large first factor derived from factor analysis, dubbed **general intelligence** or ***g***.		
Sternberg		Sternberg (1985) has developed a theory of intelligence with three components: analytic (academic) intelligence, creative intelligence and practical intelligence. Analytic intelligence is the only variety adequately measured by psychometric tests.	The analytic skill draws on the basic cognitive processes. It is the ability to reason, to process information and to solve problems. In addition, the skill resembles more with the general concept of intelligence.

(Contd.)

TABLE 11.4 *(Contd.)*

	Intelligence A Elementary Information Processing	Intelligence B Acquired Problem-Solving Skills	Intelligence C Artifact of Averaging Unlike Abilities
Thurstone		Thurstone's work in factor analysis led him to formulate a model of intelligence center around 'Primary Mental Abilities' (PMAs) that were independent group factors of intelligence that different individuals possessed in varying degrees Primary Mental Abilities. The seven primary mental abilities in Thurstone's model were *verbal comprehension*, *word fluency*, *number facility*, *spatial visualization*, *associative memory*, *perceptual speed* and *reasoning*.	
Wallach and Wing		Wallach and Wing (1969) found that scores on the Scholastic Aptitude Test (SAT) predict classroom achievement, but *not* achievement in extracurricular pursuits such as leadership, writing, science and art. Achievement in these fields depends not on intelligence, but on ideational productivity or effort. 'Cognitive vitality' or energy may be a more important predictor of talent than intelligence. A more contemporary approach might suggest that self- or peer rated 'intellect' or 'openness to experience' (the fifth factor in the **five-factor model**) may be more important than scores on IQ tests in predicting creative extracurricular achievement.	
	Intelligence A: **Elementary Information Processing**	**Intelligence B:** **Acquired Problem-Solving Skills**	**Intelligence C:** **Artifact of Averaging Unlike Abilities**

primary stages during childhood. This learning shapes the child's underlying neurological circuitry that continues to mature into adolescence. If systematic learning is encouraged during the primary learning stages, as the child grows, emotional intelligence can be enhanced and deficits can be repaired through remedial learning and coaching.

Failing to master the competencies of emotional intelligence leads to heightened risks of psychiatric/psychological disorders like mood, anxiety, eating disorders and substance abuse. Thus, it is very important that the child be taught how to develop and strengthen these competencies in order to guard against a spectrum of social and psychiatric risks.

Components of Emotional Intelligence

There are five components of emotional intelligence that have been highlighted by **Daniel Goleman** (1995). They are summarized as follows:

1. *Self-awareness*: Recognizing one's feelings as they occur is the linchpin of emotional intelligence. The ability to monitor feelings from moment to moment is key to psychological insight and self-understanding. Being aware of one's emotions makes one more confident when making important personal decisions such as who to marry or what career path to follow.

2. *Managing Emotions*: Having appropriate emotional reactions is a capacity that builds on self-awareness. The ability to modulate negative effects such as anxiety, anger and depression is a crucial emotional skill. Emotional resilience helps one to prevail over life's inevitable setbacks and upsets; those who lack emotional self-regulation are continually besieged by feelings of distress.

3. *Motivating Oneself*: Being able to focus on a goal is essential for a range of accomplishments. Emotional self-control—such as delaying gratification or controlling impulsivity—is crucial in working towards such life goals. Individuals who can harness their emotions and maintain hope and optimism despite frustrations are generally more productive and effective in their undertakings.

4. *Recognizing Emotions in Others*: Empathy, another skill based in emotional self-awareness, is fundamental to interpersonal effectiveness. Those who are well-attuned to subtle social cues that indicate what others feel are more successful in personal and professional relations.

5. *Handling Relationships*: The art of relationships requires skill in managing others' emotions. Social competence underlies popularity, leadership and interpersonal effectiveness.

There are individual differences existing in each of the above-mentioned areas. Each individual's neurological constitution determines these capacities within each domain of emotional intelligence. Even though the underlying basis for emotional competence is neural, the brain circuitry is adaptable i.e. capable of being hampered into shape. The five domains mentioned above, largely, represent sets of habit and responses that are learned hence, there is great possibility of improvement with appropriate effort.

Recent Modifications

More recently, **Goleman** (2002) favors only four domains of emotional intelligence with 19 categories, as described in his book *Primal Leadership*. These four domains are as follows.

1. *Self-awareness*: These include emotional self-awareness, accurate self-assessment and self-confidence.

2. *Self-Management*: This includes emotional self-control, transparency (trustworthiness), adaptability, achievement orientation, initiative and optimism.

3. *Social-Awareness*: This includes empathy, organizational awareness and service orientation.

4. *Relationship-Management*: This includes inspirational leadership, influence, developing others, change catalyst, conflict management, building bonds, teamwork and collaboration.

According to Goleman, an important thing to understand is these emotional intelligence competencies are not innate talents but learned abilities.

Hallmarks of Emotional Intelligence

Jack Block (1995), using a related measure, has found the following three dominant characteristics of emotional intelligence. These are – self-assurance, optimism and social poise. According to him, individuals with emotional intelligence tend to have superior self-control along with an ability of self-motivation. They are principled, responsible and as such life appears meaningful to them. They manage and express their emotions appropriately. They are assertive yet sympathetic and caring in relationships. They have a rich and balanced emotional life. They are capable of managing without much worry or rumination. They appear to be gregarious, spontaneous, playful and open to sensual experience.

Emotional Quotient (EQ)

The emotional quotient is a measure of one's emotional intelligence. It is defined as an individual's ability to use both emotional and cognitive thought. The components of emotional intelligence are 'simple, yet powerful enough to effect change and they are not only limited to the ones defined'. Physiologically speaking, emotional intelligence involves the lower and central sections of the brain, called the limbic system. It also primarily involves the amygdala, which has the ability to scan everything that's happening to us moment to moment to see if it is a threat. According to Goleman and Darwin, it is emotionally intelligent individuals who are most able to adapt to dynamic environments and therefore most likely to succeed and thereby survive.

Table 11.5 shows the comparison between emotional quotient and intelligence quotient in terms of manner of operation.

TABLE 11.5 Comparison of Emotional and Intelligence Quotient

Emotional Quotient	Intelligence Quotient
Uses emotions in trying to convince someone	Uses facts alone in trying to convince someone
Uses emotions in addition to cognitive abilities to function	Relies solely on logic to function
Helps in knowing how and why	Knows only what
Helps in understanding how to motivate different types of individuals	Treats every individual in the same manner in a motivational exercise
Helps in understanding and controlling emotions to use them for something	Lets your emotions control you because you do not know how to deal with them

According to Goleman, IQ and EI are not opposing competencies, but rather separate ones. People with a high IQ but low EI (or the opposite) are, despite the stereotypes, relatively rare. There is a correlation between IQ and some aspects of EI. Table 11.6 shows the (pure-type) stereotypes.

Acquisition of Emotional Intelligence

Although emotional behavior are rooted in the operation of neurotransmitter systems, temperament is not destiny; emotional intelligence competencies are largely learned with experience through childhood shaping and resetting of those neurotransmitter systems. Timid children seem to begin life with a neural circuitry

TABLE 11.6 Pure-type Stereotypes

	Pure High IQ	Pure High EI
Male	Is typified, no surprise, by a wide range of intellectual interest and abilities. He is ambitious and productive, predictable and dogged and untroubled by concerns about himself. He also tends to be critical and condescending, fastidious and inhibited, uneasy with sexuality and sensual experience, unexpressive and detached and emotionally bland and cold.	Is socially poised, outgoing and cheerful, not prone to fearfulness or worried rumination. He has a notable capacity for commitment to people or causes, for taking responsibility and for having an ethical outlook; he is sympathetic and caring in his relationships. His emotional life is rich, but appropriate; he is comfortable with himself, others, and the social universe he lives in.
Female	Has the expected intellectual confidence, is fluent in expressing her thoughts, values intellectual matters and has a wide range of intellectual and aesthetic interests. She tends to be introspective, prone to anxiety, rumination, and guilt and hesitates to express her anger openly.	Tend to be assertive and expresses her feelings directly and feels positive about herself; life holds meaning for her. She is outgoing and gregarious and expresses her feelings appropriately; she adapts well to stress. Her social poise lets her easily reach out to new people; she is comfortable enough with herself to be playful, spontaneous and open to sensual experience. She rarely feels guilty or sinks into rumination.

that renders them more reactive to even mild stress—from birth, their hearts beat faster than other infants' in response to do strange or novel situations. This easily aroused anxiety seems to promote life-long introversion. Middle-aged women who report having been particularly shy as children tend to experience more fears, worries and guilt, and to suffer more from stress-related conditions such as migraine headaches, irritable bowel syndrome and other stomach problems throughout life, compared with their more extroverted peers.

PSYCHOLOGY IN EVERYDAY LIFE

Why are Some Lives Fulfilled Whereas Some are Not: The Critical Role of EQ

Many of us wonder and seek to know about the skills that are best predictors of academic and life success? There have always been questions as to why some children when they grow up are more successful in their careers and relationships than others they grew up with. Today it is being recognized by many educators that students who receive an exclusively academic education may be ill-equipped for future challenges, both as individuals and members of society—it is just not enough to feed only the mind. This new insight has led to the emergence of the field of social and emotional learning (SEL), which enables one to better understand the biological, emotional and intellectual aspect in relation to success and happiness. It has been advocated that through social and emotional learning children's emotional intelligence (EQ) is bolstered, giving them an enormous edge in their personal and professional futures. **Daniel Goleman** (1995), the leading expert in this field, reported: 'IQ is only a minor predictor of success in life, while emotional and social skills are far better predictors of success and well-being than academic intelligence.'

The term 'emotional intelligence' was first used by Peter Salovey. However, the concept of emotional intelligence (EQ) is nothing new. It has been there since the time of Socrates who uttered the wise words, 'Know Thyself'. Ages passed and now we have begun to formalize Socrates' philosophies into what has become known as social and emotional learning (SEL), the learning process by which we can aspire to a higher EQ. Many researches done lend support to the fact that that EQ is the best predictor of a child's future achievement; better than any other single factor. EQ is a better predictor of success than IQ and technical skills combined. In his important work on multiple intelligences, Howard Gardner has outlined the presence of seven domains of

intelligence; two of them were interpersonal and intrapersonal—these combined were the forerunner of what we now known as emotional intelligence.

Social and emotional competencies 'allow us to modulate emotions, solve social problems creatively, to be effective leaders and collaborators, (and) to be assertive and responsible'. Self-understanding and greater emotional management coupled with the ability to deal wisely and effectively with others, positively impacts people's capacity to negotiate their everyday lives. An atmosphere that provides support for one's social and emotional learning and competence versus one that does not can make a huge difference in a child's life. The difference is equal to the difference in the outcome of throwing seeds on cement versus planting seeds in enriched soil. The good news is that social and emotional skills can be learned and enhanced at any age. Infants, children and adults alike can develop their social and emotional understanding; however, the earlier a person beings the SEL process, the greater the advantages. It is thus very crucial to provide children with an environment that allows them to develop their social and emotional skills.

The emotional lessons of childhood can have a profound impact on temperament, either amplifying or muting an innate predisposition. **Kagan** (1995) finds that throughout childhood, some timid children grow bolder as experience reshapes key neural circuitry. More socially skilled children in this group were far more likely to have a succession of positive experiences with other children. Kagan posits this behavioral change toward boldness marks an underlying shift in neurotransmitter set points in the amygdale. All learning—emotional, factual or logical—implies a physical change in the brain, a strengthening of synaptic connection.

Research suggests that emotionally adept parenting leads to improved vagal-nerve function in children. According to **John Gottman** (1995), parents modify their children's vagal tone with emotional 'coaching': talking to children about their feelings and how to understand them, adopting an uncritical and nonjudgmental stance, helping children to solve emotional predicaments and offering constructive alternatives to hitting and sulking behaviors.

Applied Side of Emotional Quotient

It is not necessary that if one has a high intelligent quotient he will be a successful person. Survival in today's society requires that an individual has the necessary communication and organizational skills to make sound decisions and be interactive. It has been advocated by Goleman that to be successful at work, one needs to depend only 20 percent on intelligent quotient and the rest 80 percent on emotional quotient. This advocacy is based upon the fact that while at work one needs emotional intelligence components in assisting employees with decision-making in areas such as teamwork, inclusion, productivity and communication. Apart from this for effective communication, one needs to be a good listener as well and possess skills necessary for the job. All these are integral components of emotional quotient that carry the elements of self-awareness and control, empathy and social expertness. Thus, to succeed one needs more of emotional quotient than intelligence quotient.

MORAL INTELLIGENCE

Moral intelligence is 'the mental capacity to determine how universal human principles should be applied to our values, goals and actions'. In the simplest terms, moral intelligence is the ability to differentiate right from wrong as defined by universal principles. Universal principles are those beliefs about human conduct that are common to all cultures around the world. Thus, we believe they apply to all people, regardless of gender, ethnicity, religious belief or location on the globe. Broadly conceived, moral intelligence represents the ability to make sound decisions that benefit not only yourself, but others around you (**Coles** 1997; **Hass** 1998).

SOCIAL INTELLIGENCE

According to psychologist **E.L. Thorndike** (1920), who founded the study of social intelligence, the term 'social intelligence' should be defined as 'the ability to understand and manage men and women, boys and girls, to act wisely in human relations'. It is equivalent to *interpersonal intelligence*, one of the types of intelligences identified in Howard Gardner's Theory of multiple intelligences and closely related to theory of mind. According to Sean Foleno, social intelligence is a person's competence to comprehend his or her environment optimally and react appropriately for socially successful conduct. More recently, popular science writer **Daniel Goleman** (2006), has drawn on social neuroscience research to propose that social intelligence is made up of social awareness (including empathy, attunement, empathic accuracy and social cognition) and social facility (including synchrony, self-presentation, influence and concern).

Thus, interpersonal or social intelligence is the ability to understand other people: what motivates them, how they work, how to work cooperatively with them. Successful salespeople, politicians, teachers, clinicians and religious leaders are all likely to be individuals with high degrees of interpersonal intelligence. At the same time, social intelligence probably draws on specific internal (Gardner would say intrapersonal) abilities. For example, in a study of incompetence, **Kruger** and **Dunning** (1999) found that incompetent people assessed themselves as being highly competent. This lack of ability to self-assess may be due to a combination of internal (poor metacognition) and external factors (poor ability to compare oneself to others). Social intelligence appears to be receiving the most attention in the management and organizational psychology literatures (**Hough** 2001; **Riggio**, **Murphy** and **Pirozzolo** 2002).

KEY TERMS

Down's syndrome
Mental retardation
Intelligence tests
Two-factor theory
Gardner's theory
Eysenck's structural theory
PASS theory
Emotional intelligence
Emotional quotient (EQ)
Moral intelligence
Social intelligence

EVALUATE YOURSELF

Multiple Choice Questions

1. Psychologists recognize three kinds of intelligence activity. These do not include
(a) Psychological (b) Mechanical
(c) Abstract (d) Social

2. The first test designed to measure intelligence was designed by
(a) Alfred Binet (b) Theodore Simon
(c) Francis Galton (d) Louis Thurstone

3. Intelligence is the ability to
(a) Adjust in new situations (b) Avail of past experiences
(c) Abstract thinking (d) All of the above

4. Intelligence quotient is
   (a) Based on the ratio between the mental age and the chronological age
   (b) Equal to the mental age of the person
   (c) Equal to the chronological age divided by the mental age
   (d) Both (b) and (c)
5. Thurston felt that intelligence could be broken down into a number of primary abilities. To find these abilities, he applied the method of
   (a) Content analysis (b) Factor analysis
   (c) Context analysis (d) Synthesis
6. The general intelligence factor (*g*) is the major determinant of performance on the intelligence test items according to
   (a) Spearman (b) Wechsler
   (c) Thorndike (d) Vernon
7. Guilford's structure of intellect model suggests
   (a) Lumping together of items to form tests
   (b) Seven primary abilities
   (c) One hundred and twenty unique intellectual factors
   (d) The general intelligence factor '*g*'
8. Which theorist views the *g* as closely related to information processing capacity?
   (a) Horn and Cattell (b) Gardner
   (c) Sternberg (d) Jensen
9. A general relation-perceiving capacity that represents one's potential intelligence somewhat independent of socialization and education is termed by Cattell as
   (a) Crystallized intelligence (b) Fluid intelligence
   (c) Fluctuating intelligence (d) The general intelligence factor
10. The aberration PASS in the intelligence theory means
    (a) Personal assessment successively sent (b) Past associations simple solution
    (c) Planning attention simultaneous and successive (d) Present ascending series scores

Descriptive Questions

1. Critically evaluate the definition of intelligence.
2. What are the determinants of intelligence? Discuss each one of them.
3. What do you understand by the term intelligent quotient? Outline its dimensions.
4. How are intelligence tests classified? Write a note on some of the prominent intelligence tests.
5. Comparatively evaluate the intelligence theories proposed by Spearman, Thorndike and Thurstone.
6. What is Guilford's contribution in the area of intelligence? Critically evaluate his major contribution as an intelligence theorist.
7. Critically review Jensen's theory of intelligence.
8. 'Many people complain that with age, their intelligence has also declined and researches on intelligence tells this decrease begins after adolescence… .' Discuss this statement in the light of researches done by Cattell and Horn.
9. 'There are eight different forms of intelligence'. Critically evaluate the theory of intelligence which propagates this notion.
10. What are the information-processing components underlying intelligence? Discuss.

Critical Thinking Questions

1. Why is the study of intelligence important in psychology? Is it because intelligence is measurable, is unique in humans and is a significant individual difference?
2. Are IQ tests alone effective in predicting the intelligence of a person? Do you think these tests if accompanied by battery of other psycho-social tests will be more effective? Evaluate.
3. Critically compare and contrast the two-factor and multi-factor theories of intelligence.
4. Is it (a) ethical and/or (b) prudent to include EQ testing in school curriculum?

PRACTICAL EXERCISES

1. Ask your students to rank two most important theories of intelligence according to him/her. Collect the responses. Do you see some pattern? Share that with the class.
2. Divide the class into two groups. Ask them to take side on the topic – 'street-smart children grow up to be more lateral-thinking adults where as book-smart children grow up to be more structural-thinking adults.'

Answers to Multiple Choice Questions

1. (a) **2.** (c) **3.** (d) **4.** (a) **5.** (b) **6.** (a) **7.** (c) **8.** (c) **9.** (b) **10.** (c)

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Chapter 12

PERSONALITY THEORIES

CHAPTER OBJECTIVES

After reading this chapter, you will learn:

- Determinants of personality and the diverse nature of personality theories.
- The psychoanalytical theories and their many variants, along with critical reviews.
- Milestone humanistic theories, along with their critical reviews.
- Origin of the trait theories of personality and the important trait theories, along with critical reviews.
- The connection between personality and social-learning and behavioral theories, along with critical reviews.
- About an important cognitive theory of personality.
- About personality assessment and the methodologies and techniques to assess personality.

INTRODUCTION

Personality is the deeply ingrained and relatively enduring patterns of thought, feeling and behavior. Personality usually refers to something that is unique about a person, the characteristics that distinguish him or her from other people. Thought, emotion and behavior as such do not constitute a personality that is, rather, the dispositions that underlie these elements. Personality implies predictability about how a person will act or react under different circumstances.

G.W. Allport (1961) conceives personality as *the dynamic arrangement in the individual of those psychophysical systems which determine his unique adaptations to his environment.* **H.J. Eysenck** (1967), lays stress on heredity as the determinant of personality and the environment plays the role of a potter in shaping it within the limits laid down by the individuals genetic inheritance.

Thus, personality is an individual's enduring persistence response pattern across a variety of situations. It is comprised of relatively stable patterns of action often referred to as *traits, dispositional tendencies, motivations, attitudes* and *beliefs* that are combined into a more or less integrated self-structure. Although different theoretical perspectives on personality assign different degree of importance to genetic, social learning or broader socio-cultural elements most views consider each of these as important causal factors in the development of personality attributes. In general, most contemporary theories of personality consider both genes and environment as important formative influences in personality.

PSYCHOLOGY NUGGET

Why is it Difficult to Synthesize a Unified Theory of Personality?

Personality psychology, also known as *personology,* is the study of the *person,* that is, the whole human individual. When we think of personality, we often actually think of personality *differences*. This is certainly an important part of personality psychology, since one of the characteristics of persons is that they can differ from each other quite a bit. But the main part of personality psychology addresses the broader issue of 'what is it to be a person'.

Personality psychologists view their field of study as being at the top of a pyramid of other fields in psychology, each more detailed and precise than the ones above. Practically speaking, that means that personality psychologists must take into consideration biology (especially neurology), evolution and genetics, sensation and perception, motivation and emotion, learning and memory, developmental psychology, psychopathology, psychotherapy, and whatever else might fall between the cracks.

Since this is quite an undertaking, personality psychology may also be seen as the least scientific (and most philosophical) field in psychology. It is for this reason that most personality courses in colleges still teach the field in terms of *theories*. We have dozens and dozens of theories, each emphasizing different aspects of personhood, using different methods, sometimes agreeing with other theories, sometimes disagreeing.

Like all psychologists and all scientists, personality psychologists yearn for a *unified* theory—one we can all agree on and one that is firmly rooted in solid scientific evidence. Unfortunately, that is easier said than done. People are very hard to study. We are looking at an enormously complicated organism (one with 'mind', whatever that is), embedded in not only a physical environment, but in a social one made up of more of these enormously complicated organisms. Too much is going on for us to easily simplify the situation without making it totally meaningless by doing so.

Determinants of Personality

Heredity and environment interact to form personality. From the earliest age, infants differ widely because of variables that either are inherited or result from conditions of pregnancy and birth. Some infants are more attentive than others, for example, whereas some are more active. These differences can influence how parents respond to the infant—one illustration of how hereditary conditions affect environmental ones. Among the personality characteristics that are known to be at least partly determined by heredity are intelligence and temperament; some forms of psychopathology are also in part hereditary.

In addition to the influences of heredity, what happens to a developing child has a greater or lesser effect depending on when it happens. Many psychologists believe that critical periods exist in personality development. These are periods when an individual is more sensitive to a particular type of environmental event. During one period, for example, language ability changes most rapidly; during another, the capacity for guilt is most likely to be developing.

Most experts believe that a child's experiences in the family are crucial for personality development. How well basic needs are met in infancy, along with later patterns of child rearing, can leave a permanent mark on the personality. Children whose toilet training is started too early or carried out too rigidly, for example, may become defiant. Children learn behavior appropriate to their sex by identifying with their same-sex parent; a warm relationship with that parent facilitates such learning. Children are also influenced by their siblings.

Some authorities emphasize on the role of social and cultural traditions in personality development. In describing the behavior of members of two New Guinea tribes, for example, the American anthropologist Margaret Mead demonstrated this cultural relationship. Although the tribes are of the same racial stock and live in the same area, one group is peaceful, friendly and cooperative, whereas the other group is assertive, hostile and competitive.

Traditionally, psychologists hold that the traits of an individual combine to form a personality and that this personality shows great consistency over time. Recently, however, many psychologists have argued that traits exist only in the eye of the beholder and that a person's personality varies with the situation.

NATURE OF PERSONALITY THEORY

In this chapter, an organized summary of the major contemporary theories of personality will be presented. A comprehensive view of the development of personality theory must surely acknowledge the work of great philosophers such as Hippocrates, Plato and Aristotle who contributed much during their times and paved the way for future development of personality theory. Psychiatrists such as Kraepelin, Janet, Freud and his followers, using clinical and intuitive, rather than scientific methods carried out the first systematic work.

Currently, we find a welter of different theories of personality based on different methods and constructs. There is little agreement on the data to be studied, still less on the definition. **Allport** (1937) listed fifty definitions and surveys such as Hall and Lindzey's or Wepman and Heine's describe at least fifteen approaches. However, many theorists might accept that personality is the relatively stable organization of a person's motivational dispositions, arising from the interaction between biological drives and the social and physical environment. The term implies both cognitive and physical attributes but usually refers chiefly to the affective-conative traits, sentiments, attitudes, complexes and unconscious mechanisms, interests and ideals that determine man's characteristic or distinctive behavior and thought.

This brings us to the close of our introductory discussion and now we shall proceed to the essence of this part - the theories of personality. If the reader is to retain a lone thought from what has been said to this point, let it be the simple impression that personality theories are attempts to formulate or represent significant aspects of human behavior.

EXPERIMENTAL PERSPECTIVE

Approaches to Study Personality

Currently, we find a welter of different theories of personality based on different methods and constructs. There is little agreement on the data to be studied, still less on the definition. Allport listed 50 definitions in 1937 and surveys such as Hall and Lindzey's or Wepman and Heine's describe at least 15 approaches. However, many theorists might accept that personality is the relatively stable organization of a person's motivational dispositions, arising from the interaction between biological drives and the social and physical environment. The term implies both cognitive and physical attributes but usually refers chiefly to the affective-conative

traits, sentiments, attitudes, complexes and unconscious mechanisms, interests and ideals, which determine man's characteristic or distinctive behavior and thought. Some of the major divergent views are discussed below.

1. **Social Stimulus Value:** Since classical time's personality has often been applied to the impressions made on others rather than of the inner self. In lay usage, a business director has a forceful, and an actress a glamorous personality. Clearly everyone plays varied roles, and tries to display a personality acceptable to those he meets; even his self-concept may be self-deceptive (Goffman 1956; Vernon 1964).
2. **Nomothetic:** Psychometrically inclined authors such as Cattell, Eysenck, and Guilford accept the reality of stable personality traits of varying degrees of generality but point out that they cannot be directly observed; they must be inferred from consistencies in speech and behavior. Their aim, then, is to isolate the main dimensions of personality through factor analysis of correlation's between tests. Hence personality is conceived as a person's scores on all the measurable factors or common traits.
3. **Idiographic:** German writers such as Dilthey and Spranger, together with most clinical psychologists, stress the need for intuitive understanding of the unique organization of each individual personality, as against measurement of his attributes. This approach is inevitably subjective, and Freudian constructs of unconscious motives are particularly open to criticism as mythical entities, even if useful in theory-building and in psychotherapy.
4. **Behaviorism:** May and Hartshorne's studies of character and other attempts to measure general traits yielded such low correlation's between tests of the same traits as to suggest that personality differences consist of specific situations. This accorded with contemporary stimulus-response (S-R) learning theories. Followers of Skinner went further by dispensing wholly with inner dispositions or drives, claiming that we should study only what is directly observable and operationally defined (Lundin 1961).
5. **Anti-Reductionism:** Both Freudian and learning theorists like Dollard and Miller trace back motivation to tension reduction of the biological drives and the effects of early learning's in infancy. Constitutional temperamental differences are also commonly recognized, for instance, by typologists such as Sheldon. Adler was the first to stress positive striving towards the future rather than determination by the past; and Allport argued that new interests and motives can be acquired at any time of life, becoming 'functionally autonomous'. The notion of the individual as creating his own personality fits in with current emphasis on curiosity and competence as basic motives, with Horney's and Fromm's accent on social influences, and with Roger's and Maslow's theories of self-actualization as the fundamental principle in personality growth and development.
6. **Organismic And Field Theory:** Theories of Lewin's, Goldstein's and Angyal's attribute the organism's behavior to its interaction with the surrounding field, rather than to its fixed dispositions. Lewin's pictorial representation of tension systems valences and barriers in the total 'life space' has been influential mainly in social psychology. But Murray's theory of 'press' has proved useful in conceptualizing environmental factors in personality.
7. **Phenomenology:** It considers personality wholly in terms of the person's perceptions of himself, of other people and his environment. Motivation, learning and adjustment are ascribed to man's need to resolve incongruities in his phenomenal field, and refashion his maladaptive interpretations. The approach, originating with Husserl, was developed by Smygg and Combs, and is implicit both in Roger's self-theory and Kelly's psychology of personal constructs. Likewise, existentialism holds that man is free to strive for meaning and self-realization in a hostile and purposeless universe.
8. **Culture Pattern Theories:** Anthropologists and sociologists tend to think of personality as the product of the social group in which people are reared. Thus, Malinowski's and Mead's observations of the non-universality of the Oedipus complex and adolescent instability show that different cultures meet man's needs in different ways and lead to different modal organizations. While accepting that personality always develops in a particular social milieu, psychologists are still more concerned with variations from the cultural norms.

FREUD'S CLASSICAL PSYCHOANALYTICAL THEORY

There are two main strands to personality theory in Freudian tradition and the relation between them still poses problems. One is a 'dynamic' theory of an instinctual drive whose satisfaction or frustration at different stages

PSYCHOLOGY NUGGET

Defense Mechanisms

- *Denial:* Claiming/believing that what is true is actually false
- *Displacement:* Redirecting emotions to a substitute target
- *Intellectualization:* Taking an objective viewpoint
- *Projection:* Attributing uncomfortable feelings to others
- *Rationalization:* Creating false but credible justifications
- *Reaction Formation:* Overacting in the opposite way to the fear
- *Regression:* Going back to acting as a child
- *Repression:* Pushing uncomfortable thoughts into the subconscious
- *Sublimation:* Redirecting 'wrong' urges into socially acceptable actions

of a child's development gives rise to particular traits or dispositions; the other is a 'structural' description of how various mental functions are organized and interact.

From the 'dynamic' point of view, personality is shaped by the way in which a person deals with instinctual drives and with the anxieties associated with them. This part of the theory is about the form taken by those drives (which are known as '*libido*') and by the anxiety produced when libido is blocked, and about the *defense mechanisms* used by the ego to reduce psychic tension and preserve a balance of forces consistent with adaptive action. Libido is satisfied or discharged mainly through bodily pleasure associated with the meeting of biological needs; it is therefore 'sexual' in Freud's revised technical sense of 'obtaining pleasure from zones of the body'. However, since successful ego-functioning is necessary for some pleasure to be possible, such as self-preservation and self-esteem; the ego must have its own instinctual energy that is known as '*narcissistic libido*'. The process by which an instinct latches onto an appropriate object, whether material or psychological, as a medium for its discharge, is '*cathexis*'; so that a person, place, activity, etc. that has been a source of pleasure is said to have been '*cathected*' or invested with libido. Obstructions of cathexis, and hence of libidinal discharge, produce tension that is experienced as anxiety, unless the libido can be '*displaced*' onto a substitute object serving the same purpose. Displacement into abstract, intellectual or cultural-aesthetic objects is called sublimation.

In the course of normal psychological development, libido is concentrated successively on different zones of the body, and its satisfaction or frustration at each stage is accompanied by particular emotional reactions. Those that are particularly intense or preponderant become consolidated as habitual dispositions. Too much of either satisfaction or frustration at a particular stage may lead to libido becoming '*fixated*' there, so that personality is dominated by the traits associated with that level and psycho-sexual maturity is not achieved.

At the time of toilet-training, libido is focused on the anal zone and its processes, and this is when the infant is first obliged to exchange pleasure for social respectability. Tension-reduction must be confined to approved times and places; and this learning of impulse-control is a seed of ego development. The issues are retention-release, giving-withholding, mess-cleanliness, obstinacy-flexibility, approval-shame.

From about the fourth year, the *phallic* part of the genitalia, i.e. penis or clitoris, becomes the focal zone, representing for the child physical prowess, competence and worth (or their apparent absence). Necessarily, the theory diverges for the sexes, and it also asserts that the child's feelings about parents are now intensified in the *Oedipus* and *Elektra Complexes* whose dominant anxieties are castration-fear and penis-envy. Associated phallic personality features are recklessness, self-confidence and courage, but these have not

been validated in the way oral and anal traits have been. However, the existence of a *latency period* between the oedipal stage and pre-puberty, in which sexual and aggressive fantasies are relatively dormant, has been given some support by research.

The final genital phase is characterized by a move away from mere self-satisfaction towards a pleasure-giving relationship with the opposite-sex partner, with the aim of reproduction. Psychological correlates are group activities, social awareness and constructive and protective schemes. The relative security and dominance of this stage in the mature personality depends upon how much libido has been shed at the pre-genital stages like troops left behind to fortify precarious positions. The stage at which the strongest force was left is that to which a person most readily '*regresses'* under stress.

From the structural point of view, the mental apparatus is seen as made up of three main systems: *Id*, *Ego* and *Superego* (see Fig. 12.1). For Freud, the Id is superficially the reservoir of biological instincts and primitive emotions that press non-rationally for gratification according to the *pleasure principle*. It forms a major part of the unconscious mind. The Ego, by contrast, is rational and realistic and has developed out of the Id as the young child learns to delay and adapt his demands in the light of physical and social realities. It is the Ego that checks whether and how satisfaction of a particular wish, fantasy or impulse would be consistent with reality-constraints ('*reality testing*') and to do this it is equipped with '*perceptual consciousness*'. The Ego is said to be the executive of personality since it has to perform executive functions in the sense of bringing integration between the conflicting demands of the Id, the Superego and the external world.

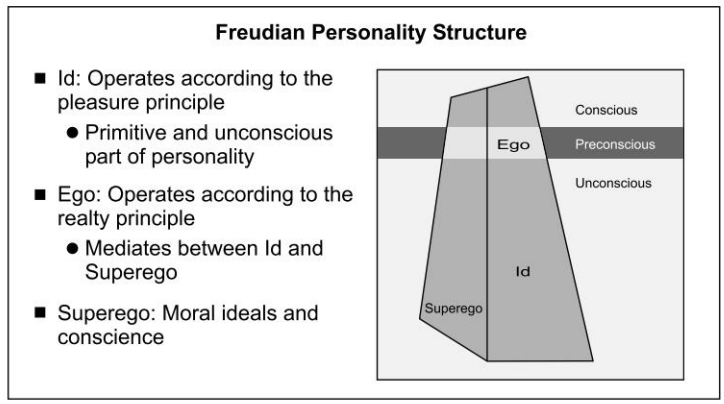

Fig. 12.1 Freudian Personality Structure

It, however, must be kept in mind that the Ego is the organized portion of the Id that it comes into existence in order to forward the aims of the Id and not to frustrate them and that all its power is derived from the Id. It has no existence apart from the Id and it never becomes completely independent of the Id. Its principle role is thus to mediate between the instinctual requirements of the organism and the conditions of the surrounding environment; its superordinate objectives are to maintain that life of the individual and to see that species is reproduced.

The third and the last system of personality to be developed is the Superego. It is the internal representative of traditional values and ideals of society as interpreted to the child by its parents and enforced by means of a system of rewards and punishments. The Superego is the moral arm of personality, it represents the ideal rather than the real, and it strives for perfection rather than pleasure. Its main concern is to decide whether something is right or wrong so that it can act in accordance with the moral standards authorized by

the agents of society. The main functions of the Superego are - to inhibit the impulses of the Id, particularly those of a sexual or aggressive nature; to persuade the Ego to substitute moralistic goals for realistic ones and to strive for perfection.

The Id, Ego and the Superego are merely names for various psychological processes that obey different system principles. These different principles mostly work together as a team under the administrative leadership of the Ego. The personality normally functions as a whole, rather than as three separate segments. In a general way, the Id may be thought of as the biological component of personality, the Ego as the psychological component and the Superego as the social component.

Critical Review

Freud was an original thinker who created a comprehensive theory of human behavior that had a profound impact on twentieth century society, as well as in areas of human endeavor such as art and literature. Few theorists in any scientific discipline have attained such a degree of fame and few theoretical concepts have been so fully incorporated into the Western culture.

Despite this, **Karl Popper** (1957) declared that psychoanalysis is a pseudoscience because it is inherently untestable. He argued that psychoanalysis is unfalsifiable because the logic of the theory allows for any finding to be explained in different ways. For example, Freud states that aggressive impulses can lead either to aggressive actions or to reaction formations against them. Therefore, it is impossible to test definitively any hypotheses about aggressive action.

Freudian psychoanalytic theory presents imprecise concepts and metaphors based on Freud's interpretation of unrecorded therapy sessions, and as such, it cannot be thoroughly examined through experimental and scientific methods. Nevertheless, recent developments within cognitive psychology concerning human memory and subliminal perception have reopened the unconscious for serious scientific investigation. From the neuropsychological perspective, **Faulkner** and **Foster** (2002) argue that the effects of brain injury may teach us a considerable amount about the relationship between the conscious and unconscious mind.

ERIK ERIKSON'S THEORY OF PERSONALITY DEVELOPMENT

The transition from one psychosexual stage to another is partly maturational. As our bodies mature and grow, we acquire new drives, needs and satisfactions. This kind of change is most dramatic at puberty. For the young child, the changes from the oral to the anal to the phallic stages (Freud's Psychosexual Theory 1960) are partly maturational. They are also very heavily influenced by the social demands of growing up. **Erik Erikson** (1963) has enriched Freud's stage theory by adding psychosocial stages to the bare-boned psychosexual stages proposed by Freud. Erikson views each stage as a time in a person's life when certain basic crises must be resolved. He has described eight such stages, which are discussed here.

1. Infancy—Trust Vs Mistrust

During the first year, infants must resolve their feelings of trust versus mistrust in the world and in other people. If during this year, they learn to place basic trust in others, then an optimistic and trusting adult life is in store for them. In this period of infancy if the baby is well handled and loved, he will develop trust, security and a basic optimism. If the baby is handled badly and neglected, he will become insecure and mistrustful. The first demonstration of social trust in the baby is the ease of his feelings, the depth of sleep, and the relaxation of his bowels. When there is trust and security, the infant will not cry when the mother goes out of sight, because she has become an inner certainty as well as an outer predictability.

2. Early Childhood—Autonomy Vs Shame and Doubt

During the second stage of life, when infants continue to learn to cope with and control the world around them, the basic conflict between a sense of autonomy and a doubting worrisome personality must be resolved. If successful, infants develop a sense of personal competence and confidence in their ability to control their own fate. This stage is the time of toilet training. If the training is successful, the child is proud of his body. If it is unsuccessful, the child may feel dirty and ashamed. According to Erikson, shame, 'is essentially rage turned against the self'. He wants to bury his face and hide himself. 'Doubt is the brother of shame.' It leads to 'compulsive doubting' later on and paranoid fears.

3. Pay Age—Initiative Vs Guilt

The third psychosocial stage of life is considered critical for acquiring initiative and for minimizing feelings of guilt and dismay. During each of these stages, the parents' behavior—whether they encourage or discourage the placing of trust, attempts to control things and efforts to initiate activities—is crucial for the resolution of basic conflicts. What children learn about themselves during their early years will influence how they cope with later developmental crises.

4. School Age—Industry Vs Inferiority

The fourth stage occurs during the school years. At this stage, the child has to learn the academic subjects; he has to master reading, writing, arithmetic, social studies and nature studies. This requires work at home and the need for self-discipline increases. He has also to relate himself to his peers in the classroom and on the play fields. He has to progress from free play to structured teamwork. The child who possesses autonomy and initiative is able to become industrious and he learns to master all these tasks in the classroom and in the playground with ease. However, the child with mistrust may doubt his future; shame and guilt may drive him to defeat and to feelings of inferiority.

5. Adolescence—Identity Vs Role Diffusion

The fifth stage occurs during adolescence. The well-adjusted young person feels self-confidence; he is not self-conscious. He has a firm sense of identity. He tries out new roles. He may be rebellious. In late adolescence, clear sexual identity is established. He develops interest in the opposite sex. The adolescent looks for leadership, he wants someone to inspire him; he wants to test his ideals. He finally decides on his career as an adult and prepares himself for it. On the other hand, if there is doubt about oneself there is role diffusion. There is the danger of delinquency or outright psychosis. There is the inability to settle an occupational identity. In order to get over the difficulties, such young men join cliques, crowds and indulge in delinquency or rioting, etc.

6. Young Adulthood—Intimacy Vs Isolation

The young adult who emerges from the identity struggle seeks intimacy to make possible good friendship. On the other hand, the person who fails in this seeks isolation; he avoids close friendships; he also avoids marriage. Erikson recalls that when Freud was asked what a normal person should do well, Freud had replied 'to love and do work'. A normal adequate individual should work and produce goods or services and he should also have the capacity to love people and lead a normal family life. This is what ancient Indians identified as '*grihasta dharma*'.

PSYCHOLOGY IN EVERYDAY LIFE

Identity Crisis in Young Adults

The term *identity crisis* was coined by the eminent personality theorist Erik Erikson. His interest in identity began in childhood. According to his belief, it was one of the most important conflicts people face in development. He reasoned that an identity crisis is a time of intensive analysis and exploration of different ways of looking at oneself.

Erikson has described identity as 'a subjective sense as well as an observable quality of personal sameness and continuity, paired with some belief in the sameness and continuity of some shared world image'. He further explains it as follows: 'As a quality of unself-conscious living, this can be gloriously obvious in a young person who has found himself as he has found his communality. In him we see emerge a unique unification of what is irreversibly given—that is, body type and temperament, giftedness and vulnerability, infantile models and acquired ideals—with the open choices provided in available roles, occupational possibilities, values offered, mentors met, friendships made and first sexual encounters.' (**Erikson** 1970). Researchers have found that those who have made a strong commitment to an identity tend to be happier and healthier than those who have not. Those with a status of identity diffusion tend to feel out of place in the world and do not pursue a sense of identity.

In today's rapidly changing world, identity crises are more common today than in Erikson's time. Exploring different aspects of yourself in the different areas of life, including your role at work, within the family, and in romantic relationships, can help strengthen your personal identity.

7. Adulthood—Generativity Vs Stagnation

Adulthood requires generativity in marriage, parenthood and work. As Erikson writes, 'Generativity is primarily the interest in establishing and guiding the next generation ... where this enrichment fails ... there is often a pervading sense of individual stagnation and interpersonal impoverishment.'

8. Maturity—Ego Integrity Vs Despair

When all the preceding psychosocial stages have been resolved, the mature adult reaches 'integrity', the peak of adjustment. The integrated person is successful, trusting and independent and dares to try new paths. He works hard; he has a well-defined role and he maintains a balanced self-concept. The man who has not been able to resolve the earlier psychosocial crisis may view himself and his life with disgust and despair. According to Erikson, 'Ego integration permits participation by fellowship as well as acceptance of the responsibility of leadership.'

The stages of psychosocial development discussed are not laid out according to strict chronological timetable. Erikson feels that a given child has his own timetable; and therefore it would have been misleading to specify an exact duration for each stage. Moreover, each stage is not passed through and then left behind. Instead, each stage contributes to the formation of the total personality. In Erikson's words, '.... anything that grows has a ground plan, and that out of this ground plan the parts arise, each part having its time of special ascendancy, until all the parts have arisen to form a functioning whole' (**Erikson** 1968). This is known as the *epigenetic principle*.

Critical Review

There are a number of good reasons why Erikson's theory may be correct, and an individual's sense of identity may change considerably through adolescence. However, Erikson's ideas were not obtained via any

large-scale surveys; they were in fact only based on his own observations and his clinical practice. Therefore, they require the evidence and support of empirical findings to discover when a sense of identity is actually achieved. An attempt to do this was made by **James Marcia** (1966), after he developed an interview technique to asses 'identity status'. A number of studies have been undertaken using Marcia's scheme. **Meilman** (1979) using this technique found out that identity development is not so strongly focused in adolescence as Erikson believes. **O'Connell** (1976) also found similar patterns. The work on identity status and its attempt to pin down Erikson's ideas has shown some interesting findings but can be criticized on three counts. Firstly, it is not the case that adolescents experience the moratorium status in different topic areas at the same time. It is evident that at a single point in time, one content area (e.g. religious belief) may be stable while another area of life decision (e.g. sexuality) is in crisis. Secondly, a crisis can occur at any point in time during adult life, but identity development is quite prominent in the early adult years (**Cowie** and **Smith** 1996). Finally, it has been discovered that for most young people, most of the time 'changes in identity are gradual' (**Cowie** and **Smith** 1996) and are not restricted to individual stage-like experiences. It would therefore appear that the status categories are not such a useful tool for adequately assessing identity as first expected.

CARL JUNG'S ANALYTIC THEORY

Key concepts in Jung's theory include the *psyche*—which subsumes the conscious, *personal unconscious* and *collective unconscious*—his reformulation of Freud's libido construct, the two psychological attitudes and four psychological functions that comprise his typology of behavior and the notion of synchronicity.

Psyche

Jung visualized the personality or **psyche** as an organic entity composed of three layers: the *conscious*, the *personal unconscious* and the *impersonal* or *collective unconscious*. **Consciousness** consists of everything about which a person is currently aware with the ego at its core. Jung defined *ego* as the thinking, feeling, perceiving and remembering organ of the personality. The primary function of the ego is to represent how a person views him or herself and the surrounding environment. The ego, according to Jung, is selective in the sense that it focuses on a portion of the internal and external environment, while ignoring the rest. Jung also located the persona on the conscious layer of the psyche. The **persona** is the mask or veneer a person projects to others and as such, constitutes the person's public personality. Whereas the persona is necessary for social living, if it becomes the individual's sole means of identity, it can severely limit the person's ability to express the unconscious elements of his or her experience.

At the next level of the psyche lies the **personal unconscious**. Jung defined the personal unconscious as thoughts, feelings and images that were once conscious but have been lost to awareness because of repression, forgetting, inattention or subliminal perception. Jung's personal unconscious parallels the unconscious and preconscious found in Freud's topographical model, with two important exceptions. First, Jung's personal unconscious not only stores past experiences but also anticipates future events. Second, Jung's personal unconscious serves an adaptive function by accentuating qualities and dispositions under-represented in the conscious. The principal elements of the personal unconscious are an 'agglomeration of associations' known as complexes. A *complex* is an emotionally charged constellation of associated thoughts, wishes, perceptions and memories. Hence, a power complex might consist of a group of interrelated thoughts, memories, wishes and perceptions centering around issues of power and control (see Fig. 12.2).

At the deepest layer of psyche lies the impersonal or **collective unconscious**. Compared to the personal unconscious that is said to be unique to each person, the collective unconscious is hypothesized to be the same for everyone. The collective unconscious is a remnant of our ancestral past and a foundation for legend,

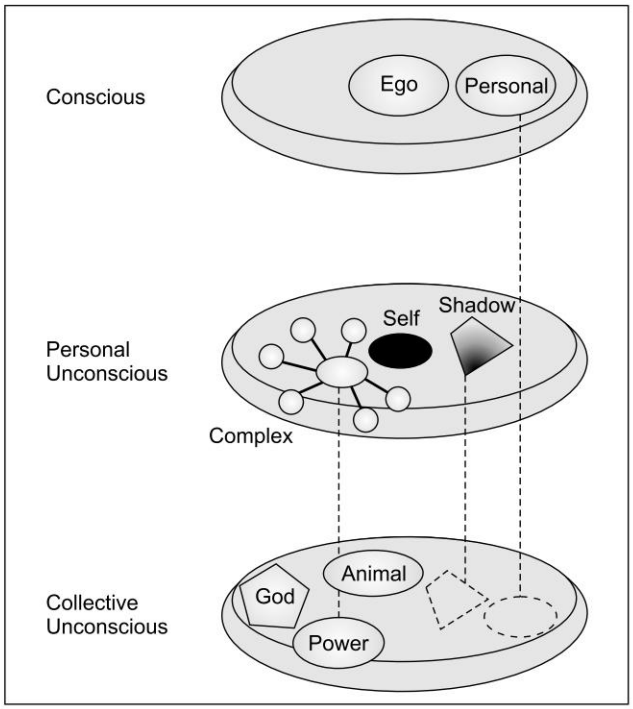

Fig. 12.2 Schematic Diagram of Jung's Conception of Psyche

myth and folklore. Similarities in mythology or folklore across different cultures were cited by Jung as verification of the collective unconscious. Whereas the personal unconscious is comprised of complexes, the collective unconscious contains instincts and archetypes. **Instincts** are defined as unconscious physical impulses to action, while *archetypes* derive from instincts and serve as the psychic counterpart to and symbolic expression of instincts. Archetypes operate according to an inherent organizing principle or psychic predisposition to think and act in a particular way. Jung posited that archetypes were universal forms with no content, the content being supplied by the cultural and personal experiences of the individual. As primordial images, archetypes find their symbolic expression in dreams, fantasies and hallucinations. The central archetype in Jung's system is the **self**. Jung pictured the self as a mandala, the symbol of unity in many Eastern religions to indicate that the self provides balance between the conscious and unconscious layers of the psyche. Whereas the ego is the center of consciousness, the self is the center of the personality. Apart from the self, there are three other main archetypes in his theory. The first is **persona**, which is expressed at the conscious level of the psyche (see Fig. 12.2), is the predisposition to project and is an image to the outside world lying within the collective unconscious. The second is **shadow**, which is the underbelly of the personality and has its foundation in primitive animal instincts. Because the shadow embodies the undesirable or unacceptable aspects of one's personality, it is often projected onto others. Finally, the third is well-known archetypes, the **anima** and **animus**. The anima is the feminine side of the man and the animus is the masculine side of the woman. Jungians attribute sensitivity and caring in men and assertiveness and reasoning in women to the anima and animus, respectively.

Libido

Jung expanded Freud's **libido** construct to encompass all forms of energy equating it with general psychic energy. His libido theory is based upon three interlocking principles. *The principle of opposition* holds that conflict between opposing processes or forces creates psychic energy. The *principle of equivalence* posits that psychic energy directed at a particular goal or objective is restructured or counterbalanced to accomplish an opposite goal or objective. Finally, the *principle of entropy* states that the psychic system is continually moving toward equilibrium or balance. In short, resolution of conflict contributes to equalization of tension. Hence, Jung visualized a system of energy created by a conflict of opposing forces that balanced itself and moved the organism toward equilibrium.

Psychological Types

Jung proposed a model of psychological attitudes and functions that he believed could elegantly explain the process by which people interpret themselves and the world. The two psychological **attitudes** that Jung highlighted were introversion and extraversion. **Introversion** is a turning of the libido inward to where the person is more influenced by the inner world than by the outer world. **Extraversion**, on the other hand, is a turning of the libido outward so that the individual pays greater attention to the outer world than to the inner world. Jung recognized that the vast majority of people fall somewhere between these two extremes, even as most of us gravitate toward one end of the continuum or the other. By means of a process known as **compensation,** the individual balances his or her conscious attitude with an equally powerful unconscious attitude.

The four psychological **functions** that comprise Jung's theory are *thinking*, *feeling*, *sensing* and *intuiting*. The **thinking** function is marked by a tendency to use the intellect to understand and interpret one's experience. Evaluating one's experience against subjective standards of acceptance and rejection evolves out of the **feeling** function. Determining whether an experience is present through the senses of sight, sound, smell, touch or taste is how the **sensing** function operates. The most difficult of the four functions to comprehend is the **intuiting** function. Here, the individual uses intuition or the unconscious to perceive reality and size up situations. Thinking and feeling are considered rational functions in that they are based on reasoning and judgment, whereas sensing and intuiting are irrational functions in that they focus on immediate perception independent of reasoning and judgment. Jung believed that most people rely on one of the four functions that he referred to as the *primary* or *superior function*, although he made allowances for two or three well differentiated functions in some individuals. The goal of self-realization or **individuation** is the synthesis and differentiation of all four functions, a task relatively few people ever accomplish.

Synchronicity

Late in his career, long after he had laid out the major tenets of his analytical theory, Jung came up with the theoretical notion of synchronicity. **Synchronicity** was defined by Jung as a causal linking phenomenon that appeared when an event in the outside world coincided with a psychological event or state of mind. Hence, the two events are correlated in space and time without necessarily being causally connected. Thinking about your father and learning shortly thereafter that he died around the same time you were thinking about him is an example of what Jung meant by synchronicity. Jung believed that synchronicity illustrates the relativity of space and time and the narrow corridor that separates the inner and outer worlds by way of the collective unconscious. Telepathy, clairvoyance and other paranormal events were believed by Jung to be the result of synchronicity.

Critical Review

While there is some evidence that myths, symbols and forms transcend culture, there is no evidence that these archetypes exist in a biologically based collective unconscious (**Noll** 1994; **Pietikainen** 1998a). Like many of Jung's concepts, libido is imprecisely defined and largely inaccessible to empirical testing. Logical problems with Jung's concept of libido have also been noted. There is evidence from the Myers-Briggs Type Indicator (MBTI) and other measures that support predictions derived from Jung's theory of psychological types (**Thompson** and **Ackerman** 1994; **Vacha-Haase** and **Thompson** 2002). Synchronicity also by definition is virtually impossible to test. Likewise, more parsimonious explanations for phenomena Jung attributed to synchronicity are possible (**Faber** 1998).

EXPERIMENTAL PERSPECTIVE

MBTI and Personality Assessment

This test is based on Carl Jung's theory of psychological types and the personality research of Isabel Briggs Myers and Katharine Cook Briggs. It serves as a tool to *assist* in determining personality type.

About Personality Types

Carl Jung's theory of psychological types says that each person is 'wired' with different tendencies and preferences. Some of us are extraverted while others are introverted; some are 'thinkers' while others are 'feelers' and so on.

The 16 Personality Types

There are 16 distinct personality types, each belonging to one of four temperaments:

Protectors (SJ)	Creators (SP)	Intellectuals (NT)	Visionaries (NF)
ESTJ—Overseer	ESTP—Persuader	ENTJ—Chief	ENFJ—Mentor
ESFJ—Supporter	ESFP—Entertainer	ENTP—Originator	ENFP—Advocate
ISTJ—Examiner	ISTP—Craftsman	INTJ—Strategist	INFJ—Confidant
ISFJ—Defender	ISFP—Artist	INTP—Engineer	INFP—Dreamer

NEO-FREUDIAN THEORY

The term 'neo-Freudian' is reserved for a smaller group of psychoanalysts whose theories share two core features. Firstly, they reject Freud's 'libido theory', his view that the primary motivators in personality are innate biological instincts of sexuality and aggression, which are specific to childhood. Secondly, they correspondingly emphasize on the importance of social needs, the influence of cultural and interpersonal factors and the role of the self in personality development.

The three theorists most frequently described as neo-Freudians in this more restrictive sense are Alfred Adler, Karen Horney and Harry Stack Sullivan. The following brief discussion first describes the major contributions of these thinkers and then summarizes what their theories have in common.

Alfred Adler

Adler was born in Vienna in 1870. He was a member of the original small group of psychoanalysts, which met at Freud's house to discuss analytic theory. He came to reject some basic tenets of Freud's theory; however, including the notion that sexual trauma is the basis for neurosis.

If we analyze Adler's contributions as compared with that of Freud's and Jung's, we find them in sharp contrast to Freud's major assumption that human behavior is motivated by inborn instincts and Jung's principle *axions* that human conduct is governed by inborn *archetypes*. Adler assumed that humans are motivated primarily by the social urges. Humans are, according to Adler, inherently social beings. They relate themselves to other people, engage in cooperative social activities place social welfare above selfish interests and acquire a style of life that is predominantly social in orientation. Adler did not say that humans become socialized merely by being exposed to social processes, social interest is inborn although the specific types of relationships with people and social institutions that develop are determined by the nature of the society into which the person is born.

To be critical about the differences portrayed by Adler, there is not much of a difference as the theories of Freud and Jung are just as biological in view point as that of Adler's. We find that each of the three assume that a person has an inherent nature that shapes his or her personality. The point of similarity can be easily seen. Freud has laid emphasis on sex, Jung on primordial thought patterns, and Adler lays stress on social interest. However, a point of difference does exist. It is this very point that has enriched Adler's contribution to psychological theory, and the point is that Adler has laid stress upon the social determinants of behavior whereas Freud and Jung either overlooked it or minimized it.

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Adler's Synthesis of Lifestyle

Alfred Adler, rather than talking about 'personality' as the Freudians did, preferred to talk about the '*style of life*', which today is popularly known as '*lifestyle*' and is a very common term for us today. According to him, a lifestyle does not develop in a vacuum, but it is the result of our interaction within our social environment. This 'style of life' was the slogan of Alder's Individual Psychology and his personality theory. It is the recurrent theme in all of Adler's later writings and the most distinctive feature of his psychology. In his writings, Adler used the terms 'style of life', 'pattern of life', 'life plan', 'life scheme', and 'line of movement' interchangeably. For Adler, the individual's style of life is one's personality, the unity of the personality, the individual form of creative opinion about oneself, the problems of life and his whole attitude to life and others.

During the first few years of life, each individual develops a style of life that greatly influences his behavior. Adler wrote, '*If we know the goal of a person, we can undertake to explain and to understand what the psychological phenomena want to tell us why they were created, what a person had made of his innate material, why he had made it just so and not differently, how his character traits, his feelings and emotions, his logic, his morals, and his aesthetic must be constituted in order that he may arrive at his goal. If we could infer the individually comprehended goal from the ornaments and melodies of a human life and, on this basis, develop the entire style of life (and the underlying individual law of movement), we could classify a person with almost natural-science accuracy. We could predict how a person would act in a specific situation.*' The life style of the individual is considered the key to his behavior. His major goal is superiority and compensation for his feeling of inferiority, but he may achieve this goal in a great variety of ways.

The striving for superiority is based on the human's ability to be aware of himself, of his ability to remember past experiences and to imagine himself in the future. The individual's life style is determined by his inventive and creative power and is an expression of his uniqueness. Each person develops his concept of self and of people and of the environment which surrounds him in his own unique and personal way.

Adler's second major contribution to personality theory is his concept of the *creative self*. Unlike Freud's ego that consists of a group of psychological processes serving the ends of inborn instincts, Adler's self is a highly personalized, subjective system that interprets and makes meaningful that experience of the organism. Moreover, it searches for experiences that will aid in fulfilling the person's unique style of life; if these experiences are not to be found in the world the self creates them. Adler's contribution to this new trend of recognizing the self as an important cause of behavior is considered a very significant one.

The third feature of Adler's psychology that sets it apart from classical psychoanalysis is its emphasis upon the uniqueness of personality. Adler considered each person to be a unique configuration of motives, traits, interests and values; every act performed by the person bears the stamp of his or her own distinctive *style of life*.

Adler, in sharp contrast to Freud's sexual theory, comments that humans are primarily social and not sexual creatures. They are motivated by social and not by sexual interest. Their inferiority's are not limited to the sexual domain but may extend to all facets of being, both physical and psychological. They strive to develop a unique style of life in which the sexual drive plays a minor role. In fact, the way in which one satisfies sexual needs is determined by one's style of life and nor vice versa. Thus, Adler's dethroning of sex was for many people a welcome relief from the monotonous pansexualism of Freud.

Finally, Adler considered consciousness to be the center of personality and which makes him the pioneer in the development of an ego-oriented psychology. According to Adler, humans are conscious beings; they are ordinarily aware of the reason for their behavior. They are conscious of their inferiority's and conscious of the goals for which they strive. More than that, humans are self-conscious individuals capable of planning and guiding their actions with full awareness of their meaning for their own self-realization. This is nothing but the complete antithesis of Freud's theory that has virtually reduced consciousness to the status of a non-entity—a mere froth floating on the great sea of the unconscious.

Adler's theory of personality is an extremely economical one in the sense that a few basic concepts sustain the completely theoretical structure. The major tenants of his theory are contained in six key concepts:

1. **Fictional Finalism**: The notion that people are motivated not primarily by past events, but by their images and expectations for future possibilities.
2. **Striving For Superiority**: The individual's innate tendency to develop his capacities to the full and to strive for perfection.
3. **Inferiority Feelings**: This Adler sees as a normal response to the realization of being less than perfect and which motivate all efforts towards self-actualization.
4. **Social Interest**: The innate tendency to be interested in other people and in the social group, manifested in cooperation, empathy, altruism and ultimately, the desire for a perfect society.
5. **Style of Life**: The different unique forms in which the individuals strive for perfection.
6. **The Creative Self**: The active, constructive center of personality that interprets experience and chooses a response to it.

In brief, we can say that Adler fashioned a humanistic theory of personality that was the antithesis of Freud's conception of man. By endowing man with altruism, humanitarianism, cooperation, creativity, uniqueness and awareness, he restored to man a sense of worth and dignity that psychoanalysis had pretty largely destroyed. In place of the dreary materialistic picture that horrified and repelled many readers of Freud, Adler offered a portrait of man that was more satisfying, more hopeful and far more complimentary to man. Adler's conception of the nature of personality coincided with the popular idea that man can be the master and not the victim of his fate.

Critical Review

Adler's theory in many ways seems more straightforward than Jung's, since his focus on striving for superiority seems less abstract than Jung's concept of individuation as the goal of growth. This is also seen in other aspects of this theory, such as style of life as an individual's pattern of personality and adjustment. In the end, his theory faces many of the same difficulties as other psychodynamic theories, in terms of evaluating its validity. Nonetheless, there is little doubt that Adler has had significant influence within the psychodynamic approach, and his theory still has many supporters.

Karan Horney

Horney saw herself as remaining within the Freudian tradition, though she tried to correct what she saw as the limitation of Freud's approach: his biological and mechanistic orientation. She accepted Freud's notion of psychic determinism, unconscious motivation and the importance of irrational emotional experience. In Horney's words, 'My conviction, expressed in a nutshell, is that psychoanalysis should outgrow the limitations set by its being an instinctivistic and genetic psychology.' Horney took sharp issue with Freud on some of his views about '*feminine psychology*'. She argued that '*penis envy*' was not a normal development in females, but rather an unusual and pathological occurrence. She also countered that some of her male patients envied women, their capacity for pregnancy, childbirth, motherhood, breast development and suckling. Horney did not deny the existence of sex differences altogether, but she stressed on the striking similarities of the two sexes as a member of the human race facing similar challenges; she proposed that what psychiatry and personality theory needed was a 'psychology of persons'. Two major components of her 'person' psychology were the twin notion of *basic anxiety* and *basic hostility* (**Horney** 1937).

Basic Anxiety She said that basic anxiety arises in childhood when the child feels helpless in a threatening world. Children learn that they are relatively weak and powerless, dependent on their parents for safety and satisfaction. Loving and reliable parents can create a feeling of security, but erratic, indifferent or rejecting parents may sharpen the child's sense of helplessness and vulnerability. This sets the stage for basic anxiety.

Basic Hostility In Horney's view, basic hostility is what usually accompanies basic anxiety and grows out of resentment over the parental behavior that led to anxiety in the first place. Because the hostility cannot be expressed directly to parents, it is typically repressed that only increases the child's anxiety. Children caught in this bind-dependent on their parents, anxious because of their parents, hostile towards their parents and unable to express their true feelings directly tend to rely heavily on one specific strategy of social behavior.

Any one of these strategies may become a more or less permanent fixture in the personality; a particular strategy may assume the character of a drive or need in the personality dynamics. Horney presents a list of ten needs that are acquired as a consequence of trying to find solutions for the problem of disturbed human relationships. She calls these needs 'neurotic' because they are irrational solutions to the problem.

1. The neurotic need for affection and approval
2. The neurotic need for a 'partner' who will take over one's life
3. The neurotic need to restrict one's life within narrow borders
4. The neurotic need for power
5. The neurotic need to exploit others
6. The neurotic need for prestige
7. The neurotic need for personal admiration
8. The neurotic ambition for personal achievement

9. The neurotic need for self-sufficiency and independence
10. The neurotic need for perfection and unassailability

These ten needs are the sources from which inner conflicts develop. They are never satisfied. In a latter publication (1945), Horney classifies these ten needs under three headings: Moving towards people; Moving against people and Moving away from people.

Moving towards people This involves excessive compliance. Security is sought by making oneself indiscriminately compliant, subject to the will of others and inclined to do whatever they wish in order to gain their approval and affection. The result may be a kind of security, but a costly kind that involves total repression of basic hostility and leaves the individual feeling depleted, exploited and unhappy.

Moving against people This involves pursuit of satisfaction through ascendance and domination of others. Self-protection is provided via one's power over others. Basic hostility may be expressed but basic anxiety is usually denied. As a result, feelings of weakness and vulnerability are neither explored nor resolved.

Moving away from people This is self-protection by withdrawal. Some people avoid the risk and pain of social relationships by avoiding relationships in the first place. This strategy does provide some protection but it also cuts short any real prospect for growth in the social realm.

Horney believed that normal people use all three modes of social interaction at times but in a relatively balanced and flexible manner, adjusting their approach to situational demands. Neurotic people, she argued, allow one approach to dominate their social interactions and this rigidity gets them into trouble.

Critical Review

It is but evident that Horney has borrowed Adler's best ideas—the three coping strategies resemble Adler's three types. Furthermore, twisting and bending the concept she came to the same conclusion. This had to happen as they both belong to the same school of thought. Horney bitterly criticized Freud's idea of penis envy but also admitted it did occasionally occur with neurotic woman. Finally, Horney's theory is limited to the neurotic leaving out the truly healthy individual. If we believe in her theory in its totality then, there is a neurotic in all of us, since she has put neurosis and health on a single continuum. However, her conceptualizations laid the groundwork for many of the central ideas of feminism that emerged decades later (**Eckardt** 2005; **Jones** 2006).

Harry Stack Sullivan

More than any of the other neo-Freudian, Sullivan moved away from Freudian theory and articulated a model of personality that is thoroughly social and interpersonal. In fact, he claims that the notion of personality, conceived in term of the single individual, is hypothetical, an illusion. Personality, he argues, consists in the relatively enduring patterns of interpersonal relations which are manifested in our lives—our relations with the real others and with the imagined others which make up the content of our thoughts, feelings and fantasies.

Sullivan describes six stages in personality development, each of which represents a new interpersonal constellation. In *infancy*, the child relates to the mother via its oral activity towards the nipple and develops notions of the good and bad other, and the correct and the wrong other. In *childhood* with the beginning of language, the child begins to relate to playmates and to form more cognitive representations of others. In the *juvenile period* (first school), the child learns to relate to the peer group and to authorities outside the home. In *pre-adolescence,* 'chum', relations with the same sex peers are central for learning cooperation, mutuality,

reciprocity and intimacy. The development of patterns of heterosexual relations becomes the focus in *early adolescence*, as *puberty* brings the beginning of the lust dynamism and this becomes differentiated from companionships and intimacy. Finally, in *late adolescence*, a long period of education in varying social roles and relations brings about the transition to the complexity of the adult social living and citizenship.

Critical Review

A personality theorist's early life history, including gender, birth order, religious beliefs, ethnic background, schooling as well as sexual-orientation all relate to that person's adult beliefs, conception of humanity and the type of personality theory that that person will develop. Sullivan did not have a positive attitude toward adult homosexuality. Whatever be the influence of his past life on this thought pattern, his concepts are useful for evaluating and solving the problems of social groups, since they were developed in the context of social settings and expressed in interpersonal terms. He stressed the removal of interpersonal barriers between hostile groups in order to make close, harmonious contact possible. His work therefore has implications for the reduction of ethnic conflicts and the gap between generations.

Otto Rank

Another student of Freud, Otto Rank, introduced a new theory of neurosis attributing all neurotic disturbances to the primary trauma of birth. In his later writings, he described individual development as a progression from complete dependence on the mother and family, to a physical independence coupled with intellectual dependence on society and finally to complete intellectual and psychological emancipation. Rank also laid great importance on the will defined as '*a positive guiding organization and integration of self, which utilizes creatively as well as inhibits and controls the instinctual drives*'.

Other Psychoanalytic Schools (Neo-Freudian)

Apart from Horney and Sullivan, the later noteworthy modifications of psychoanalytic theory include also those of the American psychoanalysts Erich Fromm and British psychoanalyst Melanie Klein.

Erich Fromm

The theories of Fromm lay particular emphasis on the concept that society and the individual are not separate and opposing forces that the nature of society is determined by its historic background, and that the needs and desires of individuals are largely formed by their society. As a result, Fromm believed, the fundamental problem of psychoanalysis and psychology is not to resolve conflicts between fixed and unchanging instinctive drives in the individual and the fixed demands and laws of society, but to bring about harmony and an understanding of the relationship between the individual and society. Fromm also stressed the importance to the individual of developing the ability to fully use his or her mental, emotional and sensory powers.

Melanie Klein

An important school of thought is based on the teachings of the British psychoanalyst Melanie Klein. Because most of Klein's followers worked with her in England, this has come to be known as the English school. Its influence, nevertheless, is very strong throughout the European continent and in South America. Its principal theories were derived from observations made in the psychoanalysis of children. Klein posited the existence of complex unconscious fantasies in children under the age of six months. The principal source of anxiety arises from the threat to existence posed by the death instinct. Depending on how concrete representations of the destructive forces are dealt with in the unconscious fantasy life of the child, two basic early mental

attitudes result that Klein characterized as a '*depressive position'* and a '*paranoid position'*. In the paranoid position, the ego's defense consists of projecting the dangerous internal object onto some external representative that is treated as a genuine threat emanating from the external world. In the depressive position, the threatening object is introjected and treated in fantasy as concretely retained within the person. Depressive and hypochondriacal symptoms result. Although considerable doubt exists that such complex unconscious fantasies operate in the minds of infants, these observations have been of the utmost importance to the psychology of unconscious fantasies, paranoid delusions and theory concerning early object relations.

Table 12.1 summarizes personality theories and Table 12.2 gives an overview of personality models.

TABLE 12.1 Personality Theories

Theories	Description
Trait theories	According to the *Diagnostic and Statistical Manual* of the American Psychiatric Association, personality traits are 'prominent aspects of personality that are exhibited in a wide range of important social and personal contexts'. In other words, persons have certain characteristics which partly determine their behavior. According to the theory, a friendly person is likely to act friendly in any situation because of the traits in his personality.
	Gordon Allport delineated different kinds of traits, which he also called dispositions. *Central traits* are basic to an individual's personality, while *secondary traits* are more peripheral. *Common traits* are those recognized within a culture and thus may vary from culture to culture. *Cardinal traits* are those by which an individual may be strongly recognized.
	Raymond Cattell's research propagated a two-tiered personality structure with 16 'primary factors' (16 Personality Factors) and five 'secondary factors'. A different model was proposed by **Hans Eysenck**, who believed that just three traits —extraversion, neuroticism and psychoticism—were sufficient to describe human personality. Differences between Cattell and Eysenck emerged due to preferences for different forms of factor analysis, with Cattell using oblique, Eysenck orthogonal, rotation to analyze the factors that emerged when personality questionnaires were subject to statistical analysis. Building on the work of Cattell and others, **Lewis Goldberg** proposed a five-dimension personality model, nicknamed the 'Big Five': Neuroticism Extraversion Agreeableness Conscientiousness Openness to experience
	John L. Holland proposed a 'RIASEC' model of personality widely used in vocational counseling. The RIASEC is a circumplex model where the six types are represented as a hexagon where adjacent types are more closely related than those more distant. Realistic—physical, hands-on, tool-oriented, masculine Investigative—scientific, technical, methodical Artistic—writing, painting, singing, etc. Social—nurturing, supporting, helping, healing Enterprising—organizing, activating, motivating Conventional—clerical, detail-oriented
	Building on the writings of Carl Jung, Isabel Myers and her mother **Katherine Briggs**, delineated personality types by constructing the Myers-Briggs Type Indicator. Their personality typology has some aspects of a trait theory. It explains people's behavior in terms of opposite fixed characteristics. Introversion / Extraversion Sensing / Intuition Thinking / Feeling Judging / Perceiving

(Contd.)

TABLE 12.1 *(Contd.)*

Theories	Description
Psychodynamic theories	Psychodynamic (also called psychoanalytic) theories explain human behavior in terms of interaction between the various components of personality. **Sigmund Freud** was the founder of this school. He broke the human personality down to three significant components: the ego, superego, and id. According to Freud, personality is shaped by the interactions of these three components.
Behaviorist theories	This school of thought was initiated by **B.F. Skinner**. According to these theories, people's behavior is formed by processes such as operant conditioning. Behaviorists explain personality in terms of reactions to external stimuli.
Cognitive and social-cognitive theories	In cognitivism, behavior is explained as guided by cognitions (e.g. expectations) about the world, and especially those about other people. **Albert Bandura**, a social learning theorist suggested that the forces of memory and emotions worked in conjunction with environmental influences.
Humanistic theories	In humanistic psychology, it is emphasized that people have free will and that they play an active role in determining how they behave. Humanistic psychology focuses on subjective experiences of persons instead of factors that determine behavior. **Abraham Maslow** and **Carl Rogers** were proponents of this view.

TABLE 12.2 Personality Models: Modern Typology

Models	Description
Factorial model	***Factorial models*** posit that there are dimensions along which human personality differs. The main purpose of a personality model is thus to define the dimensions of personality. Factor analysis is a primary tool of theorists composing factorial models. Such models arise directly from a classical individual differences approach to the study of human personality. Goldberg's Big Five model may be the best-known example of this type of theory.
Type model	***Typologies* or *type models*** arise naturally from some theories that posit *types* of people. For example, astrological signs represented a well-known, pre-scientific typological model. Typological models posit a relatively small number of modal types and possibly some interaction between the types. The Jungian typology implemented in the MBTI may best represent the typology approach.
Circumplex model	***Circumplex* models** may resemble factorial or type models but further specify a relationship between the different types or factors. Typically, some types or factors are more related than others and can be presented on a polygon. Holland's RIASEC may be the best-known example of this type of theory. Correlations of personality scores should resemble a simplex form where opposing types have low correlation and close types have a high correlation.

HUMANISTIC THEORIES

A number of theorists have focused their work upon the entity known as *self*. The term self has two distinct sets of meanings. One set has to do with people's attitude about themselves; their picture of the way they look and act; the impact they believe they have on others; and their perceived traits, abilities, foibles and weaknesses. This collection constitutes what is known as the self-*concept*, or self-*image*, 'attitudes, feelings, perceptions and evaluations of ... self as an object' (Theories Of Personality, **Hall** and **Lindzey** 1970). The second set of meanings relates to the executive functions - processes by which the individual manages, copes, thinks, remembers, perceives and plans. These two meanings, self as '*object'* and self as '*process*', are seen in most theories involving the notion of self.

Self-concepts are central to humanistic theories - theories that focus upon the individual's subjective perceptions of self, the world and the self within the world. Two of the most influential humanistic theorists are Abraham Maslow and Carl Rogers whose theories are discussed here.

Abraham Maslow's Self-Actualization Theory

Abraham Maslow developed his approach to personality from the study of healthy, creative people. In general, he objected to the usual emphasis on neurosis and maladaptive behavior that he argued derived from the fact that most personality theorists were therapists who worked with disturbed individuals. Maslow believed that in every person, 'there is an active will toward health, an impulse towards growth, or towards the actualization of human potentials' (**Maslow** 1967). This view stands in sharp contrast to Freudian and other theories that claim we have impulses, instincts, urges or traits that stand in opposition to society and that need to be repressively socializes through training and education.

Maslow drew on the work of Kurt Goldstein. In Goldstein's theory, any need motivates us to satisfy it. However, underlying all these needs is one real drive, one true motive: to self-actualize to continuously realize our own potential by whatever means we can. The drive for self-actualization is what gives unity and organization to the personality. The tasks we perform to satisfy a need are the way we look towards self-actualization. We may all share the same drive for self-actualization but the means and ends we seek vary. This is because, according to Goldstein, we have different inherent preferences and potentialities. These not only help define our means and ends, they also influence our individual development. According to Goldstein, our drive for self-actualization comes from within, and the healthy individual can overcome 'the disturbance arising from the clash with the world, not out of anxiety but out of the joy of conquest' (**Goldstein** 1939). The individual then has the possibility of mastery or control of the environment. However, if the realities of the environment are too consistent with the goals of the individual, the individual will break down or redefine his or her goals. An environment, then, must allow an individual to be in a state that is normal or adequate to his or her nature. If the environment is too unstable, the constancy and identity of the individual are threatened. If in the course of childhood development, the environment is too stressful or inconsistent with the needs of the individual, Goldstein says, the child will develop behavior patterns that deter the process of self-actualization. Maslow's need hierarchy can be used to clarify the conditions under which this occurs.

Maslow divides his need hierarchy into two groups, one based on deficiency, the other on growth. The former Maslow calls the *basic needs* (e.g. need for food); the latter are called *meta-needs* (e.g. desire for beauty, justice and goodness). Basic needs, according to Maslow, are basic in the sense that if they are unfulfilled, people give them priority over other needs. For Maslow, self-actualization is the final concern of the person: It can only receive attention after the physiological, safety, belonging and love and esteem needs of the person have been met. If the physical and social environments do not provide fulfillment of these basic needs, the person will seek to satisfy these needs by whatever means possible. Thus, the environment can either temporarily or permanently block or thwart the natural drive for self-actualization. A person who sees the world as threatening and unpredictable may pursue safety or security needs to the exclusion of self-actualization. Maslow believed in the possibilities of personal growth and thought it worthwhile to urge people to self-actualize. He took some care to describe in detail the characteristics of the self-actualized person. (Refer to Chapter 9 on Motivation—*Abraham Maslow's whole characteristics of self-actualizing people*. Also, refer to *A Theory of Sequential Need Development* for detailed works and critical analysis of Maslow.)

Rogers Self-Theory

Like Goldstein and Maslow, Carl Rogers in his *person-centered personality theory* viewed the individual as a whole being composed of complexes cognitive, emotional, biological and other processes and capable of

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Self-Actualization Theory

In his final book, *The Farther Reaches of Human Nature*, Maslow describes eight ways in which individuals *self-actualize* or eight behaviors leading to self- actualization. This discussion represents the culmination of Maslow's thinking on self-actualization.

1. **Concentration:** 'First, self- actualization means experiencing fully, vividly, selflessly, with full concentration and total absorption' (*The Farther Reaches of Human Nature*, p. 45). More often than not, we are relatively unaware of what is going on within or around us. For instance, different eyewitnesses may recount different versions of the same incident. However, we have all had moments of heightened awareness and intense involvement, moments that Maslow would call self-actualizing.
2. **Growth Choices:** If we think of life as a series of choices, then self-actualization is the process of making each decision a choice for growth. We often have to choose between growth and safety, between progressing and regressing. Each choice has its positive and its negative aspects. To choose safety is to remain with the known and the familiar but to risk becoming stultified and state. To choose growth is to open oneself to new and challenging experiences but to risk the unknown and possible failure.
3. **Self-awareness:** In the process of self-actualizing, we become more aware of our inner nature and act accordingly. This means that we decide for ourselves whether we like certain films, books, or ideas, regardless of others' opinions.
4. **Honesty:** Honesty and taking responsibility for one's actions are essential elements in self-actualizing. Rather than pose and give answers that are calculated to please another or to make ourselves look good, we can look within for the answers. Each time we do so, we get in touch with our inner selves.
5. **Judgment:** We can develop our capacity for 'better life choices' using the first four steps. We learn to trust our own judgment and our own inner feelings and to act accordingly. Maslow believes that following our instincts leads to more accurate judgments about what is constitutionally right for each of us-better choices in art, music, and food, as well as in major life decisions, such as marriage and a career.
6. **Self-development:** Self-actualization is also a continual process of developing one's potentialities. It means using one's abilities and intelligence and "working to do well the thing that one wants to do" (*The Farther Reaches of Human Nature*, p. 48). Great talent or intelligence is not the same as self-actualization; many gifted people fail to use their abilities fully while others, with perhaps only average talents, accomplish a great deal. Self-actualization is not a thing that someone either has or does not have. It is a never-ending process of making real one's potential. It is all about continually living, working, and relating to the world rather than to a single accomplishment.
7. **Peak Experiences:** 'Peak experiences are transient moments of self-actualization' (*The Farther Reaches of Human Nature*, pp. 1 and 48). We are more whole, more integrated, more aware of ourselves and of the world during peak moments. At such times we think, act, and feel most clearly and accurately. We are more loving and accepting of others, have less inner conflict and anxiety, and are better able to put our energies to constructive use. Some people enjoy more peak experiences than others; particularly those Maslow called transcending self-actualizers.
8. **Lack of Ego Defenses:** A further step in self-actualization is to recognize our ego defenses and to be able to drop them when appropriate. To do so, we must become more aware of the ways in which we distort our images of ourselves and of the external world-through repression, projection, and other defenses.

self-actualization. Like Jung and Adler, Rogers also emphasized the role of the self and conscious awareness in the life of the individual. Like many other personality theorists, he constantly tried to help people with their problems. Perhaps because many of the people he saw were college students, Roger came to a more optimistic conclusion about personal growth than did other theorists.

Rogers placed great stress on the phenomenal field of the individual or the individual's total experience at a given moment - experience that is known only to that person and cannot directly be known to others. He believed that knowing how people interpret their experiences is the first step in understanding their personality and behavior. However, Rogers also pointed out that elements of people's experience might be incorrectly represented by them or not represented at all. A healthy, mature condition of adjustment exists, he said, when people accurately symbolize to themselves their total experience. Maladjustment arises when there is a gap between people's actual experience and their awareness of it - when they deny or distort parts of their experience.

The *self-image* is particularly important in the development of personality. Each of us can be described as having an image of our *real self* (the self as it is) and of an *ideal self* (the self we would like to be). The self-image arises out of interaction with others. Parents tend to be distinguish 'worthy' actions and feelings that are rewarded, from 'unworthy' actions and feelings that are punished. If children are forced to give up or deny the 'unworthy' actions or feelings, they are compelled to deny a part of their experience. Their self-image then becomes inconsistent with their actual experience. Because their behavior is regulated not just by their own perceptions and feelings but also by values they have incorporated from their parents and others, their personality is in effect divided.

The condition for self-actualization, therefore, trusts one's own experience in the evaluation of oneself rather than evaluating oneself on the basis of the needs and interests of others. According to Rogers, a period of positive regard from parents and others in our lives help us to do this.

Critical Review

From a scientific perspective, the tendency to self-actualize is vague and untestable. While we may all have the same capacity to self-actualize, the form that actualization takes will be unique to each individual, making it impossible to establish objective criteria for measurement. Research findings though have supported some, but not all of Rogers's theoretical notions In support of his theory, it has been found that people who are seeking psychotherapy indicate more of a disparity between their real and ideal selves than people who are not seeking help. Moreover, this disparity tends to shrink in the course of successful therapy. On the other hand, some findings have suggested that acknowledging a disparity between one's real and ideal self may be a sign of maturity.

Lewin's Field Theory

Field theory is a theoretical approach by which investigators have attempted to consider the phenomena under investigation as occurring in a field, that is, as part of a totality of co-existing facts which are conceived as mutually interdependent. In particular, field theory refers to the method of analyzing casual relationships employed by Kurt Lewin and his students. This method assumes that the properties of any event are determined by its relation to the system of events of which it is a component and that changes of the moment are dependent upon changes in the immediate vicinity at a time just past.

Lewin insisted that the determinants of behavior would have to be represented in mathematical terms if psychology were to become a rigorous discipline. Because of this conviction, Lewin formulated two different psychological geometries, *topological space* and *hodological space*, to serve as diagrammatic representations of his theoretical insights.

Topological psychology provides a method for diagramming relationships in field theory. Some of the more important concepts defining topological space are *life space*, *behavior*, *environment*, *person*, *region*, *differentiation*, *locomotion* and *boundary*.

The most fundamental construct for Lewin was the *life space* or the psychological field. All psychological events are conceived to be a function of the life space that consists of the person and the environment viewed as one constellation of interdependent factors. Life space equals the psychological field or total situation; it refers to the manifold of coexisting facts that determine the behavior of an individual at a given moment.

Behavior is a function of the life space: B = f (LS). The life space is, in turn a product of the interaction between the person (P) and his environment (E). In symbolic expression, B = f (LS) = f (P, E). The word 'behavior' is employed to refer to any change in the life space that is subject to psychological laws. The characteristics of the life space (or person) are deduced from observed behavior in an observed environment.

The word 'environment' is used to refer to the objective environment or stimulus situation - the objective situation that confronts the individual at a given moment. However, Lewin also uses the term to refer to psychological environment that is conceived to be the environment as it exists for the individual. From this viewpoint, the psychological environment is an interactive product, determined both by the characteristics of the objective environment and by the characteristics of the person.

Lewin employed the term 'person' in three ways. First, he used it to refer to those properties of the individual that in interaction among themselves and with the objective environment produce the life space. In a second usage, Lewin regarded 'person' as the equivalent to 'life space'. Finally, he also used the term to refer to the 'person in the life space'. The person in the life space is the individual as related to the other entities in his life space. It may be thought of as the individual's perception of his relations to the environment he perceives.

Another basic concept is that of *region* that may be defined as any distinguishable part of the life space (or person). Regions of the psychological environment refer to present or contemplated activities rather than to the objective areas in which activities are linked. The degree of differentiation of a region refers to the number of subparts within it. Any region that has no distinguished sub-parts may be called a *cell*. Human development is expressed as a change of life space towards increasing differentiation. The life space of the newborn child is a field that has relatively few and only vaguely distinguishable areas.

Any change of position of a region within the life space is conceived to be *locomotion*. This refers primarily to locomotion of the behaving self, rather than to locomotion of parts of the psychological environment. Locomotion from one region to another involves movement of the behaving self from its present to its terminal position through a path of neighboring regions. The boundary of a region consists of those cells in the region for which there is no surrounding boundary that lies entirely within the region.

Direction in the life space is represented through the geometry of *hodological space*. The distinguished path between any two regions is the path along which the individual expects that he will move if he chooses to proceed from one region to another. It is the preferred or 'psychologically best' path, determined by its attractiveness rather than its shortness. Direction in the life space is dependent upon cognitive structure (apart from many other aspects also). If the individual has no clear knowledge of the sequence of steps necessary to achieve a given object he does not know the direction of locomotion necessary to obtain his goal. Most new situations are cognitively unstructured, and behavior will be exploratory, trial-and-error, vacillating and contradictory. Lewin utilized the concept of unstable cognitive structure to give insight into the situation of adolescence. He pointed out that the change from childhood to adulthood is a shift to a more or less unknown position.

There is interdependence between Lewin's geometrical concepts and vector psychology, which incorporates the following main dynamic concepts: *tension, valence, driving force* and *restraining force*, supplemented by the concept of *potency*. These dynamic concepts have the function of enabling one to determine which of a set of possible psychological events will occur. A system in a state of tension is said to exist within the individual whenever a psychological need or an intention exists. Tension is a state of a region or system *S* which tries to change itself in such a way that it becomes equal to the state of its surrounding regions *S1*,

S2, ..., *Sn*; it involves forces at the boundary of the region *S* in tension. A definite relation exists between the tension systems of the person and properties of the psychological environment. When a goal region that is relevant to a system in tension exists in the psychological environment, one can assert that there is a force propelling the behaving self towards the goal.

A region within the life space of an individual that attracts or repels is considered to have valence: a region of positive valence attracts, a region of negative valence repels. Potency is a factor influencing the effective strengths of valences or forces.

The construct force characterizes the direction and strength of the tendency to change. Driving force correspond to a relation between at least two regions of the life space: the region of present activity and the region of a goal. Driving forces tend to lead to locomotion. Restraining forces, as such, do not lead to locomotion, but they do influence the effect of driving forces. Any region that offers resistance to locomotion, that is, any barrier to locomotion is characterized by restraining forces at its boundary. When oppositely directed forces of about equal strength play upon the person simultaneously, conflict results.

Critical Review

Daniels (2003) pinpoints three important summary points to Lewin's field theory. First, that behavior is derived for the totality of all coexisting facts. Second, that these coexisting facts make up the dynamic field and that in the dynamic field every part is dependent on every other part. Thirdly, that behavior depends on the present field, not on past or future encounters. In this complex theory, Lewin stated that concrete people in a concrete setting can be measured mathematically and empirically proved (**Smith** 2001). In can be said that Levin's field theory equation is the psychologist's most well-known formula in social psychology, of which he was a modern pioneer. Even though as a specific psychological theory, field theory has little current vitality, but it has made its mark on the current general orientation of psychology. When his theory came it contradicted most popular theories in that it gave importance to a person's momentary situation in understanding his or her behavior, rather than relying entirely on the past (**Balkenius** 1995).

TRAIT THEORIES

The earliest approaches to personality accounted for human behavior in terms of people's innate traits or dispositions. Traits were said to be stable, enduring and consistent. A final important characteristic of traits was that they were continuous, rather than discrete. They interwined with and affected one another that meant that they could be talked about in terms of amount or degree rather than as absolutes. Because of this characteristic, however, it was difficult to find a satisfactory method for fully categorizing traits. The two trait theorists discussed here are Allport and Cattle.

Allport

According to Gordon Allport, no two people are alike, no two individuals respond in the same way to identical stimuli. Individuals differ on the basis of traits. Traits direct action, they motivate us to behave the way we do. However, some traits are more impelling than others. Allport characterized traits by the degree to which they govern personality. One important thing that needs to be pointed out is that by trait Allport did not mean one that is genetic even though he regarded some traits as 'heredity' **(Parvin** and **John** 1997). He distinguished three levels:

1. **Cardinal traits**: These are the most powerful and pervasive traits. They dominate a person's whole life. Few people possess cardinal traits. When they do, we often think of them primarily in terms of those traits.

2. **Central Traits**: These are the few traits that characterize an individual. Central traits are the kind that might be included in a letter of recommendation or a counselor's report (punctuality, industriousness, honesty, etc.).

3. **Secondary Traits**: These are the most limited in frequency and least crucial to an understanding of the dynamics of personality. They include, for example, the kind of music or food one likes.

Although traits must show up regularly in order to be known, Allport's theory allows room for trait inconsistencies or inconsistencies in human behavior. Inconsistency occurs because there are many traits, many are active at the same time, they overlap and they are organized in a different way for each individual.

Thus, we find that Allport in his theory emphasized on the individuality of the individual's world and the uniqueness of personality, and represented an image of man dominated neither by the pleasure-pain principle nor by the stimulus-response schema. His theory of '*functional autonomy'* stresses the present moment and the relative unimportance of genetic explications of behavior.

Critical Review

Allport's theory did not have great impact on later trait theorists beyond probably giving initial inspiration. Eysenck and Cattell for example, hold considerably different theories, although still employing the concept of traits **(Pervin** and **John** 1997). Another critique of his theory is that Allport did very little research in support for his theory. Even his first publication measures traits without defining them in detail, one can just hope that others perceive the concepts the same way as Allport. If not, his aim to assist in people's 'judgment' of others has failed. Although this might seem as a rather harsh critique, it does make some of his work obsolete. Finally, one could ask if we actually do come closer to the essence of personality by describing the individual in words. How about underlying emotions, motivations and changes, are they all just due to the personal characteristics that we possess? Even though many other well-supported theories of explaining personality have been proposed, Allport continued to regard this as true. He believed that by describing a person, we could learn about him or her. For *describing* personality, traits may be very useful but when *explaining* a person's behavior and motivations, one should probably ask for a much deeper theory.

Cattell's Factor Theory

The trait theory of Raymond B. Cattell, which is called factor theory, is an extreme example of a quantitatively based approach to personality. Cattell was concerned with the empirical 'mapping of the personality': with identifying a reasonable number of traits that can be used to describe all individuals and predict their behavior.

For Cattell, personality is what 'permits a prediction of what a person will do in a given situation'. The concept of a trait is important for Cattell because it is through an understanding of an individual's underlying trait structure that one can become better able to predict his or behavior in a wide variety of situations. According to Cattell, a trait may be defined as a '*unitary configuration in behavior such that when one part is present in a certain degree, we can infer that a person will show the other parts in a certain degree*'. Although it is not obvious in his definition of a trait, Cattell believes that traits are not tangible but are hypothetical constructs that are determined through an analysis of one's overt behavior. By looking at one's behavior, patterns or consistencies can be found in that behavior. These behavior patterns cause Cattell to infer the existence of a particular trait or group of traits in an individual. Cattell maintained that one must subdivide the concept of a trait in order to give meaning to it.

Cattell's most important subdivision of the concept of a trait involved the distinction between *surface traits* and *source traits*. Surface traits represent groups or clusters of overt variables that seem to go together in many different individuals and circumstances. Source traits, on the other hand, are underlying variables that seem to determine the manifestation of the surface traits. A specific situation depicting this relationship

might involve the area of intellectual performance. Through a series of studies, one finds that size of vocabulary, arithmetic ability and knowledge of literature show a strong positive relationship in individuals. It could then be said that these three overt behaviors have formed a surface trait.

In looking for the underlying causes of his surface trait or cluster of overt variables, you must find the relevant source trait. In this particular case, the most obvious source traits would be general mental capacity and amount of education experienced. Thus, when one finds a relationship among a series of overt behavior, his communality can be said to form a surface trait and the cause of this surface trait is one or more underlying variables or factors called source traits.

Cattell made a number of other distinctions between the varieties of traits that exist. Like Allport, Cattell believes that both unique and common traits exist. He agrees that common traits are those possessed by all individuals to some degree and unique traits are those that form peculiar patterns within the individual.

Cattell divided source traits into *constitutional* and *environmental-mold traits*. Constitutional source traits are those that spring or result from internal or biological conditions, whereas environmental-mold source traits involve the molding effect of social institutions and physical surroundings.

Another subdivision of traits developed by Cattell involves both surface and source traits. He states that they must be divided into *dynamic traits* and *temperament traits*. Dynamics traits are those that arise from a stimulus situation and are directed towards a particular goal. They are dependent upon the motivation and intent of the person.

Ability traits examine a person's degree of success in his or her efforts to achieve a particular goal and are themselves indicative of the individual's skills.

Finally, *temperament traits* refer to tendencies of the individual that are not affected by incentives. Describing a person as irritable or easy-going are examples of temperament traits.

Cattell has typically established the existence of particular traits through the process of *factor analysis.* On the basis of factor analytic techniques with a large number of overt variables or surface traits, Cattell believes he has verified the existence of twenty basic source traits. He has then taken what he believes are the most critical temperament and ability source traits (a total of sixteen) to form his most renowned personality inventory that is called the 16 PF test. These sixteen factors are listed in Table 12.3.

TABLE 12.3 Sixteen Personality Factors

Letter Symbol	Popular Label	Technical Title
A	Outgoing–Reserved	affectothymia–sizothymia
B	More intelligent–Less intelligent	high 'g'–low 'g'
C	Stable–Emotional	high ego strength–low ego strength
E	Assertive–Humble	dominance–submissiveness
F	Happy go lucky–sober	surgency–desurgency
G	Conscientious–expedient	high superego–low superego
H	Venturesome–shy	parmia–threctia
I	Tender minded–tough minded	premsia–harria
L	Suspicious–trusting	protension–alexia
M	Imaginative–practical	autia–praxernia
N	Shrewd–forthright	shrewdness–artlessness
O	Apprehensive–placid	guilt proneness–assurance
Q1	Experimenting–conservative	radicalism–conservatism
Q2	Self-sufficiency–group tied	self –sufficiency– group adherence
Q3	Controlled–casual	high self-concept–low integration
Q4	Tense–relaxed	ergic tension–low ergic tension

A final distinction that Cattell makes within the concept of a trait involves two types of traits that both fall under the general category of dynamic source traits. These traits are called *sentiments* and *ergs*. A sentiment is a major, acquired dynamic trait that causes a person to attend to certain objects and to act in a specific way relative to those objects. These traits are a function of objects within one's environment and can be classified as environmental-mold source traits. Ergs, on the other hand, are constitutional, dynamic source traits that are psychophysical dispositions that cause an individual to be motivated to respond to certain classes of stimuli.

Personality Development

Although Cattell considered the nature of personality development in one of his major works, his comments in this area are not particularly noteworthy. His analysis of development encompasses the entire life span and provides a stage approach to development, which is broken down into infancy, childhood, adolescence, maturity, middle age and senility. This analysis is ironically similar in many respects to that of Freud. Cattell perceives *infancy* as a time when the relationship between the child and mother is paramount, whereas *adolescence* is seen as a time of storm and stress. Childhood is described as being a relatively quiet time in comparison with infancy and adolescence. *Maturity* (23 to 46 years) is seen as a time when one chooses a career and a mate. In addition, it is a relatively constant period during which abilities and energies are at a stable level. *Middle age* is described as a time when decreasing physical skills alter the pattern of one's activities, and senility is highlighted by decrease in status and financial stability.

One can see from this description that Cattell's comments concerning development of personality are not controversial or likely to be heavily criticized. On the other hand, they have not had a profound effect upon theorists and researchers concerned with the nature of personality development.

Critical Review

Cattell contribution to personality research though may have been through the use of factor analysis but his theory is still greatly criticized. Despite many attempts his theory has never been entirely replicated (**Howarth** and **Brown's** 1971, factor analysis). They concluded, 'that the 16 PF does not measure the factors which it purports to measure at a primary level'. Studies conducted by **Eysenck** and **Eysenck** (1969) and others have also failed to verify the 16 Personality Factor Model's primary level (**Noller**, **Law** and **Comrey** 1987). However, using Cattell's exact methodology, **Kline** and **Barrett** (1983), were able to verify only four of sixteen primary factors (**Noller**, **Law** and **Comrey** 1987). Also, the reliability of Cattell's self-report data has also been questioned by researchers (**Schuerger**, **Zarrella** and **Hotz** 1989). Despite all the criticism of Cattell's hypothesis, his empirical findings lead the way for investigation and later discovery of the 'Big Five' dimensions of personality which have been monumental in understanding personality, as we know it today.

Sheldon's Constitutional Theory

'Constitution' may be understood as human *reactive potential* and *reaction style*. It is grounded in heredity or fundamental dispositions and those acquired in early childhood or more rarely at a later date and can be determined as a type or individual constitution.

The constitutional approach to the study of personality holds that the physical constitution, genetic environment and other biological features determine at least some of the basic features of personality. Older constitutional theories claimed that almost all the important elements of personality are biological in origin, while the more modern versions state that only some personality characteristics originate in biological factors. Thus, this theory can also be classified under the biological theories of personality. However, since long it is categorized under trait theories of personality.

Since ancient times, attempts have been made to classify people into types in terms of physique and other constitutional factors and to use these classifications for predicting general personality and behavior patterns. References of this can be found in literature where the age-old popular belief is often expressed that plump people are more likely to be good-natured and reliable than lean ones (Julius Caesar. Act I, Scene II).

With **Ernst Kretschmer** (1921), a German psychologist, constitutional psychology embarked upon its modern course. According to him, there are four main physical types:

1. Pyknic Types These individuals have robust well-rounded figures with a tendency towards shortness and stoutness. Trunk and body cavities are large. Chest and shoulders are rounded. The neck and limbs are short and stocky. The face is full, smooth and shield-shaped. These people are inclined to be genial, talkative, uninhibited, individuals who enjoy social contacts. Their approach to problems is practical and realistic. They express their emotions freely and warmly but at times they become unduly elated or depressed.

2. Asthenics Types They have thin flat, delicate physiques. They are slender individuals with long, lean limbs and flat narrow chests. The head is often elongated and the facial features are sharp. The general impression of one is of angularity. These individuals tend to be shy, seclusive, sensitive people who shun social contacts and spend much of their time daydreaming. They are emotionally repressed and their approach to problems is theoretical and idealistic. Usually, they are prudish and humorless.

3. Athletic Type Their built is characterizes by good muscular and skeletal development including broad shoulders, large hands and long sturdy limbs. These individuals have the same characteristics as the asthenics' types.

4. Dysplastics Types This includes the small group of cases where there are striking deviant aspects to the individuals build so that they appear to even the casual observer as 'rare, surprising and ugly'.

Kretschmer realized that it was impossible to classify all individuals as pure asthenics, athletics or pyknics. He tried to classify and integrate the intermediate and mixed types unsuccessfully and thus left his work open to criticism.

William M. Sheldon modified Kretschmer's classification. He, from the very onset, assumed that people differ in physical traits. He then suggested that these differences could be expressed as quantitative variations of three basic components:

1. Endomorphy This term refers to the relative predominance of softness and roundness throughout the body.

2. Mesomorphy It is characterized by a relative predominance of muscle, bone and connective tissue. Individuals with a mesomorphic physique are massive, solid people with large bones, big joints and heavy muscles.

3. Ectomorphy It means relative pre-dominance of linearity and fragility. Individuals having a high ectomorphic component have slender limbs and bodies.

These three components correspond approximately with the pyknic, athletic and asthenic types that have been given by Kretschmer.

Sheldon also did an extensive analysis of over 500 trait words, using intuitive procedures and correlational methods. The analysis revealed three major groups of traits and these make up the primary components of 'temperament'. In relating temperament type to body type, Sheldon found that differences in somatotype are strongly associated with differences in temperament. The chubby endomorph was likely to have an easy-going, social temperament; the athletic looking mesomorph would probably be a risk-taking, assertive type; and the physically fragile entomorph often was withdrawn and restrained.

Critical Review

These findings need to be taken very cautiously. Modern researchers have been critical about the high degree of correlation found between type and temperament. This they say reflect a bias in the eye of the beholder. Studies have shown that the connection between body type and temperament are much less strong. Still there is a relation, and Sheldon must be given credit for forcefully calling our attention to the connection between physique and temperament. He did not argue that all of a person's temperamental characteristics mysteriously flowed from that person's physique at birth but he has discussed the ways in which a person's physique might cause interaction with other people that could shape temperamental development.

Eysenck's Supertraits

All human beings possess unique characteristics that make them individuals (**Eysenck** 1952). **Eysenck** defined this set of characteristics as 'personality'. More specifically, Eysenck defined personality as a distinctive set of traits, behavior styles, and patterns that make up our character or individuality. Our perceptions about the world, attitudes, thoughts and feelings are all part of our character. Our personality makes up the basic postulate on how we deal with members of society.

Classifying people into certain personality types has remained a significant focus of researchers and personality theorists (**Mroczek** and **Little** 2006; **Skinner** 1983). One commonly employed way of examining an individual's temperament is through the three-factor model of temperament created by **Eysenck** (1956, 1978 and 1998). His conceptualization of the three temperamental supertraits is a biological framework for understanding human behavior. Eysenck conceptualized the three supertraits as intervening variables between genetics and human behavior. In other words, an individual's genetics causes an individual to have differing scores on the three supertraits (extraversion, neuroticism and psychoticism); in turn, these supertraits affect how that individual both perceives her or his world and how these perceptions affect behavior. First, we will discuss about the biological explanation of supertraits of personality and then about the 'supertraits' model.

Inhibition and Arousal

Eysenck (1967) was the clinical scientist who took a logical step further by developing a comprehensive theory of the biological basis of personality. Eysenck incorporated Pavlov's hypothesis concerning the excitatory and inhibitory forces of the nervous system, and hypothesized that individual differences in resting levels of cortical arousal are genetically influenced. He also hypothesized that cortical arousal was associated with different emotions: Moderate levels of arousal were associated with pleasant emotions, while extreme high or low arousal levels were associated with unpleasant or negative emotions. Based upon the equilibrium theory developed by Pavlov, Eysenck proposed that individuals attempt to bring their cortical arousal either up or down in order to achieve a moderate or homeostatic level of arousal. However, because predetermined, genetic individual differences exist in baseline levels of cortical arousal, stable behavioral differences may emerge throughout the life of the individual. Physiological mechanisms implicated in Eysenck's theory appear to be found in the ascending reticular activating system (**Eysenck** 1967).

Hypothesized differences in these levels of cortical arousal led Eysenck to differentiate between individuals who were *extroverts* (very low levels) and individuals who were *introverts* (very high levels). While extroverts strive to modulate their levels of arousal by seeking out stimulation, introverts attempt to moderate arousal by avoiding stimulation. Extroversion and introversion comprise one axis of Eysenck's theory of personality. The other axis of personality in Eysenck's theory is composed of the factors of *neuroticism* and stability. Eysenck proposed that the reactivity level of the autonomic nervous system feeding back to the limbic system is also a genetically determined trait. Individuals with high autonomic reactivity would be classified as neurotic and to have great difficulty in adjusting to novel stimulation. This combination of high

baseline autonomic nervous system reactivity with high baseline levels of cortical arousal formed the basis of Eysenck's definition of the anxious personality type (i.e. the neurotic introvert).

'Supertraits' Model

The model consists of three '**supertraits**': *extraversion*, *neuroticism* and *psychoticism*. Eysenck viewed the supertraits of extraversion and neuroticism as independent and believed that different personalities arise from differing combinations of the two supertraits. The first supertrait, extraversion, exists on a continuum from extravert to introvert with people existing at any point along the continuum. Extraverts are characterized by their desire to be sociable, have stimulation around them and possess an easygoing nature, whereas introverts are quiet, asocial (or not social), serious, reliable and controlled individuals (**Beatty**, **McCroskey** and **Valencic** 2001). The second of **Eysenck's** (1998) supertraits is neuroticism or an individual's tendency towards mania (being really happy) and depression (being really sad) (**Beatty et al**. 2001). In other words, neuroticism measures an individual's emotional stability, and people have varying degrees of emotional stability, ranging from those who do have emotional stability (low neurotic) to those who do not (high neurotic). Furthermore, people who are highly neurotic are prone to high levels of anxiety, depression and panic attacks (**Eysenck** 1998). The last of the three supertraits, psychoticism, refers to the extent to which an individual believes that societal rules and norms do or do not pertain to her or him (**Eysenck** and **Eysenck** 1976). People who are highly psychotic tend to be loners, un-empathetic (do not care about other people's emotions) and anti-social (violating social rules and norms). In fact, psychoticism 'is a stable or unstable disorder in which an individual loses contact with reality. Specific traits include characteristics of being insensitive, solitary, troublesome, hostile, aggressive, independent and a high-sensation seeker' (**Heaven** and **Rigby** 1985). Highly psychotic individuals are more likely to be big risk takers because they do not care or are completely unaware of any possible consequences (**Eysenck** and **Eysenck** 1976). People at the opposite end of the psychoticism spectrum are high self-monitors (**Beatty et al**. 2001).

Critical Review

Eysenck's (1956, 1978) conceptualization of the three temperamental supertraits is a biological framework for understanding human behavior. Like Cattell, Eysenck also developed a questionnaire designed to measure his supertraits – the Eysenck Personality Questionnaire or EPQ (**Eysenck** and **Eysenck** 1975). Eysenck conceptualized the three supertraits as intervening variables between genetics and human behavior. In other words, an individual's genetics causes an individual to have differing scores on the three supertraits (extraversion, neuroticism and psychoticism); in turn, these supertraits affect how that individual both perceives her or his world and how these perceptions affect behavior. According to **Eysenck** (1986), these dimensions represent general ways in which people interact. **Heaven** and **Rigby** (1985) concluded that elements of each supertrait appear early in childhood and continue on through adulthood, providing validity to the notion that we are born with these three supertraits to various degrees.

The dimensions of neuroticism, extroversion-introversion and psychoticism have demonstrated consistency over time and generalizability across cultures (**Eysenck** 1986). These dimensions might also be seen as the primary influences on communication (**Weaver** 1998) and thus are very relevant to interpersonal communication theory (**Beatty et al**. 1998, 2000; **Wrench** 2002; **McCroskey et al**. 2004a).

Five Factor Model of Personality

Not all researchers feel as though Eysenck's supertraits is the best model to utilize when exploring the interaction of personality traits and communication traits. According to **McCrae** and **John** (1992), the five-factor model is more appealing than other models because overall, it is more comprehensive. A problem

with Eysenck's model is that it collapses agreeableness and conscientiousness in its conceptualization of psychoticism. Without the examination of all five factors, the most relevant traits may be overlooked.

McCrae and **Costa** (1989) believed that this model is useful for the exploration of interpersonal behavior. A broad definition of interpersonal behavior might include social interaction or communication. **McCrae** and **John** (1992) suggest the use of this model to clarify or examine issues in fields related to psychology. According to them, 'anywhere personality assessment has been employed may benefit from a consideration of the five-factor model'.

The Five-Factor Model of Personality contains five traits: *extroversion*, *neuroticism*, *openness to experience*, *agreeableness* and *conscientiousness* (**McAdams** 1992; **McCrae** 1996; **McCrae** and **Costa** 1989; **McCrae** and **John** 1992; **Miller** 1990). Table 12.4 lists out these traits. The traits of extroversion and neuroticism were adapted from other personality scholars like Eysenck (**McCrae** and **John** 1992). Extraverts are outgoing, other-oriented, risk-taking and excitement-seeking persons; introverts are reclusive, thoughtful and quiet. Neuroticism (emotionality stability) is also marked in one of two ways. Neuroticism is marked by negative emotions such as being moody or anxious; stability is marked by an even temper, calm existence. Openness to experience, agreeableness and conscientiousness were added to fulfill the aim of a comprehensive measure of personality **(McCrae** 1996; **McCrae** and **John** 1992). An individual high in agreeableness can be characterized as altruistic, nurturing, caring and supportive; whereas someone low on this trait would be indifferent toward others, self-centered and spiteful. Conscientiousness is a trait that organizes and directs behavior as well as one that keeps impulsive behavior in check. An individual high in openness does not restrain her/him self from exploration of feelings, sensations and values; instead he/she tends to be curious, original and generally holds a broad range of interests.

TABLE 12.4 Big Five Factors

Traits	Personality Type
Extraversion	Sociable vs retiring Fun-loving vs sober Affectionate vs reserved
Agreeableness	Soft-hearted vs ruthless Trusting vs suspicious Helpful vs uncooperative
Conscientiousness	Well-organized vs disorganized Careful vs careless Self-disciplined vs weak willed
Neuroticism	Worried vs. calm Insecure vs. secure Self-pitying vs. self-satisfied
Openness	Imaginative vs. down-to-earth Prefers variety vs. prefers routine Independent vs. conforming

A review of studies involving European languages (**Peabody** and **DeRaad** 2002**)** found general support for the Big Five. Evidence from studies conducted in non-Western cultures is less widely available, but does show some support for a five-factor structure (**Church et al**. 1997). Finally, studies of brain functioning show that Big Five personality traits are related to the way the brain processes information (**McCrae et al**. 2005; **Schmitt**, **Allik** and **McCrae** 2007; **Schmitt et al**. 2008).

Critical Review

According to **McAdams** (1992), 'The Big Five are in no way akin to the basic elements of personality… [the] basic ingredients…of personality'. Instead, the Big Five make nice surface level characterizations of behavior. **Eysenck's** (1986) explanations of behavior are deeper and provide some degree of causality. McAdams further comments, For 'Eysenck…what provides ultimate legitimacy… [is his] biological underpinning'.

Further, on since, the Big Five traits are broad and comprehensive; they are not nearly as powerful in predicting and explaining actual behavior as are the more numerous lower-level traits. Many studies have confirmed that in predicting actual behavior the more numerous facet or primary level traits are far more effective (**Mershon** and **Gorsuch** 1988; **Paunonon** and **Ashton** 2001).

More recent criticisms of the five-factor model have looked at the possible exclusion of other universal personality factors. Evidence for a sixth factor is strong, and there is some evidence for a seven-factor model. A cross-cultural study completed by **Aston et al**. (2004) suggests that a factor containing the aspects of Honesty or Humility should be added to the current five-factor model to make it more comprehensive. Further evidence has suggested that a global property of personal attractiveness may be a feasible addition to the current model (**Larsen** and **Buss** 2002). The numerous exclusions marked by recent research suggest that the foundations of the five-factor model should be re-evaluated.

The five-factor model has also been criticized for being unable to concretely label the fifth factor. There has been much debate as to the validity of either Intelligence or Imitation as the fifth factor. Comparing different cultures has caused much of the dispute over the labeling of the fifth factor. Different cultures value different personality characteristics, and this contributes to the problem of defining the fifth factor (**Larsen** and **Buss** 2002). The difference in values leads to the conclusion that, globally, there cannot be a consensus on a fifth trait and calls into question the possibility of a globally reliable hierarchy of personality.

Research findings have not found much of a significant test-retest correlation for some of the Big five factors (**Soldz** and **Vaillant** 1999). This suggests that the Big Five personality traits are subject to considerable change across the adult years but the five-factor model provides a rather *static* account of personality (**Terracciano et al**. 2006). Recent studies have come out with support to this change and have empirically suggested that ongoing changes to personality structure occur across the whole lifespan (**Cattell et al**. 2002; **Fraley** and **Roberts** 2005; **Roberts et al**. 2006a,b). Evidently, the modification of personality traits (personality learning) continues throughout the adult years and thus low test-retest correlations of the Big five factors is justified.

In conclusion, it appears that the currently popular five-factor model should be replaced with an expanded and altogether more inclusive model of *dynamic* personality structure (**Boyle** 2008).

LEARNING AND BEHAVIORAL THEORIES

The learning and behavioral theories of personality are based on the principles derived from studies of lower order organisms such as rats and pigeons and these are applied to analyze the nature of human personality. For learning theorists, animal behavior is externally determined by environmental factors. Their central proposition is that human behavior can likewise be considered as externally determined. Like the rats and the pigeon, the human organism responds to stimuli presented by other people or by the external world. According to learning theorists, the environment controls our behavior and it does this through the *reinforcement contingencies* it delivers. Learning theorists hold that the human personality is a set of patterns of learned behavior. A set of stimulus conditions is presented, the person responds to it and reinforcement may follow. If it does, the response will be emitted again if the stimulus conditions recur.

Learning theorists believe that people's personalities differ because of childhood differences in stimulus patterns, reinforcement contingencies and punishment patterns. Even though the human personality is complex, it is based on simple learning principles, such as generalization of previous learning to new situations and the increasing ability to discriminate, through experience, among the stimuli that lead to the reinforcement.

Dollard and Miller's Stimulus-Response Theory

John Dollard and Neal Miller joined forces in the 1930's to test the basic idea that individual and social behavior can be explained by means of basic learning principles. They tried to translate Freud's psychoanalytic concepts into the language of learning theory and to test his concepts in the laboratory. They developed their theory of personality stressing on the importance of learning. It was based on a small number of observable, simple processes and elements. In their own words, '. . . in order to learn one must want something, notice something, do something and get something. Stated more exactly, these factors are *drive*, *cue*, *response* and *reward'*. We will review each one of these factors very briefly. According to Dollard and Miller, we are born with a set of innate needs - for food, water, oxygen and warmth, to name but a few. We would have died if these needs had not been satisfied during our early life, yet now we can perform the necessary responses to obtain them ourselves. Obviously, although the needs may be inherited, the responses to meet them are learned.

Two kinds of drives operate within us. At birth and while young, we may be stimulated into action mainly by primary drives such as hunger. As is true of all drives, the stronger the deprivation (for example, hunger), the stronger the drive—within the normal range of drive levels. Moreover, if some stimulus always occurs when a primary drive is operating, then that stimulus may also come to acquire drive-like properties—it may cause behavior. These are secondary (or learned) drives that develop if a stimulus occurs frequently in association with a primary drive. One example is fear.

Once a drive is aroused, cues guide you. They encourage you to respond, determining when and where you will respond and even which response will be made. How are you called when it is time for a meal? Especially at home, that call or bell or shout is a cue. It guides you to the table, where the appropriate eating responses can be performed.

At birth, we have a series of organized (often-reflexive) responses we can make. These can be called our initial response hierarchy. Learning, which Dollard and Miller view as central to the development of personality, can lead to changes in that initial response hierarchy. The latest order—the one you reusing now—is called the resultant hierarchy. Drives accompanied by cues guide the organism to respond in a particular way and place.

Another important contribution to personality dynamics is their theory of *conditioned anxiety*. According to this theory, a tone originally is a neutral stimulus but if an electric shock frequently follows it, it comes to be a cue for fear responses originally produced by the shock. A child who is hurt by a fall from a swing may become anxious when near the swing. By *stimulus generalization*, the child may become afraid of other play equipment and come to avoid playgrounds in order to avoid the anxiety caused by the sight of the equipment.

Two properties of conditioned anxiety make it a particularly important concept of learning theories of personality. First, anxiety may be conditioned to a previously neutral stimulus by just a few pairings, and sometimes by a single pairing. Given the normal hurts and harms of an ordinary childhood, we probably all may have conditioned fears. Second, because people learn responses that get them out of an anxiety situation, they may never discover that the original reason for the anxiety—the physical or emotional pain that followed the cue—is no longer present. The child who avoids the swing from which it once fell may not discover that with a little practice the swing could be easily mastered. The conditioned anxiety theory gives us an insight

into why many people continue to engage in patterns of action that seem to be useless or even self-defeating. They do so because these patterns remove them from anxiety cues, and do not allow them to discover that the original source of the fear is gone.

Critical Review

The issue of reinforcement is the most controversial portion of this theory. On developing this theoretical model for personality, these theorists argued that any response that reduces our drive level is reinforcing; it will tend to occur again. We are likely to do again whatever response reduces our hunger.

Notice how learning is emphasized. You start with an array of organized reflexive responses, but experience and reinforcements soon change that order. These theorists say that your personality is based on your most recent learning experiences. You change from day to day and month to month. Your personality, then, is composed of habits – the learned associations between drives, appropriate cues and responses. You differ from your friends because your prior experiences differ. Your personality can be expected to change with future experiences. The structure of Freud's concept of personality - id, ego and superego - is collapsed into habits in this theory. Freud's instincts become drives in this theory. Where Freud emphasizes childhood experiences, the behaviorists stress the effects of more recent experiences. Both emphasize on the long-term stability of the consequences of past experience. Unlike psychoanalytic theory, Dollard and Miller's theory is testable. Although based on the study of how animals work, their conclusions have also been found true of humans.

Skinner's Radical Behaviorism

B.F. Skinner's (1953, 1971, 1972) views, like those of Dollard and Miller, are derived from experiments. However, Dollard and Miller borrowed from both the *classical* and *instrumental conditioning* models, whereas Skinner's approach is exclusively instrumental or operant - that is, it deals only with the processes by which *reinforcement* and *punishment* influences the likelihood of behavior. For Skinner 'personality' is actually a collection of reinforced responses. In his view, there is really no need for a concept of 'personality' or for such 'excess baggage' as traits and types.

Skinner's learning principles proved useful in specifying the ways in which a person's history of reinforcement determines the person's behavior. Skinner distinguishes two basic situations in which reinforcement operates. The simplest kind of learning, following Pavlov, is based on classical conditioning, in which an initially neutral stimulus (CS) is paired with an unconditioned stimulus (UCS) that causes the unconditioned response (UCR).

Skinner, however, was most concerned with reinforcement as it occurred in operant conditioning. In this type of conditioning, the likelihood of a response, being emitted is affected by whether that response was followed by reinforcement in the past. Reinforcement to Skinner is the primary way that people learn responses and control the responses of others.

In the course of personality development, a child learns to respond to certain stimuli with certain responses, and to give very different responses to other stimuli. This learning takes place through *stimulus generalization* and *discrimination*.

Skinner and other learning theorists have proposed several mechanisms to explain behavior that is maladaptive or harmful to the individual abnormal behavior. Dollard and Miller's concept of conditioned anxiety is one of the mechanisms.

Skinner suggests three other mechanisms that may produce maladaptive behavior. The first is 'random' or chance reinforcement. Occasionally, the world delivers a reward to people that is quite independent of their actions. Nonetheless, the reinforcement increases the probability that a person will repeat whatever action he

or she was emitting when the reward was delivered. This type of reinforcement, where there is no cause-and-effect relation between action and reward, can lead to 'superstitious' behavior.

A second reward mechanism for producing unwanted behaviors centers on ambiguities about what exactly is reinforcing, and in what way. Tired parents sometimes do not pay attention to their children until the children get out of hand. The attention may then take the form of scolding, but it may also have rewarding elements. Sadly, some people get so little attention that almost any form of it is rewarding.

The third mechanism accounting for maladaptive behavior is provided by the Skinnerian discovery of *schedules of reinforcement*. For any of the reasons discussed above, undesirable behavior may have been at least occasionally reinforced in the past. The problem is why that behavior does not extinguish in the present. Because they are undesirable responses, they usually receive reinforcement only intermittently. Responses learned under conditions of intermittent reinforcement are much more resistant to extinction than those that are always reinforced. Therefore, the occasional reinforcement of a maladaptive response may be enough to cause it to be emitted at a higher rate. In general, then, learning theories of personality can account for the persistence of apparently useless or harmful behaviors.

Critical Review

With such accounts of people's behavior, described entirely in terms of objectively observable events, Skinner generated what some consider a 'personalityless' view of personality. Many are offended by Skinner's efforts to reduce the seeming richness of human personality to nothing more than a set of responses strengthened by reinforcers. Immediate rewards are no longer considered to be the best reinforcers under all conditions, although they play an important role in many types of learning. Today, scientists acknowledge that learning involves more complicated combinations of factors. Sometimes a delayed reward is more effective than an immediate one. A combination of reward and punishment can also speed learning.

Furthermore, Skinner in his so-called personality theory has neglected language and intelligent thought as well as overlooked the role of genetics in personality. He has not elaborated upon social relationships except mutual reinforcements. It also does not describe internal characteristics of the individual. Cumulatively, it will not be wrong to say that Skinner's proposed theory is not one of personality. If behavior can be fully explained in terms of environmental consequences, there appears no need for a theory of personality.

Bandura and Walters: Social Learning Theory

The third learning-theory perspective is built on the perceived limitations of the first two. **Albert Bandura** and **Richard Walters** (1963) saw the animal-derived principles of Dollard, Miller and Skinner as simply too limited to account for important aspects of real human behavior. In real life, they argued, people often do not have the luxury of learning through instrumental or operant conditioning. The approach that Bandura and Walters took focused on the highly efficient form of learning known as *observational learning* or *imitation* (*for details on these types of learning, refer to chapter on learning*). For them, most of the learning is of this indirect, observational kind.

The basic principle of social learning is very simple and accords with common sense: People learn through imitation based on observation of others. Children can learn to make a new response just by watching others, without having made that response before themselves and without being reinforced themselves or even having seen anyone else reinforced for the responses.

Whether a person will imitate a model depends on a number of factors:

1. *Whether the model being observed is rewarded or punished*: Although people may imitate a model who is not rewarded, they are much more likely to imitate models who have been rewarded for their behavior than those who have been punished or have not received any reward (**Bandura**, **Ross** and **Ross** 1963a).

2. *Characteristics of models:* These include age, sex and social status, but the most important is whether or not the model is seen as powerful or weak. Children are much more likely to imitate a model that seems powerful to them than one who seems weak (**Jakubczak** and **Walters** 1959).
3. *The way the model is presented:* Models in films and TV are very influential - children watching a model behave aggressively on TV or in a film were just as likely to imitate that behavior as children who observed a model who was physically present (**Bandura**, **Ross** and **Ross** 1963b).
4. *Inhibition:* Observing models may help to reduce inhibitions, especially if the model is doing something that is not socially acceptable. In this case, the person observing may not so much be learning a new response as gaining the nerve to make a response that before was only imagined (**Walters** and **Llewellyn Thomas** 1963). Again, imitation may depend on the observer's ability to discover the reinforcement structure of the situation. If a model is not punished for an action, this may be particularly effective in removing inhibitions of a similar action in the observer.

Bandura and **Rosenthal** (1966) pointed out another type of learning that is important in social learning theory, and that is the vicarious learning of classically conditioned emotional responses. Fears, particularly, are easily learned this way. Bandura has shown that the conditioned anxiety avoidance sequence described by Dollard and Miller may begin not as the person's own anxiety experience, but as a 'second-hand' fear acquired from observing another.

Social learning theorists have made three important additions to a learning theory of personality: People can learn indirectly by observing the action of and the consequences of those actions; people are often sensitive to the social context in which learning takes place; and people interpret experience in the process of learning.

Bandura (1977, 1978) has taken his thinking one-step further; by pointing out that, people develop self-evaluatory standards that affect their reactions to their own performances. That is, people have standards that they gain self-respect by living up to. They set goals for themselves and derive satisfaction from reaching these goals or disappointment from not reaching them. These self-standards, Bandura points out, are an important part of all our experience, and 'to ignore the influential role of self-evaluation reactions in the self-regulation of behavior is to disavow (refuse to acknowledge; deny responsibility) a uniquely human capacity.

EXPERIMENTAL PERSPECTIVE

Bobo Doll Experiment

In 1961 and 1963, Albert Bandura studying the patterns of behavior associated with aggression conducted two experiments which were christened as the *Bobo doll experiment*. Through these experiments, he looked forward to prove that aggression could in part be explained based upon the social learning theory, which stated that behavior such as aggression is learned through observing and imitating others.

These experiments have historical importance since they acted as the launching pad for many other studies related with the effects of violence as shown on media on child psychology. Through his research works, Bandura observed that those children who were exposed to the aggressive model were more likely to act in physically aggressive ways than those who were not exposed to it. For those children exposed to the aggressive model, the number of imitative physical aggressions exhibited by the boys was 38.2 and 12.7 for the girls.

The results concerning gender differences strongly supported Bandura's prediction that children are more influenced by same-sex models. Boys exhibited more aggression when exposed to aggressive male models than boys exposed to aggressive

female models. When exposed to aggressive male models, the number of aggressive instances exhibited by boys averaged 104 compared to 48.4 aggressive instances exhibited by boys exposed to aggressive female models.

While the results for the girls show similar findings, the results were less drastic. When exposed to aggressive female models, the number of aggressive instances exhibited by girls averaged 57.7 compared to 36.3 aggressive instances exhibited by girls exposed to aggressive male models.

Bandura also found that the children exposed to the aggressive model were more likely to act in verbally aggressive ways than those who were not exposed to the aggressive model. The number of imitative verbal aggressions exhibited by the boys was 17 times and 15.7 times by the girls. In addition, the results indicated that the boys and girls who observed the nonaggressive model exhibited far less non-imitative mallet aggression than in the control group, which had no model.

The experimenters came to the conclusion that children observing adult behavior are influenced to think that this type of behavior is acceptable thus weakening the child's aggressive inhibitions. The result of reduced aggressive inhibitions in children means that they are more likely to respond to future situations in a more aggressive manner.

Lastly, the evidence strongly supports that males have a tendency to be more aggressive than females. When all instances of aggression are tallied, males exhibited 270 aggressive instances compared to 128 aggressive instances exhibited by females.

Critical Review

Biological theorists argue that the social learning theory completely ignores individual's biological state. In addition, they state that the social learning theory rejects the differences of individuals due to genetic, brain and learning differences (**Jeffery** 1990). In addition, the social learning theory rejects the classical and operant conditioning processes. The biological preparedness of the individual to learn as well as the role of the brain in processing information from the social environment are critical to learning theory, but they are ignored by the social learning theory.

Talking about the effect of violence on television, Feshbach and R.D. Singer concluded in their studies that television actually decreases the amount of aggression in children (**Feshbach** 1971). The theory that viewing violence on television leads to a decrease in aggression is called the *Catharsis effect* (**Gerbner, G., Gross, L**. and **Melody, W.H.** 1982). **Cooks** (1993), on the other hand, believes that individuals tend to support the theory that television violence causes aggression because the public needs to justify the aggression they see in others.

However, in recent studies proof of the role that media plays in teaching aggression lies in the fact that once the ban on television was lifted in South Africa in 1975, the homicide rate increased by 130% (cited in **Woods et al**. 1991). This has also been confirmed in longitudinal studies done. Biological evidence also indicates that given the underdeveloped frontal lobe of children, they are unable to distinguish between fantasy and reality. For this reason, they are very susceptible to unwittingly adopting media portrayals as reality and generalizing those behaviors, attitudes and circumstances presented in the media (**Bar-on**, **Broughton, Buttross, Corrigan et al**. 2001).

Despite these criticisms, Albert Bandura's Social Learning Theory has maintained an important place in the study of aggression and criminal behavior. It has proved useful in understanding the variations of human aggression. It has been applied to numerous social problems such as adolescent contraception, coercive sexual behavior, HIV-AIDS transmission and predatorial crime (**Hogben** and **Byrne** 1998).

GEORGE KELLY'S: A COGNITIVE THEORY OF PERSONALITY

Kelley's theory of personality postulates that most of man's behavior is influenced by *thinking, judging* and *participating* rather than instincts, drives, growth or other such motives. Kelly's fundamental postulates that

EXPERIMENTAL PERSPECTIVE

Repertory Grid Interview Test of Kelly

Repertory grid is a technique for identifying the ways that a person construes (interprets/gives meaning to) his or her experience. It provides information from which inferences about personality can be made, but it is not a personality test in the conventional sense. It is underpinned by a strong theory, the Personal Construct Theory developed by George Kelly first published in 1955.

A grid consists of four parts:

1. **A Topic:** It is about some part of the person's experience.
2. **A set of Elements, which are examples or instances of the topic:** Working as a clinical psychologist, Kelly was interested in how his clients construed people in the roles they adopted towards the client, and so, originally, such terms as 'my father', 'my mother', 'an admired friend' and so forth were used. Since then, the Grid has been used in much wider settings (educational, occupational and organizational) and so any well-defined set of words, phrases, or even brief behavioral vignettes can be used as elements. For example, to see how I construe the purchase of a car, a list of vehicles within my price range could make an excellent set of elements.
3. **A set of Constructs:** These are the basic terms that the client uses to make sense of the elements and are always expressed as a contrast. Thus, the meaning of 'good' depends on whether you intend to say 'good versus poor', as if you were construing a theatrical performance, or 'good versus evil', as if you were construing the moral or ontological status of some more fundamental experience.
4. **A set of ratings of Elements on Constructs:** Each element is positioned between the two extremes of the construct using a 5- or 7-point rating scale system; this is done repeatedly for all the constructs that apply; and thus its meaning to the client is captured, and statistical analysis varying from simple counting, to more complex multivariate analysis of meaning, is made possible.

Constructs are regarded as personal to the client, who is psychologically similar to other people depending on the extent to which s/he would tend to use similar constructs, and similar ratings, relating to a particular set of elements. And it is the way that the constructs are identified, which makes a repertory grid unique.

The repertory grid has found favor among both academics and practitioners in a great variety of fields because it has one unique characteristic. It provides a way of describing people's construct systems (loosely, understanding people's perceptions) without prejudging the terms of reference.

Unlike a conventional rating-scale questionnaire, it is not the investigator but the interviewee who provides the constructs on which a topic is rated. Market researchers, trainers, teachers, guidance counselors, new product developers, sports scientists, and knowledge capture specialists are among the users who find the technique (originally developed for use in clinical psychology) helpful.

a person's processes are psychologically channelized by the way in which he anticipates events. On the basis of this, Kelly has developed eleven *corollaries: construct, individual, organization, sociality, dichotomy, fragmentation* and *commonality.*

The basic structure of personality, according to him, is the *personal construct*. Personal *construct* is a way of interpreting the world based on one's evaluation of things. A personal construct is bipolar, having a range of convenience, a focal point of convenience and characterized by permeability - impermeability. The types of personal constructs include *verbal, proverbial, submerged, core, peripheral, subordinate* and *superordinate.* For measuring certain constructs, Kelly constructed the *role construct repertory test* (REP test).

Kelley's concept of '*man as scientists*' means that every person thinks about the events of his life in a scientific manner. They hypothesize about the events in their future, test the hypothesis and try to find out

its validity. Also that, every person has the capacity to change his environment and reinterpret it constantly. Every person gets frustrated if his personal constructs fail to explain his life's experiences.

Kelley's *circumspection, preemption, control* cycle (CPC) is a three-stage process. Circumspection means thinking about various constructs or considering all possible hypotheses about the events. Preemption means selecting a few of the constructs and concentrating on them more seriously. Control means deciding, finally, the kind of action one will take or the kind of behavior that is most appropriate under the circumstances.

In brief, Kelley's theory of personality states that all men construct their personal theories about the events, situations and the outside world that are basic to their functioning. That all men develop two types of constructs, *core constructs* and *peripheral constructs*. That living organisms are by definition motivated and finally that the organism is constantly under the pressure of the totality of events that influence the individual at a time.

Critical Review

Long before 'cognitive psychology' existed, Kelly created a truly cognitive theory of personality, a theory in which how people construe is at the core (**Mischel** 1980). Kelly took great pains to emphasize that his theory was at least as concerned with human passion and action as with thought, and at a fundamental level, he attempted to integrate all of these features of human functioning in his definition of the construct. Another remarkable part of his theory is that it includes 'fresh interpretations of the unconscious as against Freud's psychic energy'. For Kelly, there was no need to create an energy system for human beings similar to that in physics. Human beings are not inert substances that need energy to move them. They are living matter and one crucial property of living matter is that it moves.

Another remarkable features of personal construct theory—and one that no doubt contributes to the flexibility with which it has been applied to people and problems of all sorts—is its abstract, content-free orientation. Unlike many psychological theorists, Kelly did not propose a detailed list of human needs, motives, conflicts or ideals that presumably hold for all people, but instead focused on the general processes by which people made sense of and navigated the social world. This abstractness makes personal construct theory about as 'value free' as a theory of personality could aspire to be.

However, recurrent complaint is that Kelly did not talk about development—that is, from birth to adulthood. It has been argued (**Fransella** 1995) that the omission was deliberate, in the sense that the whole theory of personal constructs is about development—human beings are seen as forms of motion, no matter what our age. There is also a second reason for the omission. The theory rejects all attempts to put people into categories or boxes. It follows that Kelly was skeptical of the prescriptive age-and-stage models that characterized the developmental theories of his day, even those of theorists like Piaget who shared some of his constructivist leanings.

PSYCHOLOGY NUGGET

Personality Theory in Perspective

1. Much about personality remains unknown.

One thing is certain that the theories of personality, either individually or collectively, do not adequately account for personality. It is not that the theories are incorrect; rather they are not correct enough. Personality remains much more complicated than the

theories designed to account for it. In other words, although each theory illuminates part of what we call personality, much remains in darkness. Existing theories need to be extended, and new theories need to be developed before we can say that we have a thorough understanding of personality.

2. The best available explanation of personality comes from a composite of all the major theories.

All major personality theories add to our understanding of personality and, therefore, it is not necessary to search for a correct theory or even the most correct theory. A person cannot hope to understand personality with only one theory. Which personality theory is 'best' depends on which aspect of personality one is attempting to explain.

Is it not possible that society forces individuals to repress sexual and aggressive urges and that such repressed urges manifest themselves indirectly in an individual's life, as Freud and Dollard and Miller maintain? Is it not possible that we are born with tendencies to respond to the major categories of existence, such as birth, death and members of the opposite sex, as Jung suggested? Is it not possible that we all strive for perfection or superiority and for the betterment of society as Adler suggested ? Is there not evidence that some neurotics attempt to adjust to life by moving towards people, others by moving away from people and still others by moving against people, as Horney suggested? Is there not evidence that life consists of various stages; each characterized by different needs and potential accomplishments, and that one of the most significant events in one's life is the development of an identity, as Erikson suggests? Does it not make sense to say that each individual is unique and that some adult motives are no longer tied to their earlier origins, as Allport proposed? Is it not possible that through an understanding of an individual's underlying trait structure that one can become better able to predict his or her behavior in a wide variety of situations, as Cattell suggests? Can anyone doubt the powerful influence of reward on behavior that Skinner describes? Can we not confirm Roger's contention that because of our need for positive regard we develop conditions of worth which become our frame of reference for living rather than our own organismic valuing process ? Last, can we not accept Maslow's contention that the motives of individuals with their basic needs satisfied are quantitatively different from the motives of the individuals still struggling to satisfy their basic needs?

What the realm of personality theory needs is a grand synthesizer, a person who could coordinate the various terms and concepts from all the various theories.

3. Childhood experience is extremely important to determining adult personality characteristics.

Almost all personality theorists (excluding Allport and Kelly) link adult personality characteristics to certain categories of childhood experience. The theories of Freud, Adler, Horney, Erikson, Skinner, Dollard and Miller, and Rogers all stress the importance of childhood experience to determining whether an adult will be healthy, neurotic, or at some point in between.

It seems reasonable to conclude that if childhood experiences are so important in molding various personality attributes, parents should know the basics of child rearing. It is ironic that the task judged by many to be one of the most complex that humans perform, that is, child rearing, requires no special training at all.

Most inadequate child rearing appears to result from a lack of concern for the child. However, even when a serious effort is made to rear a child 'properly', the effort often fails because child rearing is a tremendously complicated business.

Some parents feel that just being 'nice' to their child is all that it takes to be an effective parent. However, overprotection and indiscriminate displays of affection may be as harmful as under-production and too little affection. Skinner has remarked: 'Children are our most valuable resources and they are now shamefully wasted. Wonderful things can be done in the first years of life, but we leave them to people whose mistakes range all the way from abuse to overprotection and the lavishing of affection on the wrong behavior' (Skinner, 1978).

4. You are the final judge.

In the realm of personality theory, because one usually does not have rigorous laboratory experiments available to help decide what is valid and what is invalid, how does one know what information to accept and what to reject? It seems under existing circumstances Lord Buddha gave the best answer to this question: '. . . Believe nothing on the faith of traditions, even though they have been held in honor for many generations, and in diverse places. Do not believe a thing because many speak of it. Do not believe

on the faith of the sages of the past. Do not believe what you have imagined, persuading yourself that a God inspires you. Believe nothing on the sole authority of your masters or priests. After examination, believe what you yourself have tested and found to be reasonable, and conform your conduct thereto' (Hawton 1949).

PERSONALITY ASSESSMENT

The interview, a widely used method of personality assessment, is a means of eliciting from the subject a report of past, present and anticipated future responses. Most interviews are unstructured but some use set questions asked in a given sequence. Skilled interviewers pay attention to what is said and notice how responses relate to nonverbal cues such as *posture* and *facial expressions*.

Direct observations are made either in a natural setting or in a laboratory. In *naturalistic observations*, the assessor notes reactions to everyday situations, typical responses to people and expressive behavior. In the laboratory, the investigator experimentally manipulates situations and observes the subject's behavior under these controlled conditions. The personality assessor might also rely on the reports of others who have observed the subject in the past.

Personality tests are of two general types—*self-report inventories* and *projective tests*. Self-report inventories, such as the *Minnesota Multiphasic Personality Inventory*, pose questions about personal habits, attitudes, beliefs and fantasies. *Psychoanalytic approaches* to personality assessment include projective tests such as the *Rorschach* and the *Thematic Apperception Test* (TAT). In projective testing, the subject's responses to ambiguous or unstructured situations are assumed to reflect inner reality. The Rorschach test, for example, is a projective test consisting of a series of inkblots, about which the subject reports his or her perceptions; the assessor subsequently interprets these responses. *Social learning* theorists assess personality by discovering the kinds of situation in which specific behavior occur (either through observation or self-reports) and noting the stimulus conditions that appear to co-vary with the behavior. By changing the stimulus conditions they attempt to modify behavior. The *humanistic approaches* to assessment of personality includes techniques for measuring one's *self-concept* and degrees of *self-disclosure*.

PSYCHOLOGY IN EVERYDAY LIFE

Assessing your Personality for Career-Readiness Profiling

Assessing your personality along with your interests and skills will help you to choose an apt career. Career counselors assess your skills and talents and suggest opportunities based on your interests. They talk to you about setting goals and achieving them. Career counselors give you a better idea of who you are and what you want after completing your studies.

Personality

Your personality traits can determine which careers are best suited to you. Answers to questions like given below can help you zero in on the careers you might excel in:

- Are you shy or outgoing?
- Are you patient or impulsive?
- Are you good with children or adults?
- Do you like animals or machines?

Personality Inventories

For a closer look at yourself, take a personality inventory—a questionnaire that asks how you would think, act and feel in specific situations.

The most popular personality inventory is the Myers-Briggs Type Indicator (MBTI). Unofficial versions of this personality inventory are available online and can be completed in 30 minutes. Your answers to the multiple-choice questions will be evaluated and you'll receive an explanation of your personality type.

- Personality Type provides the most abbreviated version and also presents popular career options.
- Humanmetrics offers a longer, more personalized version.
- The official version of the MBTI is available in print. This official test is administered by qualified trainers, and trained professionals evaluate the answers. Check with a guidance counselor to see if this test is available.

After learning about your personality, you might come to a conclusion whether the job that you are thinking of is perfect for you

Interests

Ask yourself the questions such as given below:

- Do you love to read?
- Do you find the puzzles like sudoku interesting?
- List out the things that makes you happy?
- Do you enjoy painting or drawing?
- What are your other interests?

Your answers these questions will exhibit your true personality and provide you an insight into your personality

Skills

Find out what are you good at. Ask yourself:

- Are you a computer buff?
- What are the major activities that you excel in? Can any of these has the potential of becoming your career choice.
- Are you a voracious reader?

Answers the questions similar to above and analyzing them can help you a lot in determining your career choice.

Objective Personality Tests

These tests measure *social and emotional adjustment* and are used to identify the need for psychological counseling. Items that briefly describe feelings, attitudes and behaviors are grouped into subscales, each representing a separate personality or style, such as social extroversion or depression. Taken together, the subscales provide a profile of the personality as a whole. Trait theorists measure personality using rating scales and personality inventories such as the *Minnesota Multiphasic Personality Inventory* (MMPI) that is constructed to aid in diagnosing psychiatric patients. Research has shown that the MMPI may also be used to describe differences among normal personality types.

Projective Techniques

Some personality tests are based on the phenomenon of projection, a mental process described by Sigmund Freud as the tendency to attribute to others personal feelings or characteristics that are too painful to acknowledge. Projective methods of assessing personality employ standard sets of somewhat *ambiguous stimuli*. The expectation is that people will 'project' their needs, feelings or beliefs onto the stimuli and

respond in ways that reveal important aspects of their personalities. Because projective techniques are relatively unstructured and offer minimal cues to aid in defining responses, they tend to elicit concerns that are highly personal and significant. The best-known projective tests are the *Rorschach test*, popularly known as the inkblot test (developed by **Hermann Rorschach** 1921/1942) and the (TAT) *Thematic Apperception Test* (developed by **Christina Morgan** and **Henry Murray** 1938 and based on Murray's *theory of needs*); others include *word-association techniques*, *sentence-completion tests* and various drawing procedures. The psychologist's past experience provides the framework for evaluating individual responses. Although the subjective nature of interpretation makes these tests particularly vulnerable to criticism, in clinical settings they are part of the standard battery of psychological tests.

KEY TERMS

Personality
Personality theory
Epigenetic principle
Psyche
Complex
Synchronicity
Neo-Freudian theory
Self-actualization theory
Supertraits
Personality assessment

EVALUATE YOURSELF

Multiple Choice Questions

1. The term 'personality' refers to
(a) The modes of behavior
(b) The various personality traits
(c) The physical and intellectual abilities
(d) The whole individual

2. The 'types' of personality were discussed by
(a) Freud
(b) Jung
(c) Adler
(d) Rogers

3. Reference to individuals as 'introverts' and 'extroverts' was first made by
(a) Freud
(b) Adler
(c) Jung
(d) Allport

4. According to Freud's psychoanalytic theory, the structure of personality consists of
(a) Id, preconscious and conscious
(b) Unconscious, preconscious and conscious
(c) Id, ego and superego
(d) Unconscious, ego and superego

5. According to Adler, personality development is greatly influenced by reactions to
(a) Sensory stimuli
(b) Inferiority feelings
(c) Superiority feelings
(d) All types of strong feelings

6. Allport formulated the idea of
(a) Functional fixedness
(b) Functional autonomy
(c) Functional psychoses
(d) Functionalism

7. Which one of these is not a super-trait?
(a) Extroversion
(b) Neuroticism
(c) Psychoticism
(d) Conscientiousness

8. Which one of these is not a trait in the big five model of personality?
(a) Extroversion
(b) Neuroticism
(c) Psychoticism
(d) Conscientiousness

9. The social learning theorists portray
   (a) Learner as passive recipient of environmental influence
   (b) No individual differences while explaining behavior
   (c) Learner as having internal cognitive processes to explain imitation, etc.
   (d) Both (a) and (c)
10. Which of the following is a projective test?
   (a) WAIS (b) DAT (c) TAT (d) MMPI

Descriptive Questions

1. Define personality and discuss its determinants.
2. Critically evaluate Freud's psychoanalytical theory.
3. 'The transition from one psychosexual stage to another is partly maturational.' Critically evaluate and discuss this statement in the light of personality theory.
4. Highlight the key concepts of Jung's analytic theory and critically evaluate them.
5. Briefly state the contributions of the neo-Freudians in the field of personality psychology.
6. What do you understand by person-centered personality theory? Critically evaluate Roger's contribution in this area.
7. Critically evaluate Lewin's contribution in the field of personality theory.
8. What is the quantitatively based approach to personality? Discuss with the help of relevant theoretical base.
9. 'Eysenck conceptualized the three super-traits as intervening variables between genetics and human behavior.' Critically evaluate this statement.
10. Critically review the five-factor model of personality.

Critical Thinking Questions

1. Why do you think that it is difficult to synthesize a unified theory of personality. Can you classify the theories into broad categories? What will be your bases for the criteria?
2. Abraham Maslow's self-actualization theory evolved from Erik Erikson's theories. Critically evaluate and establish the evolutionary lineage.
3. What are the similarities and differences between the psychoanalytical school of thought and the humanistic school?
4. Which assessment test is most suitable, according to you, to evaluate fitness for employed in the defense services?

PRACTICAL EXERCISES

1. Ask your students to visit a website on personality test and take the test. Plot the scores and try to find 4–5 stereotypes. Discuss the deficit areas of the students. (Please make sure that only that information is asked about which the students are comfortable in making them public.)
2. Prepare 5–6 different inkblots and distribute these to 5–6 groups in the class. Ask them to make notes of what they see. Describe the 'group psychology' of each group and share these with the class.

Answers to Multiple Choice Questions

1. (d) **2.** (b) **3.** (c) **4.** (c) **5.** (b) **6.** (b) **7.** (d) **8.** (c) **9.** (c) **10.** (c)

GLOSSARY

A

Abnormal psychology: The area of psychological investigation concerned with understanding the nature of individual pathologies of mind, mood and behavior.

Absolute threshold: The minimum amount of physical energy needed to produce a reliable sensory experience; operationally defined as the stimulus level at which a sensory signal is detected half the time.

Accommodation: The process by which the ciliary muscles change the thickness of the lens of the eye to permit variable focusing on near and distant objects. According to Piaget, accommodation is the process of restructuring or modifying cognitive structures so that new information can fit into them more easily; this process works in tandem with assimilation.

Acquisition: The stage in a classical conditioning experiment during which the conditioned response is first elicited by the conditioned stimulus.

Action potential: The nerve impulse activated in a neuron that travels down the axon and causes neurotransmitters to be released into a synapse.

Addiction: A condition in which the body requires a drug in order to function without physical and psychological reactions to its absence; often the outcome of tolerance and dependence.

Algorithm: A step-by-step procedure that always provides the right answer for a particular type of problem.

All-or-none law: The rule that the size of the action potential is unaffected by increases in the intensity of stimulation beyond the threshold level.

Amacrine cells: Cells that integrate information across the retina; rather than sending signals toward the brain, amacrine cells link bipolar cells to other bipolar cells and ganglion cells to other ganglion cells.

Ambiguity :A perceptual object that may have more than one interpretation.

Amnesia: A failure of memory caused by physical injury, disease, drug use or psychological trauma.

Amygdala: The part of the limbic system that controls emotion, aggression and the formation of emotional memory.

Analytic psychology: A branch of psychology that views the person as a constellation of compensatory internal forces in a dynamic balance.

Anchoring heuristic: An insufficient adjustment up or down from an original starting value when judging the probable value of some event or outcome.

Animal cognition: The cognitive capabilities of non-human animals; researchers trace the development of cognitive capabilities across species and the continuity of capabilities from non-human to human animals.

Anorexia nervosa: An eating disorder in which an individual weighs less than 85 percent of her or his expected weight but still controls eating because of a self-perception of obesity.

Anxiety: An intense emotional response caused by the preconscious recognition that a repressed conflict is about to emerge into consciousness.

Anxiety disorders: Mental disorders marked by physiological arousal, feelings of tension and intense apprehension without apparent reason.

Apparent motion: A movement illusion in which one or more stationary lights going on and off in succession are perceived as a single moving light; the simplest form of apparent motion is the phi phenomenon.

Archetype: A universal, inherited, primitive and symbolic representation of a particular experience or object.

Assimilation: According to Piaget, the process whereby new cognitive elements are fitted in with old elements or modified to fit more easily; this process works in tandem with accommodation.

Association cortex: The parts of the cerebral cortex in which many high-level brain processes occur.

Attachment: Emotional relationship between a child and the regular caregiver.

Attention: A state of focused awareness on a subset of the available perceptual information.

Attitude: The learned, relatively stable tendency to respond to people, concepts and events in an evaluative way.

Attribution theory: A social-cognitive approach to describing the ways the social perceiver uses information to generate causal explanations.

Attributions: Judgments about the causes of outcomes.

Auditory cortex: The area of the temporal lobes that receives and processes auditory information.

Auditory nerve: The nerve that carries impulses from the cochlea to the cochlear nucleus of the brain.

Automatic processes: Processes that do not require attention; they can often be performed along with other tasks without interference.

Autonomic nervous system (ANS): The subdivision of the peripheral nervous system that controls the body's involuntary motor responses by connecting the sensory receptors to the central nervous system (CNS) and the CNS to the smooth muscle, cardiac muscle and glands.

Availability heuristic: A judgment based on the information readily available in the memory.

Axon: The extended fiber of a neuron through which nerve impulses travel from the soma to the terminal buttons.

B

Basic level: The level of categorization that can be retrieved from memory quickly and used most efficiently.

Basilar membrane: A membrane in the cochlea that, when set into motion, stimulates hair cells that produce the neural effects of auditory stimulation.

Behavior: The actions by which an organism adjusts to its environment.

Behavior analysis: The area of psychology that focuses on the environmental determinants of learning and behavior.

Behavior modification: The systematic use of principles of learning to increase the frequency of desired behavior and/or decrease the frequency of problem behavior.

Behavioral confirmation: The process by which people behave in ways that elicit from others specific expected reactions and then use those reactions to confirm their beliefs.

Behavioral data: Observational reports about the behavior of organisms and the conditions under which the behavior occurs or changes.

Behavioral measures: Overt actions and reactions that are observed and recorded, exclusive of self-reported behavior.

Behavioral rehearsal: Procedures used to establish and strengthen basic skills; as used in social-skills training programs, requires the client to rehearse a desirable behavior sequence mentally.

Behaviorism: A scientific approach that limits the study of psychology to measurable or observable behavior.

Behaviorist perspective: The psychological perspective primarily concerned with observable behavior that can be objectively recorded and with the relationships of observable behavior to environmental stimuli.

Belief-bias effect: A situation that occurs when a person's prior knowledge, attitudes or values distort the reasoning process by influencing the person to accept invalid arguments.

Between-subjects design: A research design in which different groups of participants are randomly assigned to experimental conditions or to control conditions.

Biofeedback: A self-regulatory technique by which an individual acquires voluntary control over non-conscious biological processes.

Biological constraints on learning: Any limitations on an organism's capacity to learn that are caused by the inherited sensory, response or cognitive capabilities of members of a given species.

Biological perspective: The approach to identifying causes of behavior that focuses on the functioning of the genes, the brain, the nervous system and the endocrine system.

Biopsychosocial model: A model of health and illness that suggests that links among the nervous system, the immune system, behavioral styles, cognitive processing and environmental factors can put people at risk for illness.

Bipolar cells: Nerve cells in the visual system that combine impulses from many receptors and transmit the results to ganglion cells.

Blocking: A phenomenon in which an organism does not learn a new stimulus that signals an unconditioned stimulus, because the new stimulus is presented simultaneously with a stimulus that is already effective as a signal.

Body image: The subjective experience of the appearance of one's body.

Bottom-up processing: Perceptual analyses based on the sensory data available in the environment; results of analyses are passed upward toward more abstract representations.

Brain stem: The brain structure that regulates the body's basic life processes.

Brightness: The dimension of color space that captures the intensity of light.

Broca's area: The region of the brain that translates thoughts into speech or sign.

C

Cannon-Bard theory of emotion: A theory stating that an 'emotional stimulus produces two co-occurring reactions-arousal' and experience of emotion-that do not cause each other.

Case study: Intensive observation of a particular individual or small group of individuals.

Catharsis: The process of expressing strongly felt but usually repressed emotions.

Central nervous system (CNS): The part of the nervous system consisting of the brain and spinal cord.

Centration: A thought pattern common during the beginning of the preoperational stage of cognitive development; characterized by the child's inability to take more than one perceptual factor into account at the same time.

Cerebellum: The region of the brain attached to the brain stem that controls motor coordination, posture and balance as well as the ability to learn control of body movements.

Cerebral cortex: The outer surface of the cerebrum.

Cerebral hemispheres: The two halves of the cerebrum, connected by the corpus callosum.

Cerebrum: The region of the brain that regulates higher cognitive and emotional functions.

Chronological age: The number of months or years since an individual's birth.

Chunking: The process of taking single items of information and recoding them on the basis of similarity or some other organizing principle.

Circadian rhythm: A consistent pattern of cyclical body activities usually lasting 24 to 25 hours and determined by an internal biological clock.

Classical conditioning: A type of learning in which a behavior (conditioned response) comes to be elicited by a stimulus (conditioned stimulus) that has acquired its power through an association with a biologically significant stimulus (unconditioned stimulus).

Clinical psychologist: An individual who has earned a doctorate in psychology and whose training is in the assessment and treatment of psychological problems.

Clinical social worker: A mental health professional whose specialized training prepares him or her to consider the social context of people's problems.

Closure: A perceptual organizing process that leads individuals to see incomplete figures as complete.

Cochlea: The primary organ of hearing; a fluid-filled coiled tube located in the inner ear.

Cognition: Processes of knowing, including attending, remembering and reasoning; also the content of the processes, such as concepts and memories.

Cognitive appraisal: With respect to emotions, the process through which physiological arousal is interpreted with respect to circumstances in the particular setting in which it is being experienced; also, the recognition and evaluation of a stressor to assess the demand, the size of the threat, the resources available for dealing with it, and appropriate coping strategies.

Cognitive appraisal theory of emotion: A theory stating that the experience of emotion is the joint effect of physiological arousal and cognitive appraisal that serves to determine how an ambiguous inner state of arousal will be labeled.

Cognitive development: The development of processes of knowing, including imagining, perceiving, reasoning and problem-solving.

Cognitive dissonance: The theory that the tension-producing effects of incongruous cognitions motivate individuals to reduce such tension.

Cognitive map: A mental representation of physical space.

Cognitive perspective: The perspective on psychology that stresses human thought and the processes of knowing, such as attending, thinking, remembering, expecting, solving problems, fantasizing and consciousness.

Cognitive processes: Higher mental processes such as perception, memory, language, problem solving and abstract thinking.

Cognitive psychology: The study of higher mental processes such as attention, language use, memory, perception, problem solving and thinking.

Cognitive science: The interdisciplinary field of study of the approach systems and processes that manipulate information.

Collective unconscious: The part of an individual's unconscious that is inherited, evolutionarily developed, and common to all members of the species.

Complementary colors: Colors opposite each other on the color circle; when additively mixed, they create the sensation of white light.

Concepts: Mental representations of kinds or categories of items or ideas.

Conditioned reinforcers: In classical conditioning, formerly neutral stimuli that have become reinforcers.

Conditioned response (CR): In classical conditioning, a response elicited by some previously neutral stimulus that occurs as a result of pairing the neutral stimulus with an unconditioned stimulus.

Conditioned stimulus (CS): In classical conditioning, a previously neutral stimulus that comes to elicit a conditioned response.

Conditioning: The ways in which events, stimuli and behavior become associated with one another.

Cones: Photoreceptors concentrated in the center of the retina that are responsible for visual experience under normal viewing conditions and for all experiences of color.

Consciousness: A state of awareness of internal events and of the external environment.

Consistency paradox: The observation that personality ratings across time and among different observers are consistent, while behavior ratings across situations are not consistent.

Control procedures: Consistent procedures for giving instructions, scoring responses and holding all other variables constant except those being systematically varied.

Controlled processes: Processes that require attention; it is often difficult to carry out more than one controlled process at a time.

Convergence: The degree to which the eyes turn inward to fixate on an object.

Coping: The process of dealing with internal or external demands that are perceived to be threatening or overwhelming.

Corpus callosum: The mass of nerve fibers connecting the two hemispheres of the cerebrum.

Counseling psychologist: Psychologist who specializes in providing guidance in areas such as vocational selection, school problems, drug abuse and marital conflict.

Counterconditioning: A technique used in therapy to substitute a new response for a maladaptive one by means of conditioning procedures.

Creativity: The ability to generate ideas or products that are both novel and appropriate to the circumstances.

Criterion validity: The degree to which test scores indicate a result on a specific measure that is consistent with some other criterion of the characteristic being assessed; also known as predictive validity.

Cross-sectional design: A research method in which groups of participants of different chronological ages are observed and compared at a given time.

Crystallized intelligence: The facet of intelligence involving the knowledge a person has already acquired and the ability to access that knowledge; measures by vocabulary, arithmetic and general information tests.

Cultural perspective: The psychological perspective that focuses on cross-cultural differences in the causes and consequences of behavior.

Cutaneous senses: The skin senses that register sensations of pressure, warmth and cold.

D

Dark adaptation: The gradual improvement of the eyes' sensitivity after a shift in illumination from light to near darkness.

Daytime sleepiness: The experience of excessive sleepiness during daytime activities; the major complaint of patients evaluated at sleep disorder centers.

Decision aversion: The tendency to avoid decision-making; the tougher the decision, the greater the likelihood of decision aversion.

Decision-making: The process of choosing between alternatives; selecting or rejecting available options.

Declarative memory: Memory for information such as facts and events.

Deductive reasoning: A form of thinking in which one draws a conclusion that is intended to follow logically from two or more statements or premises.

Delusions: False or irrational beliefs maintained despite clear evidence to the contrary.

Dendrites: The branched fibers of neurons that receive incoming signals.

Dependent variable: In an experimental setting, any variable whose values are the results of changes in one or more independent variable.

Developmental psychology: The branch of psychology concerned with interaction between physical and psychological processes and with stages of growth from conception throughout the entire lifespan.

Dichotic listening: An experimental technique in which a different auditory stimulus is simultaneously presented to each ear.

Difference threshold: The smallest physical difference between two stimuli that can still be recognized as a difference; operationally defined as the point at which the stimuli are recognized as different half of the time.

Discriminative stimuli: Stimuli that act as predictors of reinforcement, signaling when particular behavior will result in positive reinforcement.

Dispositional variables: The organismic variables or inner determinants of behavior that occur within human and non-human animals.

Dissociative amnesia: The inability to remember important personal experiences, caused by psychological factors in the absence of any organic dysfunction.

Dissociative disorder: A personality disorder marked by a disturbance in the integration of identity, memory or consciousness.

Distal stimulus: In the processes of perception, the physical object in the world, as contrasted with the proximal stimulus, the optical image on the retina.

Divergent thinking: An aspect of creativity characterized by an ability to produce unusual but appropriate responses to problems.

DNA (deoxyribonucleic acid): The physical basis for the transmission of genetic information.

Double-blind control: An experimental technique in which biased expectations of experimenters are eliminated by keeping both participants and experimental assistants unaware of which participants have received which treatment.

Dream analysis: The psychoanalytic interpretation of dreams used to gain insight into a person's unconscious motives or conflicts.

Dream work: In Freudian dream analysis, the process by which the internal censor transforms the latent content of a dream into manifest content.

Drives: Internal states that arise in response to disequilibrium in an animal's physiological needs.

E

Echoic memory: Sensory memory that allows auditory information to be stored for brief durations.

Ego: The aspect of personality involved in self-preservation activities and in directing instinctual drives and urges into appropriate channels.

Ego defense mechanisms: Mental strategies (conscious or unconscious) used by the ego to defend itself against conflicts experienced in the normal course of life.

Egocentrism: In cognitive development, the inability of a young child at the pre-operational stage to take the perspective of another person.

Elaborative rehearsal: A technique for improving memory by enriching the encoding of information.

Electroconvulsive therapy (ECT): The use of electroconvulsive shock as an effective treatment for severe depression.

Electroencephalogram (EEG): A recording of the electrical activity of the brain.

Emotion: A complex pattern of changes, including physiological arousal, feelings, cognitive processes and behavioral reactions, made in response to a situation perceived to be personally significant.

Emotional intelligence: Type of intelligence defined as the abilities to perceive, appraise and express emotions accurately and appropriately, to use

emotions to facilitate thinking, to understand and analyse emotions, to use emotional knowledge effectively and to regulate one's emotions to promote both emotional and intellectual growth.

Encoding: The process by which a mental representation is formed in the memory.

Encoding specificity: The principle that subsequent retrieval of information is enhanced if cues received at the time of recall are consistent with those present at the time of encoding.

Endocrine system: The network of glands that manufacture and secrete hormones into the bloodstream.

Engram: The physical memory trace for information in the brain.

Environmental variables: External influences on behavior.

Episodic memories: Long-term memories for autobiographical events and the contexts in which they occurred.

EQ: The emotional intelligence counterpart of IQ.

Equity theory: A cognitive theory of work motivation that proposes that workers are motivated to maintain fair and equitable relationships with other relevant persons; also, a model that postulates that equitable relationships are those in which the participants' outcomes are proportional to their inputs.

Erogenous zones: Areas of the skin surface that are especially sensitive to stimulation and that give rise to erotic or sexual sensations.

Estrogen: The female sex hormone produced by the ovaries that is responsible for the release of eggs from the ovaries as well as for the development and maintenance of female reproductive structures and secondary sex characteristics.

Etiology: The causes of, or factors related to, the development of a disorder.

Evolutionary perspective: The approach to psychology that stresses on the importance of behavioral and mental adaptiveness, based on the assumption that mental capabilities evolved over millions of years to serve particular adaptive purposes.

Excitatory inputs: Information entering a neuron that signals it to fire.

Expectancy effects: Results that occur when a researcher or observer subtly communicates to participants the kind of behavior he or she expects to find, thereby creating that expected reaction.

Expectancy theory: A cognitive theory of work motivation that proposes that workers are motivated when they expect their efforts and job performance to result in desired outcomes.

Experimental methods: Research methodologies that involve the manipulation of independent variables in order to determine their effects on the dependent variables.

Explicit uses of memory: Conscious efforts to recover information through memory processes.

Extinction: In conditioning, the weakening of a conditioned association in the absence of a reinforcer or unconditioned stimulus.

F

Face validity: The degree to which test items appear to be directly related to attribute the researcher wishes to measure.

Fear: A rational reaction to an objectively identified external danger that may induce a person to flee or attack in self-defense.

Fight-or-flight response: A sequence of internal activities triggered when an organism is faced with a threat; prepares the body for combat and struggle or for running away to safety; recent evidence suggests that the response is characteristic only of males.

Figure: Object-like regions of the visual field that are distinguished from background.

Five-factor model: A comprehensive descriptive personality system that maps out the relationships among common traits, theoretical concepts and personality scales; informally called the Big Five.

Fixation: A state in which a person remains attached to objects or activities more appropriate for an earlier stage of psycho-sexual development.

Fixed-interval schedule: A schedule of reinforcement in which a reinforcer is delivered for the first response made after a fixed period of time.

Fixed-ratio schedule: A schedule of reinforcement in which a reinforcer is delivered for the first response made after a fixed number of responses.

Fluid intelligence: The aspect of intelligence that involves the ability to see complex relationships and solve problems.

Fovea: Area of the retina that contains densely packed cones and forms the point of sharpest vision.

Free association: The therapeutic method in which a patient gives a running account of thoughts, wishes, physical sensations and mental images as they occur.

Frequency distribution: A summary of how frequently each score appears in a set of observations.

Frequency theory: The theory that a tone produces a rate of vibration in the basilar membrane equal to its frequency, with the result that pitch can be coded by the frequency of the neural response.

Frontal lobe: Region of the brain located above the lateral fissure and in front of the central sulcus; involved in motor control and cognitive activities.

Frustration-aggression hypothesis: According to this hypothesis, frustration occurs in situations in which people are prevented or blocked from attaining their goals; a rise in frustration then leads to a greater probability of aggression.

Functional fixedness: An inability to perceive a new use for an object previously associated with some other purpose; adversely affects problem solving and creativity.

Functional MRI (fMRI): A brain imaging technique that combines benefits of both MRI and PET scans by detecting magnetic changes in the flow of blood to cells in the brain.

Functionalism: The perspective on mind and behavior that focuses on the examination of their functions in an organism's interactions with the environment.

G

g: According to Spearman, the factor of general intelligence underlying all intelligent performance.

Ganglion cells: Cells in the visual system that integrate impulses from many bipolar cells in a single firing rate.

Gate-control theory: A theory about pain-modulation that proposes that certain cells in the spinal cord act as gates to interrupt and block some pain signals while sending others on to the brain.

Gender: A psychological phenomenon that refers to learned sex-related behavior and attitudes of males and females.

Gender identity: One's sense of maleness or femaleness; usually includes awareness and acceptance of one's biological sex.

Gender roles: Sets of behavior and attitudes associated by society with being male or female and expressed publicly by the individual.

General adaption syndrome (GAS): The pattern of non-specific adaptational physiological mechanisms that occurs in response to continuing threat by almost any serious stressor.

Generalized anxiety disorder: An anxiety disorder in which an individual feels anxious and worried most of the time for at least six months when not threatened by any specific danger or object.

Generativity: A commitment beyond one's self and one's partner to family, work, society and future generations; typically, a crucial step in development in one's 30s and 40s.

Genes: The biological units of heredity; discrete sections of chromosomes responsible for transmission of traits.

Genetics: The study of the inheritance of physical and psychological traits from ancestors.

Genocide: The systematic destruction of one group of people, often an ethnic or racial group, by another.

Genotype: The genetic structure an organism inherits from its parents.

Gestalt psychology: A school of psychology that maintains that psychological phenomena can be understood only when viewed as organized, structured wholes, not when broken down into primitive perceptual elements.

Glia: The cells that hold neurons together and facilitate neural transmission, remove damaged and dead neurons, and prevent poisonous substances in the blood from reaching the brain.

Goal-directed selection: A determinant of why people select some parts of sensory input for further processing; it reflects the choices made as a function of one's own goals.

Ground: The backdrop or background areas of the visual field, against which figures stand out.

Guided search: In visual perception, a parallel search of the environment for single, basic attributes that guides attention to likely locations of objects with more complex combinations of attributes.

H

Hallucinations: False perceptions that occur in the absence of objective stimulation.

Health: A general condition of soundness and vigor of body and mind; not simply the absence of illness or injury.

Health psychology: The field of psychology devoted to understanding the ways people stay healthy, the reasons they become ill and the ways they respond when they become ill.

Heredity: The biological transmission of traits from parents to offspring.

Heritability estimate: A statistical estimate of the degree of inheritance of a given trait or behavior,

assessed by the degree of similarity between individuals who vary in their extent of genetic similarity.

Heuristics: Cognitive strategies, or 'rules of thumb', often used as shortcuts in solving a complex inferential task.

Hierarchy of needs: Maslow's view that basic human motives form a hierarchy and that the needs at each level of the hierarchy must be satisfied before the next level can be achieved; these needs progress from basic biological needs to the need for transcendence.

Hippocampus: The part of the limbic system that is involved in the acquisition of explicit memory.

HIV: Human immuno-deficiency virus, a virus that attacks white blood cells (T lymphocytes) in human blood, thereby weakening the functioning of the immune system; HIV causes AIDS.

Homeostasis: Constancy or equilibrium of the internal conditions of the body.

Horizontal cells: The cells that integrate information across the retina; rather than sending signals toward the brain, horizontal cells connect receptors to each other.

Hormones: The chemical messengers, manufactured and secreted by the endocrine glands, that regulate metabolism and influence body growth, mood and sexual characteristics.

Hue: The dimension of color space that captures the qualitative experience of the color of a light.

Human behavior genetics: The area of study that evaluates the genetic component of individual differences in behavior and traits.

Humanistic perspective: A psychological model that emphasizes on an individual's phenomenal world and inherent capacity for making rational choices and developing to maximum potential.

Hypnosis: An altered state of awareness characterized by deep relaxation, susceptibility to suggestions, and changes in perception, memory, motivation and self-control.

Hypnotizability: The degree to which an individual is responsive to standardized hypnotic suggestion.

Hypothalamus: The brain structure that regulates motivated behavior (such as eating and drinking) and homeostasis.

Hypothesis: A tentative and testable explanation of the relationship between two (or more) events or variables; often stated as a prediction that a certain outcome will result from specific conditions.

I

Iconic memory: Sensory memory in the visual domain; allows large amounts of information to be stored for very brief durations.

Id: The primitive, unconscious part of the personality that operates irrationally and acts on impulse to pursue pleasure.

Identification and recognition: Two ways of attaching meaning to percepts.

Illusion: An experience of a stimulus pattern in a manner that is demonstrably incorrect but shared by others in the same perceptual environment.

Illusory contours: Contours perceived in a figure when no contours are physically present.

Implicit uses of memory: Availability of information through memory processes without the exertion of any conscious effort to encode or recover information.

Imprinting: A primitive form of learning in which some infant animals physically follow and form an attachment to the first moving object they see and/or hear.

Incentives: External stimuli or rewards that motivate behavior although they do not relate directly to biological needs.

Independent variable: In experimental settings, the stimulus condition whose values are free to vary independently of any other variable in the situation.

Induced motion: An illusion in which a stationary point of light within a moving reference frame is seen as moving and the reference frame is perceived as stationary.

Inductive reasoning: A form of reasoning in which a conclusion is made about the probability of some state of affairs, based on the available evidence and past experience.

Inferences: Missing information filled in on the basis of a sample of evidence or on the basis of prior beliefs and theories.

Inferential statistics: Statistical procedures that allow researchers to determine whether the results they obtain support their hypotheses or can be attributed just to chance variation.

Inhibitory inputs: Information entering a neuron signaling it not to fire.

Insomnia: The chronic inability to sleep normally; symptoms include difficulty in falling asleep, frequent waking, inability to return to sleep and early-morning awakening.

Instincts: Pre-programmed tendencies that are essential to a species survival.

Instinctual drift: The tendency for learned behavior to drift toward instinctual behavior over time.

Intelligence quotient (IQ): An index derived from standardized tests of intelligence; originally obtained by dividing an individual's mental age by chronological age and then multiplying by 100; now directly computed as an IQ test score.

Intelligence: The global capacity to profit from experience and to go beyond given information about the environment.

Interdependent construals of self: Conceptualization of the self as part of an encompassing social relationship; recognizing that one's behavior is determined, contingent on, and, to a large extent organized by what the actor perceives to be the thoughts, feelings and actions of others.

Interference: A memory phenomenon that occurs when retrieval cues do not point effectively to one specific memory.

Internal consistency: A measure of reliability; the degree to which a test yields similar scores across its different parts, such as on odd versus even items.

Internalization: According to Vygotsky, the process through which children absorb knowledge from the social context.

Interneurons: Brain neurons that relay messages from sensory neurons to other interneurons or to motor neurons.

Ion channels: The portions of neurons' cell membranes that selectively permit certain ions to flow in and out.

J

James-Lange theory of emotion: A peripheral-feedback theory of emotion stating that an eliciting stimulus triggers a behavioral response that sends different sensory and motor feedback to the brain and creates the feeling of a specific emotion.

Just noticeable difference (JND): The smallest difference between two sensations that allows them to be discriminated.

K

Kinesthetic sense: Sense concerned with bodily position and movement of the body parts relative to each other.

L

Language-making capacity: The innate guidelines or operating principles that children bring to the task of learning a language.

Language production: What people say, sign and write, as well as the processes they go through to produce these messages.

Latent content: In Freudian dream analysis, the hidden meaning of a dream.

Law of common fate: A law of grouping that states that elements moving in the same direction at the same rate are grouped together.

Law of effect: A basic law of learning that states that the power of a stimulus to evoke a response is strengthened when the response is followed by a reward and weakened when it is not followed by a reward.

Law of proximity: A law of grouping that states that the nearest or most proximal, elements are grouped together.

Law of similarity: A law of grouping that states that the most similar elements are grouped together.

Learned helplessness: A general pattern of non-responding in the presence of noxious stimuli that often follows after an organism has previously experienced non-contingent, inescapable aversive stimuli.

Learning: A process based on experience that results in a relatively permanent change in behavior or behavioral potential.

Learning-performance distinction: The difference between what has been learned and what is expressed in overt behavior.

Lesions: Injuries to or destruction of brain tissue.

Levels-of-processing theory: A theory that suggests that the deeper the level at which information was processed, the more likely it is to be retained in the memory.

Libido: The psychic energy that drives individuals toward sensual pleasures of all types, especially sexual ones.

Lightness constancy: The tendency to perceive the whiteness, grayness or blackness of objects as constant across changing levels of illumination.

Limbic system: The region of the brain that regulates emotional behavior, basic motivational urges, and memory, as well as major physiological functions.

Longitudinal design: A research design in which the same participants are observed repeatedly, sometimes over many years.

Long-term memory (LTM): Memory processes associated with the preservation of information for retrieval at any later time.

Loudness: A perceptual dimension of sound influenced by the amplitude of a sound wave; sound waves with large amplitudes are generally experienced as loud and those with small amplitudes as soft.

Lucid dreaming: The theory that conscious awareness of dreaming is a learnable skill that enables dreamers to control the direction and content of their dreams.

M

Magnetic resonance imaging (MRI): A technique for brain imaging that scans the brain using magnetic fields and radio waves.

Manifest content: In Freudian dream analysis, the surface content of a dream that is assumed to mask the dream's actual meaning.

Maturation: The continuing influence of heredity throughout development; the age-related physical and behavioral changes characteristic of a species.

Mean: The arithmetic average of a group of scores; the most commonly used measure of central tendency.

Measure of central tendency: A statistic, such as a mean, median, or mode that provides one score as representative of a set of observations.

Measures of variability: A statistic, such as a range or standard deviation that indicates how tightly the scores in a set of observations cluster together.

Median: The score in a distribution above and below which lie 50 percent of the other scores; a measure of central tendency.

Meditation: A form of consciousness alteration designed to enhance self-knowledge and well-being through reduced self-awareness.

Medulla: The region of the brain stem that regulates breathing, waking and heartbeat.

Memory: The mental capacity to encode, store and retrieve information.

Mental age: In Binet's measure of intelligence, the age at which a child is performing intellectually, expressed in terms of the average age at which normal children achieve a particular score.

Mental retardation: Condition in which individuals have IQ scores 70 to 75 or below and also demonstrate limitations in the ability to bring adaptive skills to bear on life tasks.

Mental set: The tendency to respond to a new problem in the manner used to respond to a previous problem.

Meta-analysis: A statistical technique for evaluating hypotheses by providing a formal mechanism for detecting the general conclusions found in data from many different experiments.

Meta-memory: Implicit or explicit knowledge about memory abilities and effective memory strategies; cognition about memory.

Mnemonics: Strategies or devices that use familiar information during the encoding of new information to enhance subsequent access to the information in memory.

Mode: The score appearing most frequently in a set of observations; a measure of central tendency.

Motivation: The process of starting, directing and maintaining physical and psychological activities; includes mechanisms involved in preferences for one activity over another and the vigor and persistence of responses.

Motor cortex: The region of the cerebral cortex that controls the action of the body's voluntary muscles.

Motor neurons: The neurons that carry messages away from the central nervous system toward the muscles and glands.

N

Narcolepsy: A sleep disorder characterized by an irresistible compulsion to sleep during the daytime.

Natural selection: Darwin's theory that favorable adaptations to features of the environment allow some members of a species to reproduce more successfully than others.

Nature-nurture controversy: The debate concerning the relative importance of heredity (nature) and learning or experience (nurture) in determining development and behavior.

Need for achievement (n Ach): An assumed basic human need to strive for achievement of goals that motivates a wide range of behavior and thinking.

Negative punishment: A behavior is followed by the removal of an appetitive stimulus, decreasing the probability of that behavior.

Negative reinforcement: A behavior is followed by the removal of an aversive stimulus, increasing the probability of that behavior.

Neuromodulator: Any substance that modifies or modulates the activities of the postsynaptic neuron.

Neuron: A cell in the nervous system specialized to receive, process and/or transmit information to other cells.

Neuropathic pain: Pain caused by abnormal functioning or overactivity of nerves; it results from injury or disease of nerves.

Neuroscience: The scientific study of the brain and of the links between brain activity and behavior.

Neurotransmitters: Chemical messengers released from neurons that cross the synapse from one neuron to another, stimulating the postsynaptic neuron.

Nociceptive pain: Pain induced by a noxious external stimulus; specialized nerve endings in the skin send this pain message from the skin, through the spinal chord, into the brain.

Nonconscious: Information not typically available to consciousness or memory.

Non-REM (NREM) sleep: The period during which a sleeper does not show rapid eye movement; characterized by less dream activity than REM sleep.

Normal curve: The symmetrical curve that represents the distribution of scores on many psychological attributes; allows researchers to make judgments of how unusual an observation or result is.

Norms: Standards based on measurements of a large group of people; used for comparing the scores of an individual with those of others within a well-defined group.

O

Object relations theory: Psychoanalytic theory that originated with Melanie Klein's view that the building blocks of how people experience the world emerge from their relations to loved and hated objects (significant people in their lives).

Observational learning: The process of learning new responses by watching the behavior of another.

Observer bias: The distortion of evidence because of the personal motives and expectations of the viewer.

Occipital lobe: Rearmost region of the brain; contains primary visual cortex.

Olfactory bulb: The center where odor-sensitive receptors send their signals, located just below the frontal lobes of the cortex.

Operant: Behavior emitted by an organism that can be characterized in terms of the observable effects it has on the environment.

Operant conditioning: Learning in which the probability of a response is changed by a change in its consequences.

Operant extinction: When a behavior no longer produces predictable consequences, its return to the level of occurrence it had before operant conditioning.

Operational definition: A definition of a variable or condition in terms of the specific operation or procedure used to determine its presence.

Opponent-process theory: The theory that all color experiences arise from three systems, each of which includes two 'opponent' elements (red versus green, blue versus yellow and black versus white).

Optic nerve: The axons of the ganglion cells that carry information from the eye toward the brain.

Organismic variables: The inner determinants of an organism's behavior.

Organizational psychologists: Psychologists who study various aspects of the human work environment, such as communication among employees, socialization or enculturation of workers, leadership, job satisfaction, stress and burnout and overall quality of life.

Orientation constancy: The ability to perceive the actual orientation of objects in the real world despite their varying orientation in the retinal image.

Over regularization: A grammatical error, usually appearing during early language development, in which rules of the language are applied too widely, resulting in incorrect linguistic forms.

P

Pain: The body's response to noxious stimuli that are intense enough to cause, or threaten to cause, tissue damage.

Parallel forms: Different versions of a test used to assess test reliability; the change of forms reduces effects of direct practice, memory, or the desire of an individual to appear consistent on the same items.

Parallel processes: Two or more mental processes that are carried out simultaneously.

Parasympathetic division: The subdivision of the autonomic nervous system that monitors the routine operation of the body's internal functions and conserves and restores body energy.

Parietal lobe: Region of the brain behind the frontal lobe and above the lateral fissure; contains somatosensory cortex.

Partial reinforcement effect: The behavioral principle that states that responses acquired under intermittent reinforcement are more difficult to extinguish than those acquired with continuous reinforcement.

Participant modeling: A therapeutic technique in which a therapist demonstrates the desired behavior and a

client is aided, through supportive encouragement, to imitate the modeled behavior.

Perception: The processes that organize information in the sensory image and interpret it as having been produced by properties of objects or events in the external, three-dimensional world.

Perceptual constancy: The ability to retain an unchanging percept of an object despite variations in the retinal image.

Perceptual organization: The processes that put sensory information together to give the perception of a coherent scene over the whole visual field.

Peripheral nervous system (PNS): The part of the nervous system composed of the spinal and cranial nerves that connect the body's sensory receptors to the CNS and the CNS to the muscles and glands.

Personality: The unique psychological qualities of an individual that influence a variety of characteristic behavior patterns (both overt and covert) across different situations and over time.

Personality disorder: A chronic, inflexible, maladaptive pattern of perceiving, thinking and behaving that seriously impairs an individual's ability to function in social or other settings.

Personality inventory: A self-report questionnaire used for personality assessment that includes a series of items about personal thoughts, feelings and behaviors.

Personality types: Distinct patterns of personality characteristics used to assign people to categories; qualitative differences, rather than differences in degree, used to discriminate among people.

PET scans: Brain images produced by a device that obtains detailed pictures of activity in the living brain by recording the radioactivity emitted by cells during different cognitive or behavioral activities.

Phenotype: The observable characteristics of an organism, resulting from the interaction between the organism's genotype and its environment.

Pheromones: Chemical signals released by organisms to communicate with other members of the species; often serve as long-distance sexual attractors.

Phi phenomenon: The simplest form of apparent motion, the movement illusion in which one or more stationary lights going on and off in succession are perceived as a single moving light.

Phonemes: Minimal units of speech in any given language that make a meaningful difference in speech production and reception; *r* and l are two distinct phonemes in English but variations of one in Japanese.

Photoreceptors: Receptor cells in the retina that are sensitive to light.

Physical development: The bodily changes, maturation and growth that occur in an organism starting with conception and continuing across the life span.

Physiological dependence: The process by which the body becomes adjusted to and dependent on a drug.

Pitch: Sound quality of highness or lowness; primarily dependent on the frequency of the sound wave.

Pituitary gland: Located in the brain, the gland that secretes growth hormone and influences the secretion of hormones by other endocrine glands.

Place theory: The theory that different frequency tones produce maximum activation at different locations along the basilar membrane, with the result that pitch can be coded by the place at which activation occurs.

Placebo control: An experimental condition in which treatment is not administered; it is used in cases where a placebo effect might occur.

Placebo effect: A change in behavior in the absence of an experimental manipulation.

Pons: The region of the brain stem that connects the spinal cord with the brain and links parts of the brain to one another.

Population: The entire set of individuals to which generalizations will be made based on an experimental sample.

Positive punishment: A behavior is followed by the presentation of an aversive stimulus, decreasing the probability of that behavior.

Positive reinforcement: A behavior is followed by the presentation of an appetitive stimulus, increasing the probability of that behavior.

Possible selves: The ideal selves that a person would like to become, the selves a person could become, and the selves a person is afraid of becoming; components of the cognitive sense of self.

Preattentive processing: Processing of sensory information that precedes attention to specific objects.

Preconscious memories: Memories that are not currently conscious but that can easily be called into consciousness when necessary.

Predictive validity: See criterion validity.

Prefrontal lobotomy: An operation that severs the nerve fibers connecting the frontal lobes of the brain with the diencephalon, especially those fibers of the thalamic and hypothalamic areas; best-known form of psychosurgery.

Primacy effect: Improved memory for items at the start of a list.

Primary reinforcers: Biologically determined reinforcers such as food and water.

Priming: In the assessment of implicit memory, the advantage conferred by prior exposure to a word or situation.

Problem solving: Thinking that is directed toward solving specific problems and that moves from an initial state to a goal state by means of a set of mental operations.

Problem space: The elements that make up a problem: the initial state, the incomplete information or unsatisfactory conditions the person starts with; the goal state, the set of information or state the person wishes to achieve; and the set of operations, the steps the person takes to move from the initial state to the goal state.

Procedural memory: Memory for how things get done; the way perceptual, cognitive and motor skills are acquired, retained and used.

Projective test: A method of personality assessment in which an individual is presented with a standardized set of ambiguous, abstract stimuli and asked to interpret their meanings; the individual's responses are assumed to reveal inner feelings, motives and conflicts.

Prototype: The most representative example of a category.

Proximal stimulus: The optical image on the retina; contrasted with the distal stimulus, the physical object in the world.

Psychiatrist: An individual who has obtained an M.D. degree and also has completed postdoctoral specialty training in mental and emotional disorders; a psychiatrist may prescribe medications for the treatment of psychological disorders.

Psychic determinism: The assumption that mental and behavioral reactions are determined by previous experiences.

Psychoactive drugs: Chemicals that affect mental processes and behavior by temporarily changing conscious awareness of reality.

Psychoanalysis: The form of psychodynamic therapy developed by Freud; an intensive and prolonged technique for exploring unconscious motivations and conflicts in neurotic, anxiety-ridden individuals.

Psychoanalyst: An individual who has earned either a Ph.D. or an M.D. degree and has completed post-graduate training in the Freudian approach to understanding and treating mental disorders.

Psychobiography: The use of psychological (especially personality) theory to describe and explain an individual's course through life.

Psychodynamic personality theories: Theories of personality that share the assumption that personality is shaped by and behavior is motivated by powerful inner forces.

Psychodynamic perspective: A psychological model in which behavior is explained in terms of past experiences and motivational forces; actions are viewed as stemming from inherited instincts, biological drives and attempts to resolve conflicts between personal needs and social requirements.

Psychological assessment: The use of specified procedures to evaluate the abilities, behaviors and personal qualities of people.

Psychological dependence: The psychological need or craving for a drug.

Psychological diagnosis: The label given to psychological abnormality by classifying and categorizing the observed behavior pattern into an approved diagnostic system.

Psychologist: An individual with a doctoral degree in psychology from an organized, sequential program in a regionally accredited university or professional school.

Psychology: The scientific study of the behavior of individuals and their mental processes.

Psychometric function: A graph that plots the percentage of detections of a stimulus (on the vertical axis) for each stimulus intensity (on the horizontal axis).

Psychometrics: The field of psychology that specializes in mental testing.

Psychoneuroimmunology: The research area that investigates interactions between psychological processes, such as responses to stress, and the functions of the immune system.

Psychopathological functioning: Disruptions in emotional, behavioral or thought processes that lead to personal distress or block one's ability to achieve important goals.

Psychopharmacology: The branch of psychology that investigates the effects of drugs on behavior.

Psychophysics: The study of the correspondence between physical stimulation and psychological experience.

Psychosocial stages: Proposed by Erik Erikson, successive developmental stages that focus on an individual's orientation toward the self and others;

these stages incorporate both the sexual and social aspects of a person's development and the social conflicts that arise from the interaction between the individual and the social environment.

Psychosomatic disorders: Physical disorders aggravated by or primarily attributable to prolonged emotional stress or other psychological causes.

Psychosurgery: A surgical procedure performed on brain tissue to alleviate a psychological disorder.

Psychotherapy: Any of a group of therapies used to treat psychological disorders that focus on changing faulty behaviors, thoughts, perceptions and emotions that may be associated with specific disorders.

Puberty: The attainment of sexual maturity; indicated for girls by menarche and for boys by the production of live sperm and the ability to ejaculate.

Punisher: Any stimulus that, when made contingent upon a response, decreases the probability of that response.

R

Range: The difference between the highest and the lowest scores in a set of observations; the simplest measure of variability.

Rapid eye movements (REM): A behavioral sign of the phase of sleep during which the sleeper is likely to be experiencing dreamlike mental activity.

Reasoning: The process of thinking in which conclusions are drawn from a set of facts; thinking directed toward a given goal or objective.

Recall: A method of retrieval in which an individual is required to reproduce the information previously presented.

Recency effect: Improved memory for items at the end of a list.

Receptive field: The visual area from which a given ganglion cell receives information.

Reciprocal altruism: The idea that people perform altruistic behavior because they expect that others will perform altruistic behavior for them in turn.

Reciprocal determinism: A concept of Albert Bandura's social learning theory that refers to the notion that a complex reciprocal interaction exists among the individual, his or her behavior, and environmental stimuli and that each of these components affects the others.

Recognition: A method of retrieval in which an individual is required to identify stimuli as having been experienced before.

Reconstructive memory: The process of putting information together based on general types of stored knowledge in the absence of a specific memory representation.

Reflex: An unlearned response elicited by specific stimuli that have biological relevance for an organism.

Refractory period: The period of rest during which a new nerve impulse cannot be activated in a segment of an axon.

Reinforcement contingency: A consistent relationship between a response and the changes in the environment that it produces.

Reinforcer: Any stimulus that, when made contingent upon a response, increases the probability of that response.

Relative motion parallax: A source of information about depth in which the relative distances of objects from a viewer determine the amount and direction of their relative motion in the retinal image.

Relaxation response: A condition in which muscle tension, cortical activity, heart rate and blood pressure decrease and breathing slows.

Reliability: The degree to which a test produces similar scores each time it is used; stability or consistency of the scores produced by an instrument.

Representative sample: A subset of a population that closely matches the overall characteristics of the population with respect to the distribution of males and females, racial and ethnic groups and so on.

Representativeness heuristic: A cognitive strategy that assigns an object to a category on the basis of a few characteristics regarded as representative of that category.

Repression: The basic defense mechanism by which painful or guilt-producing thoughts, feelings or memories are excluded from conscious awareness.

Resistance: The inability or unwillingness of a patient in psychoanalysis to discuss certain ideas, desires or experiences.

Response bias: The systematic tendency as a result of non-sensory factors for an observer to favor responding in a particular way.

Resting potential: The polarization of cellular fluid within a neuron, which provides the capability to produce an action potential.

Reticular formation: The region of the brain stem that alerts the cerebral cortex to incoming sensory signals and is responsible for maintaining consciousness and awakening from sleep.

Retina: The layer at the back of the eye that contains photoreceptors and converts light energy to neural responses.

Retinal disparity: The displacement between the horizontal positions of corresponding images in the two eyes.

Retrieval: The recovery of stored information from memory.

Retrieval cues: Internally or externally generated stimuli available to help with the retrieval of a memory.

Reversal theory: Theory that explains human motivation in terms of reversals from one to the other opposing meta-motivational states.

Rods: Photoreceptors concentrated in the periphery of the retina that are most active in dim illumination; rods do not produce sensation of color.

S

Sample: A subset of a population selected as participants in an experiment.

Saturation: The dimension of color space that captures the purity and vividness of color sensations.

Schedules of reinforcement: In operant conditioning, the patterns of delivering and withholding reinforcement.

Schemas: General conceptual frameworks or clusters of knowledge regarding objects, people and situations; knowledge packages that encode generalizations about the structure of the environment.

Schemes: Piaget's term for cognitive structures that develop as infants and young children learn to interpret the world and adapt to their environment.

Scientific method: The set of procedures used for gathering and interpreting objective information in a way that minimizes error and yields dependable generalizations.

Self-actualization: A concept in personality psychology referring to a person's constant striving to realize his or her potential and to develop inherent talents and capabilities.

Self-awareness: The top level of consciousness; cognizance of the autobiographical character of personally experienced events.

Self-concept: A person's mental model of his or her abilities and attributes.

Self-efficacy: The set of beliefs that one can perform adequately in a particular situation.

Self-esteem: A generalized evaluative attitude toward the self that influences both moods and behavior and that exerts a powerful effect on a range of personal and social behavior.

Self-fulfilling prophecy: A prediction made about some future behavior or event that modifies interactions so as to produce what is expected.

Self-handicapping: The process of developing, in anticipation of failure, behavioral reactions and explanations that minimize ability deficits as possible attributions for the failure.

Self-perception theory: The idea that people observe themselves in order to figure out the reasons they act as they do; people infer what their internal states are by perceiving how they are acting in a given situation.

Self-report measures: The self-behavior that are identified through a participant's own observations and reports.

Self-serving bias: A class of attributional biases in which people tend to take credit for their successes and deny responsibility for their failures.

Semantic memories: Generic, categorical memories, such as the meanings of words and concepts.

Sensation: The process by which stimulation of a sensory receptor gives rise to neural impulses that result in an experience, or awareness of, conditions inside or outside the body.

Sensory adaptation: A phenomenon in which receptor cells lose their power to respond after a period of unchanged stimulation; allows a more rapid reaction to new sources of information.

Sensory memory: The initial memory processes involved in the momentary preservation of fleeting impressions of sensory stimuli.

Sensory neurons: The neurons that carry messages from sense receptors toward the central nervous system.

Sensory physiology: The study of the way in which biological mechanisms convert physical events into neural events.

Sensory receptors: Specialized cells that convert physical signals into cellular signals that are processed by the nervous system.

Serial position effect: A characteristic of memory retrieval in which the recall of beginning and end items on a list is often better than recall of items appearing in the middle.

Serial processes: Two or more mental processes that are carried out in order, one after the other.

Set: A temporary readiness to perceive or react to a stimulus in a particular way.

Sex chromosomes: Chromosomes that contain the genes that code for the development of male or female characteristics.

Sex differences: Biologically based characteristics that distinguish males from females.

Sexual arousal: The motivational state of excitement and tension brought about by physiological and cognitive reactions to erotic stimuli.

Shape constancy: The ability to perceive the true shape of an object despite variations in the size of the retinal image.

Shaping by successive approximations: A behavioral method that reinforces responses that successively approximate and ultimately match the desired response.

Short-term memory (STM): Memory processes associated with preservation of recent experiences and with retrieval of information from long-term memory; short-term memory is of limited capacity and stores information for only a short length of time without rehearsal.

Signal detection theory (SDT): A systematic approach to the problem of response bias that allows an experimenter to identify and separate the roles of sensory stimuli and the individual's criterion level in producing the final response.

Significant difference: A difference between experimental groups or conditions that would have occurred by chance less than an accepted criterion; in psychology, the criterion most often used is a probability of less than 5 times out of 100, or $p < .05$.

Situational variables: External influences on behavior.

Size constancy: The ability to perceive the true size of an object despite variations in the size of its retinal image.

Sleep apnea: A sleep disorder of the upper respiratory system that causes the person to stop breathing while asleep.

Social categorization: The process by which people organize the social environment by categorizing themselves and others into groups.

Social development: The ways in which individuals' social interactions and expectations change across the life span.

Social intelligence: A theory of personality that refers to the expertise people bring to their experience of life tasks.

Social-learning theory: The learning theory that stresses the role of observation and the imitation of behavior observed in others.

Social norms: The expectation a group has for its members regarding acceptable and appropriate attitudes and behavior.

Social perception: The process by which a person comes to know or perceive the personal attributes of himself or herself and other people.

Social psychology: The branch of psychology that studies the effect of social variables on individual behavior, attitudes, perceptions and motives; also studies group and intergroup phenomena.

Socialization: The lifelong process whereby an individual's behavioral patterns, values, standards, skills, attitudes and motives are shaped to conform to those regarded as desirable in a particular society.

Sociobiology: A research field that focuses on evolutionary explanations for the social behavior and social systems of humans and other animal species.

Soma: The cell body of a neuron, containing the nucleus and cytoplasm.

Somatic nervous system: The subdivision of the peripheral nervous system that connects the central nervous system to the skeletal muscles and skin.

Somatosensory cortex: The region of the parietal lobes that processes sensory input from various body areas.

Split-half reliability: A measure of the correlation between test takers' performance on different halves (e.g. odd- and even-numbered items) of a test.

Spontaneous recovery: The reappearance of an extinguished conditioned response after a rest period.

Standard deviation (SD): The average difference of a set of scores from their mean; a measure of variability.

Standardization: A set of uniform procedures for treating each participant in a test, interview or experiment or for recording data.

Stereotypes: Generalizations about a group of people in which the same characteristics are assigned to all members of a group.

Stimulus discrimination: A conditioning process in which an organism learns to respond differently to stimuli that differ from the conditioned stimulus on some dimension.

Stimulus-driven capture: A determinant of why people select some parts of sensory input for further processing; occurs when features of stimuli-objects in the environment-automatically capture attention, independent of the local goals of a perceiver.

Stimulus generalization: The automatic extension of conditioned responding to similar stimuli that have never been paired with the unconditioned stimulus.

Storage: The retention of encoded material over time.
Stress: The pattern of specific and nonspecific responses an organism makes to stimulus events that disturb its equilibrium and tax or exceed its ability to cope.
Stressor: An internal or external event or stimulus that induces stress.
Structuralism: The study of the structure of mind and behavior; the view that all human mental experience can be understood as a combination of simple elements or events.
Superego: The aspect of personality that represents the internalization of society's values, standards and morals.
Sympathetic division: The subdivision of the autonomic nervous system that deals with emergency response and the mobilization of energy.
Synapse: The gap between one neuron and another.
Synaptic transmission: The relaying of information from one neuron to another across the synaptic gap.

T

Temporal lobe: Region of brain found below the lateral fissure; contains auditory cortex.
Terminal buttons: The bulblike structures at the branched endings of axons that contain vesicles filled with neurotransmitters.
Testosterone: The male sex hormone, secreted by the testes, that stimulates production of sperm and is also responsible for the development of male secondary sex characteristics.
Test-retest reliability: A measure of the correlation between the scores of the same people on the same test given on two different occasions.
Thalamus: The brain structure that relays sensory impulses to the cerebral cortex.
Thematic Apperception Test (TAT): A projective test in which pictures of ambiguous scenes are presented to an individual, who is encouraged to generate stories about them.
Theory: An organized set of concepts that explains a phenomenon or set of phenomena.
Timbre: The dimension of auditory sensation that reflects the complexity of a sound wave.
Top-down processing: Perceptual processes in which information from an individual's past experience, knowledge, expectations, motivations and background influence the way a perceived object is interpreted and classified.
Traits: Enduring personal qualities or attributes that influence behavior across situations.
Transduction: Transformation of one form of energy into another; for example, light is transformed into neural impulses.
Transfer-appropriate processing: The perspective that suggests that memory is best when the type of processing carried out at encoding matches the processes carried out at retrieval.
Transference: The process by which a person in psychoanalysis attaches to a therapist feelings formerly held toward some significant person who figured in a past emotional conflict.
Trichromatic theory: The theory that there are three types of color receptors that produce the primary color sensations of red, green and blue.

U

Unconditioned response (UCR): In classical conditioning, the response elicited by an unconditioned stimulus without prior training or learning.
Unconditioned stimulus (UCS): In classical conditioning, the stimulus that elicits an unconditioned response.
Unconscious: The domain of the psyche that stores repressed urges and primitive impulses.
Unconscious inference: Helmholtz's term for perception that occurs outside of conscious awareness.

V

Validity: The extent to which a test measures what it was intended to measure.
Variable: In an experimental setting, a factor that varies in amount and kind.
Variable-interval schedule: A schedule of reinforcement in which a reinforcer is delivered for the first response made after a variable period of time whose average is predetermined.
Variable-ratio schedule: A schedule of reinforcement in which a reinforcer is delivered for the first response made after a variable number of responses whose average is predetermined.
Vestibular sense: The sense that tells how one's own body is oriented in the world with respect to gravity.
Visual cortex: The region of the occipital lobes in which visual information is processed.

Volley principle: An extension of frequency theory which proposes that when peaks in a sound wave come too frequently for a single neuron to fire at each peak, several neurons fire as a group at the frequency of the stimulus tone.

W

Wisdom: Expertise in the fundamental pragmatics of life.

Within-subjects design: A research design that uses each participant as his or her own control; for example, the behavior of an experimental participant before receiving treatment might be compared to his or her behavior after receiving treatment.

Working memory: A memory resource that is used to accomplish tasks such as reasoning and language comprehension; consists of the phonological loop, visuospatial sketchpad and central executive.

Y

Yerkes-Dodson law: A correlation between task performance and optimal level of arousal.

Z

Zygote: The single cell that results when a sperm fertilizes an egg.

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